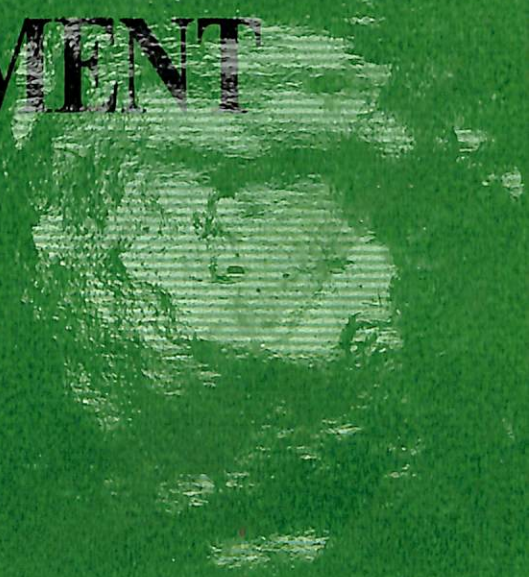
APPLICATION OF SCIENCE AND TECHNOLOGY FOR TRIBAL DEVELOPMENT



B.N. BORDOLOI

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B. N. Bordoloi

TRIBAL RESEARCH INSTITUTE, ASSAM
GUWAHATI

APPLICATION OF SCIENCE AND TECHNOLOGY FOR TRIBAL DEVELOPMENT
A book containing the proceedings, recommendations and papers presented in a seminar on "Application of Science and Technology for Tribal Development" held in Guwahati on July 29-31, 1987, edited by B. N. Bordoloi, Director, Tribal Research Institute, Assam, Guwahati-781028.

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PREFACE

Tribal development is an essential part of the entire process of development and it cannot be understood in isolation. In the present days' context of development science and technologies have been playing a very important as well as crucial role. For tribal development also application of science and technology has become more relevant in recent years. But the manner in which science and technologies are to be applied in the tradition bound societies having their own way of life, norms and value systems is a matter of great importance and every step in this respect has to taken very cautiously.

In the Tribal Sub-plan of Assam, Science and Technology for the first time had appeared as one of the development sectors in 1987-88. With a view to helping the Government by way of suggestions the schemes which were to be implemented under this sector, the Tribal Research Institute, Assam, organised a three-day Seminar on "Application of Science and Technology for Tribal Development" in the District Library Auditorium, Guwahati, from 29th to 31st July, 1987. Distinguished scholars from various disciplines of Sciences, Engineering, Technology and Social Sciences belonging to 21 organisations including the Universities, Regional Research Laboratory, Jorhat, Indian Council of Agricultural Research, Shillong Complex, Council of Scientific and Industrial Research, Shillong Unit, Khadi and Village Industries Commission, Guwahati, etc., had actively participated in the Seminar.

In the five academic sessions of the Seminar altogether 18 papers were presented by the authors themselves and two papers could not be presented due to the absence of the authors. The recommendations of the Seminar were sent to all concerned for necessary actions at their end.

The present volume, a product of the three-day Seminar, includes the proceedings, recommendations and papers presented in the Seminar.

I acknowledge with thanks the help of and co-operation I received from Dr. G. C. Sharma Thakur, Shri M. C. Saikia, Shri P. Dutta and Shri A. C. Nath, Faculty Members of the Institute, and Shri M. Chakraborty, my Steno, in bringing out the Seminar papers in a book form.

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Director
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Guwahati
the 31st December, 1988

Summary of the proceedings of the Seminar on 'Application of Science and Technology for Tribal Development' held at Guwahati from 19th to 31st July, 1987.

1.01. The Directorate of the Tribal Research Institute, Assam, had organised a three day Seminar on 'Application of Science and Technology for Tribal Development' at the District Library Auditorium, Guwahati, from 29th to 31st July, 1987. The main objective of organising the Seminar was to enable the Government of Assam to draw up a series of schemes for the development of the tribal people under the sector "Science and Technology" in the Tribal Sub-Plan on the basis of recommendations arrived at three days' deliberations in the Seminar. With this end in view papers from distinguished scholars belonging to various disciplines of Science, Engineering, Technology and Social Sciences from different Institutions, Organisations, Universities and other allied departments were invited for the Seminar based on the following five parameters :

1. Identification of existing tribal technologies including handicrafts and the problems connected with their improvement and upgradation.
2. Areas of new technologies, their potentialities, transfer, utility and applicability in the context of tribal development.
3. Forest and agro-based technologies, soil management, problems of maintenance of ecological balance, environment hazards and air and water pollution in the tribal areas.
4. Role of Science and Technology in poverty alleviation, self-employment and income generation in tribal areas.

5. Training of local tribal people for proper application of Science and Technology, entrepreneurship motivation and development and the problems of marketing.

1.02. Altogether 72 scholars including the faculty members of the Tribal Research Institute, Assam, from the following institutions, organizations and universities attended the three day Seminar ;

1. The Regional Research Laboratory, Jorhat.
2. The Indian Council of Agricultural Research, N.E. Zone, Shillong.
3. Polytechnology Transfer Centre, Shillong, under the Council for Scientific and Industrial Research.
4. Agro-Economic Research Centre for N.E. India, Jorhat.
5. Directorate of Research, Arunachal Pradesh, Itanagar.
6. Assam Agricultural University, Jorhat and Khanapara Campus.
7. Guwahati University.
8. Council for Studies of Developing Societies, New Delhi.
9. North-East Institute of Bank Management, Guwahati.
10. Indian Statistical Institute, Calcutta.
11. Commission for Scheduled Castes and Scheduled Tribes, Zonal Office, Guwahati.
12. Department of Fisheries, Government of Assam.
13. Department of Science and Technology, Government of Assam.
14. Law Research Institute, Guwahati High Court.
15. Small Industries Service Institute, Guwahati.
16. Dibrugarh University.
17. Assam Science Society.
18. Guwahati Engineering College.
19. Regional College of Education, Bhubaneswar.
20. Assam Agro-Industries Development Corporation, Guwahati.
21. Khadi & Village Industries Commission, N.E. Zone Guwahati.

1.03. Besides these institutions, Government Departments and Universities, a few individual scholars had also participated in the Seminar.

1.04. The Seminar was inaugurated at 10 A.M. on 29th July, 1987 by Shri R.N. Muhuri, I.A.S., the Commissioner, Department for Welfare of plains Tribes and Backward Classes, Govt. of Assam. In his inaugural address Shri Muhuri elaborated the strategies for tribal development and said that the main thrust of tribal development planning is poverty alleviation and hence appropriate technology could bring a new era for the tribals. He expressed the hope that the three days' deliberations of the distinguished scholars would arrive at some consensus regarding the schemes that could suitably be included in the Tribal Sub-Plan under the sector Science and Technology. He also thanked the Tribal Research Institute for organising a Seminar on such a very important and vital subject.

The inaugural session was presided over by Shri J.N. Das Ex-Vice-Chancellor, Dibrugarh University. In his presidential address, Shri Das had narrated his own experiences working among the tribal communities inhabiting the Nort-East India so far as the indigenous technologies were concerned. He emphasised that need-based and resource-based technologies suitable for each tribal society should be evolved after a proper survey of the traditional skills and technologies.

Earlier Shri B.N. Bordoloi, Director, Tribal Research Institute, Assam and who was also the Seminer Director, welcomed the distinguished participants and explained the objectives of the Seminar.

1.05. The Seminar had five academic sessions and altogether 16 papers were presented out of 18 papers received. Two papers could not be presented due to the absence of the authors.

The first academic session was held soon after the inaugural session on 29th July and it continued for two hours

from 11-30 A.M. to 1-30 P.M. This session was presided over by Shri Prafulla Chandra Barua, Director, North-East Institute of Bank Management, Guwahati, Shri Paramesh Dutta, Senior Investigator, T.R.I. Guwahati, acted as the Rapporteur. Three papers were presented in this session.

The first paper was presented by Mrs. Alakananda Nath, Research scholar, Guwahati University and the theme of her paper was "Women and Technological change in tribal societies". Her presentation was followed by a good deal of questions, querries and discussions.

The second paper was presented by Dr. B.K. Paul, Project Officer, Polytechnology Transfer Centre, Shillong, under the Council for Scientific and Industrial Research. The subject of his paper was "Technological Strategy for Tribal Development in the North-East". Like the first one, this paper was also well received and a lively discussion followed.

The third and the last paper in this academic session was presented by Shri S.N. Buragohain, Faculty Member, Agro-Economic Research Centre for N.E. India, Jorhat. This paper was jointly prepared by Dr. P.D. Saikia, Director, of the aforesaid Centre and Shri Buragohain. The presentation of this paper was also followed by a lively discussion since some case studies on different tribal communities in respect of acceptance of new technologies suited to their immediate needs were narrated in this paper.

1.06. The second academic session was held from 2-30 P.M. to 5 P.M. on 29th July, 1987 under the Presidentship of Dr. B. K. Roy Burman, Senior Professor, Council for Studies of Developing Societies, Delhi, Shri M. C. Saikia, Deputy Director, T.R.I., Assam, acted as the Rapporteur.

In this session also three papers were presented. The first paper was presented by Shri Mohini Mohan Brahma, a retired Member, Assam Public Service Commission from Kokrajhar and the theme of his paper was "Identification of existing tribal technologies including Handicrafts and their problems". This paper was based on his own experiences as a member of one of the tribal communities of Assam and it

was very much well received. His presentation was followed by questions, observations and discussions which continued for more than half an hour.

The second paper in this session was presented by Shri M. Sahariya, Joint Director of Fisheries, Govt. of Assam, on "Integrated Fish Farming". In his paper Shri Sahariya had elaborated clearly how with some very simple but new technologies tribal people could increase fish production which would be rather a major source of income. A very interesting discussion ensued his presentation.

The third paper was presented by Dr. N. G. Goswami from the Regional Research Laboratory, Jorhat. This paper was prepared jointly by Dr. J.N. Barua, Director, Regional Research Laboratory, Jorhat who is one of the eminent sceientists of our country and Shri N.G. Goswami from the same organisation. In this paper references were made to some of the important inventions of the Labotary and how the technologies associated with them could indirectly benefit the tribal people.

1.07. The third academic session of the Seminar was held from 10 A.M. to 1 P.M. on 30.7.87 and the Chairperson was Shri T.K. Kamilla, I.A.S., Development Commissioner for Hill Areas of Assam. Shri G.N. Das, District Research Officer, Diphu. (T.R.I.) was the Rapporteur. In this session also three papers were presented.

The first paper presented in this session was jointly prepared by Dr. A.C. Sarmah, Principal, Assam Engineering College, Guwahati and Smti R. Choudhury, Lecturer from the same college. The theme of the paper was "Some thoughts on Application of Science and Technology for Tribal Development". After presentation of the paper by Smti Choudhury, a lively discussion followed. The participants even questioned some of the main ideas reflected in the paper and Dr. Sarma had to clarify them.

The second paper on "Appropriate Technology and its Transfer strategy for Tribal Development" was presented by Dr. B. S. N. Reddy, Scientist, Indian Council of

Agricultural Research. Nort-East Zone, Shillong. This paper was jointly prepared by Dr. Reddy and Dr. N. V. Rao, both from the I.C.A.R. Complex, Shillong. In this paper the authors had elaborated the technological innovations made by them in respect of agricultural practices suited to the needs of the tribal people of North-East India. The strategies through which such technologies could be made were also clearly indicated. This paper also was very much well received and after presentation a lively discussion took place.

The third and the last paper in this session was presented by Shri B. N. Bordoloi, Director, T.R.I. Assam. The theme of his paper was "Environmental Degradation in the Tribal areas of Assam and Application of Science and Technology". He had shown in his paper the main factors responsible for environmental degradation in the tribal areas of Assam, both hills and plains and how the application of science and technology could minimize and stop further degradation and improve environment with short term and long term planning. The presentation, like the previous ones, was followed by a lively discussion.

1.08. The fourth academic session, held in the second half of 30th July '87 continued from 2-30 P.M. to 6 P.M.— a marathon session rather. Dr. K.C. Malhotra, Prof. Indian Statistical Institute, Calcutta, was the Chairperson in this session while Shri Mrigen Das, District Research Officer, Guwahati, (T.R.I.) was the Rapporteur. Four papers were presented in this session.

The first paper in this session was presented by Dr. B.K. Roy Burman, one of the reknowned anthropologists in India on the subject "Science and Technology in Tribal Development". In his paper Dr. Burman narrated how an interdisciplinary team of scientists, engineers, technologists, etc. under his guidance had been carrying on experimental research in 15 tribal villages in Manipur, Nagaland and Assam regarding the efficacy of the existing technologies in respect of agricultural practices and house building. He assured that

the results of these experiments would be made known to all in due course. His paper evolved great enthusiaism and discussions on this paper took about an hour.

The second paper of this session was presented by Shri Medini Mohan Choudhury, Retd. Director of Sericulture, Assam, on "Application of Science and Technology for Tribal Development planning in Assam". In his paper Shri Choudhury analysed the factors responsible for slower pace of tribal development and suggested measures for such remedies through application of Science and Technology. Like the previous one his paper also led to a great deal of deliberation after the presentation.

The third paper in this session was presented by Dr. H. N. Kakaty, Associate professor, Extension Education, College of Veterinary Science, Assam Agricultural University, Khanapara Campus on "Barriers in popularizing Cross-bred Dairy Farming in a Tribal Block". In this paper Dr. Kakati described the fate of the distribution of the cross-bred cows to the tribal families of Dimoria Tribal Development Block on the basis of his field study. Since this paper was based on empirical data it also led to a great deal of discussion after presentation.

The 4th and the last paper of this session was presented by Shri S. A. Khan, Regional Director, National Institute of Public Co-operation and Child Development, Guwahati. The theme of his paper was "Role of Science and Technology in poverty alleviation, self-employment and income generation in Tribal Areas ; Role of Human Resource Development". Shri Khan described the positive role played by the Integrated Child Development Projects located in the tribal areas and analysed how they had been helping in human resource development.

At the end of the session a cinema show for the distinguished participants was arranged and a few films on different tribal communities were screened.

1.09. The fifth and the last academic session was held from 10 A.M. to 1 P.M. on the last day of the Seminar, that is 31st

July, 1987. This session was presided over by Dr. A. K. Goswami, Member Secretary, State Council for Science and Technology. Shri A. C. Nath, Senior Investigator, T. R. I., Guwahati was the Rapporteur. Three papers were presented in this session.

The first paper presented was jointly written by Dr. P. C. Bora, Dean, Faculty of Argiculture (Now Vice-Chancellor), Assam Agricultural University, Jorhat and Dr. K.C. Talukdar, Associate Professor, Agricultural Economics of the same University. The paper was, however, presented by Dr. K.C. Talukdar and the theme of the paper was "Role of Forestry in Economic Development of tribals". The authors had given a detail analysis how forestry could transform the life of the tribal people if the forest resources around them could be utilized scientifically. This paper was also very much well received and discussion that followed the presentation was an interesting episode in the Seminar.

The second paper was presented by Shri A. K. Neog, Deputy Director, Small Industries Service Institute, Guwahati on "Entrepreneurship Development in Tribal societies—Problems and Prospects". Shri Neog in his paper analysed the causes of lack of entrepreneurship among the tribal youths and different steps taken to motivate entrepreneurship development. Since this was the only paper on entrepreneurship motivation parameter, it evoked greater response from the participants.

The last paper in the last academic session was also a co-authored paper prepared by Dr. Durgeswar Doley, Reader in Sociology, (Now Professor) Dibrugarh University and Shri A. K. Bora of the Regional Research Laboratory, Jorhat. The theme of the paper was "A Sociological Model for long term development of the tribal areas of Assam through application of Science and Technology—A case study of Mishing Tribe". The paper was presented by Shri A. K. Bora and the model the authors projected was based on some empirical studies on the Mishing tribe. Like the other ones, this paper was

also well-received and a lively discussion followed after presentation.

2.00. Two papers, one by Shri A. K. Das, Chief Project Engineer, Assam Agro-Industries Development Corporation, Guwahati on "Areas of New Technologies, their potentialities, transfer, utility and applicability in the context of tribal development" and the other by Shri S. K. Das, Asstt. Prof. of Humanities, Regional Engineering College, Silchar on "Application of Science and technology for Tribal Development" could not be presented due to absence of the authors.

2.01. In order to finalize the recommendations of the three days' deliberations a small committee was constituted with three senior scholars, namely, Dr. B. K. Roy Burman, Dr. B. K. Paul and Dr. A. K. Goswami. The five Rapporteurs of the academic sessions with their reports also helped them.

2.02. The valedictory Session of the Seminar was held at 2-30 P.M. under the presidenship of Shri P. K. Singson, Station Director, All India Radio, Guwahati. At the very outset, Shri B. N. Bordoloi, Director, T.R.I., Assam, and the Director of the Seminar preseted his report on the Seminar begnning from its conception to materialization along with the brief accounts of the inaugural session and the five academic sessions. He assured the participants that the recommendations of the Seminar would be submitted to the Government for acceptance and materialization.

2.03. Dr. B. K. Roy Burman, then, read out the recommendations numbering 15 with explanations wherever necessary. After some modifications, additions and alterations, the House accepted the recommendations and authorized the Director of the Seminar to edit them and submit to the Government for necessary actions.

2.04. The guest participants expressed satisfaction for organizing the Seminar so nicely and thanked the Tribal Research Institute, Assam, for organizing a Seminar for the first time

in the North-East India on "Application of Science and Technology for Tribal Development" and brought together scholars from 21 institutions and organisations.

2.05. Shri P. K. Singson from his presidential chair opined that this was rather a unique achivement for the Tribal Research Institute, Assam. He desired that the recommendations of the Seminar should reach every hook and corner of the seven states of the North-East so that the administrators, others concerned and the tribal people themselves could know how science and technology could be applied into their day to day life which would ultimately leed them to a better quality of their physical life through poverty alleviation.

2.06. The valedictory Session came to an end after offering a vote of thanks by Shri M. C. Saikia, Deputy Director, T. R. I., Assam.

It may be mentioned here that in the IVth Academic Session of the Seminar Shri Bhaskar Barua, I.A.S., Special Commissioner, planning and Development Department, addressed the scholars as a special invitee and wishing the Seminar a grand success he requested the scholars to put their heads together and to come up with a few concrete suggestions so that these could be implemented by the Government for the further development of the tribal people.

Recommendations :

1) There should be simple lessions on science and technology in the text books that are used in the tribal areas.
2) Instead of confining the students of the schools located in the tribal areas in their class rooms throught the six days of the week the interested teachers including that of science faculty, should take them outside at least once a week to expose them to the outside world so that the students can learn something practical on the various aspects of science and technology.
3) It is understood from the Seminar deliberations that the tribal societies have been producing a few number of

innovations but nobody pays any attention to their innovations. Such innovations donot get patronage from the Government. It is suggested that a survey of such innovations should be undertaken immediately covering all aspects so that a comprehensive picture would emerge which would help the Department of Science and Technology to take suitable necessary actions. The innovators ought to be encouraged by the Government by all possible means.

4) Preparation of resource inventors by congnitive mapping in the tribal area should be undertaken as a first step. The congnitive mapping should also indicate the pattern of access, namely, customary, statutory and undefined of the tribal communities and their neighbours to the resources. After the congnitive mapping, status papers shall have to be prepared in consultation with technological and development agencies about local resource based technologies.

5) To popularize science and technology, science and technology museums/centres should be established in selected tribal areas. This should be followed by pilot Operational Research Programme.

6) In order to reduce the intensity of degradation of environment in the tribal areas non-conventional energy sources like bio-gas, solar energy, smokeless Sullahs, etc., suitable to specific climatic conditions are to be explored immediately under an intgegrated research programme.

7) Tapping of solar energy for irrrigation purpose shall have to be explored in view of the fact that irrigation from deep tuble-wells is uncertain and irregular because of erratic supply of electricity and diesel pump sets used for lift irrigation is linked with recurring cost of maintenance. Since in Assam irrigation is mostly needed in the winter season, required sundays could be easily had.

8) Minor forest produce processing units including herbal medicines with very simple technology shall have to be developed and popularized in the tribal areas.

9) So far as the small tribal communities in the hilly areas practising shifting cultivation are concerned, a different strategy shall have to be adopted in applying science and technology for increasing production since the techniques of shifting cultivation differ from tribe to tribe.

10) Special programme for encouragement of tribal crafts particularly those based on cane and bamboo, fibre, silk, textiles, etc. shall have to be formulated and it is also essential to explore the extent to which motivational reinforcement can be drawn from tribal recreative and other artistic activities.

11) Tribal personalities who can play pioneering role in science and technology development should be encouraged and assisted to visit important science and technology institutes such as the Regional Research Laboratory, Jorhat, the Indian Council of Agricultural Research Complex, Polytechnology Transfer Centre, Shillong etc.

12) Voluntary agencies which have been playing and can play a significant role in science and technology promotion and diffusion in tribal areas should be encouraged to play their role more vigorously. At the same time a co-ordinating agency for development and transfer of technologies in the tribal areas is to be set up so that appropriate priorities on research and extension can be laid down. This agency should be made responsible for monitoring and evaluation also.

13) Teachers and students in the tribal areas should be involved in the process of transfer of technologies in the tribal areas.

14) With a view to popularising scientific knowledge and technical know-how of technologies, the State Industries Department in collaboration with the Regional Research

Laboratory, Jorhat. Indian Council for Agricultural Research, Shillong, Polotechnology Transfer Centre, Shillong, Khadi and Village Industries Board and Commission, Assam Science Society, Department of Non-Conventional Energy Sources, Small Industries Service Institute, Assam Small Industries Development Corporation, etc. should organise exhibitions in the tribal areas on Science and Technology aspects when the tribal communities perform their major community festivals.

15) Air and Water pollution caused by the industrial establishments located in tribal areas has become an environmental hazard from the points of view of health, hygiene and sanitation. Immediate control of such pollution with the help of appropriate technology is the most immediate need of the hour.

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Contents

Role of Science and Technology, area of new Technologies, their potentialities, transfer, utility and applicability in the context of Tribal Development.

J. N. Baruah*
N. G. Goswami**
A. K. Hazarika***

Science and Technology are bodies or inventories of knowledge and experience to useful purposes. Science, on the one hand, embraces the entire stock of our current knowledge of the physical and living elements in the world around us. Technology, on the other hand, contains our current knowledge and experience about how to use scientific knowledge for practical purposes. So, precisely, science is 'know-why' while technology is 'know-how'. Industrially advanced nations recognise that their economic future depends to a large extent on their ability to transform scientific knowledge into exploitable technology.

Tribal development concept

The issue of tribal development has been a subject of great concern for the policy makers in India. The problems of development, both social and economic, involve complex issues in formulation, implementation and evaluation of plan for development of tribal regions. Majority of the tribals are engaged for their sustenance in farming on their own

* Director, ** Scientist, *** Scientist, Regional Research Laboratory, Jorhat.

small holdings. A substantial number of the tribals are also engaged as agricultural labour. They are generally landless labourers or have extremely small and uneconomic land holdings. They have been unable to enjoy the fruits of science and technological development due to their low level of education, skill and awareness. Thus a vast majority of the tribal population continues to persue the traditional occupations despite the existence of employment avenues in the new industrial ventures located in that region.

Causal aspects of tribal poverty

A proper enquiry into the causes of poverty of the tribal population must also take into consideration the following four factors as well :

1. Forest and environment—tribal life is greatly conditioned and influenced by forest and other natural resources on which they depend upon for their supply of food, fedder, fuel wood and animals. Forest is also an important source of their income.
2. Infrastructural facilities—an important determinant of development of any area is the availability of infrastructural facilities. Among such facilities, irrigation assumes great importance followed by rural electrification and so on and so forth.
3. Employment opportunities elsewhere—the tribal belt in our country has large deposits of minerals and other natural deposits. The victims of these exploitations are the tribals. The large capital intensive units in the tribal areas have not only failed to provide them employment opportunities but have also caused heavy immigration of people from other parts of the state and even from outside.
4. Rural urban break up—Urbanisation is closely associated with the process of industrialisation. A comparative account of rural and urban total population and rural urban tribal population in the different census reports

brings out the pattern of tribal population in the direction of reduction compared to the non-tribal population.

Poverty alleviation parameters

System approach to alleviate poverty includes four steps. They are : (1) to fix criterion for defining poverty line, (2) to lay down the methodology of identifying the families living below the poverty line, (3) to estimate the quantity and quality of resources and technological, managerial and financial resources which are needed by an individual family for achieving the desired objective, and (4) to evolve investment plan and functional mechanism for providing the required inputs.

Application of S & T

The role of scientist/technocrat in rural development is primarily to provide scientific knowledge and skills, conduct demonstration and training in the application of selected technologies and provide expert guidance and advice on the application of S & T under user/consumer conditions.

The council of Scientific & Industrial Research (CSIR), the country's premier scientific and industrial organisation through its 39 national and 2 associate laboratories, has done considerable work on the generation, development and demonstration of new technologies with potential for ameliorating the conditions of people living in the countryside. As CSIR is a technology developing agency and is not adequately equipped for extension work to cover vast rural areas of the country, there is, therefore, a need for 'load' agency like the Council of Advancement of Rural Technology (CART), State Councils of S&T and Social Voluntary organisation, etc. which may derive help from the concerned CSIR laboratories and use the fecilities of local technical and engineering institutes for promotion and advancement of these in their operational fields.

Regional Research Laboratory, Jorhat (RRL Jorhat) is the only major multi-disciplinary national establishment of CSIR in the north eastern region. RRL Jorhat has been

contributing considerably in association with the state governments of the north eastern region for the socio-economic uplift of the rural people through its technological innovation input.

Areas of new technologies & their potentialities

The techniques and technologies developed at CSIR laboratories serves manifold purposes for human welfare and community services. The list of technologies is presented here in certain order of classifications like agro-based, forest based, poultry based and so on (please see the tables). Few related and precise information like, sources of technology, raw material, scale, cost plant capacity, employment, potential utilisation status, etc, are also mentioned based on the year 1983 index.

Transfer of technology

Using S & T for the welfare of rural masses needs a different promotional and management approach. It required blending of Research & Development (R&D) results with demonstration, training and implementation of well defined projects in an integrated mannar. Since risk-taking capacity and entrepreneurship are minimum among the rural people, especially the tribals, the project formulation for promotion of such technologies should as far as possible be sieved through the following steps :

1. identify local problem and needs and isolate priority areas requiring application of S&T :
2. study existing levels of technologies practised and identify significant gaps, the overcoming of which may immediately attract the attention of the people :
3. study priority areas among the ongoing programmes initiated by rural development agencies and identify technological gap, if any :
4. harness matching techniques/technologies to bridge the above gap and study the scope of working out a mix of both traditional and new techniques :

5. prepare an integrated project proposal for community and/or individual family use aimed at (i) direct application of known knowledge, (ii) modification of a known technology to make it adaptable to the local situation, (iii) upgradation and nationalization of traditional skills, (iv) development of new techniques required ;
6. interact with local leaders, target groups, development staff, voluntary agencies, etc. for finalizing the programme ;
7. ensure supply of inputs for implementation of improved/ new technology ;
8. involvely the target groups/beneficiaries to participate actively in demonstration/training programmes ;
9. arrange training of key personnel and trainers to facilitate dissemination, diffusion and replication of the technology;
10. monitor the project in the initial stages of implementation, help in the solution of any teething troubles, and provide expert counselling to eliminate risks of failure ; and
11. provide regular feedback to the generators of technology.

Promotional approach

In mass and community adoption projects it would be advisable to organise campaigns to explain the 'know-how' and 'know-why' of the project in advance. Local teachers and students should be involved in this task. Some projects (e.g. rodent control based on CSIR technology) may require a whole village or even the involvement of a cluster of villages. Here, the dynamics of human behaviour and the advantages of resources and management services will have to be fully explolited. Local people will have to be educated, inspired and induced to give a trial to the technologies being effored through discussions, visuals, demonstrations etc. Women should invariably be involved to function as motivators.

Investment decision

Any improved or new technology demands some investment. A person should weigh the expected benefits over those of traditional practices, whether they relate to adoption of an improved *chullah*, or a latrine, or a shelter. The advantages of these techniques and technologies will, therefore, need explanation in terms of appropriate direct/ indirect socio-economic benefits and impact on tribal families or the village community as a whole. While a number of projects need comunity participation and responsibility, others need public funding, incentives or motivation of one kind or another.

Support services and action research

Diffusion of technologies for human welfare in general and tribal welfare in particular require an integrated approach and continuous educational programme supported by needed inputs within means and easy reach of the target groups/ beneficiaries. Convincing local tribal leaders and change agents taking the lead in adopting such technologies may perhaps complement the extension efforts.

TRIBAL DEVELOPMENT AND RRL JORHAT—A CASE STUDY

In view of the prevailing agro-climatic condition, RRL Jorhat took up the socio-economic development activities for the tribals residing at rural areas mainly in the form of (1) promotional aspects of aromatic and medicinal plants ; (2) training entrepreneurs to develop technical manpower for the rural industry and (3) conducting science motivation courses. In recognition of the above mentioned programme, RRL Jorhat bagged, the 1985 Federation of Indian Chambers of Commerce & Industry (FICEI) award for rural development activities.

The villages selected by RRL Jorhat are Yaongyimsen and Kohima suburbs in Nagaland ; Tawang, Lumla, Senua

and Pasighat in Arunachal Pradesh ; Balat in Meghalaya ; Sepahijala in Tripura ; Montripukhuri in Manipur ; Boko, Meleng/Nakachari, Kenduguri, Pengeri and some other villages in Assam. It is not possible to discuss in detail all these villages individually because of time limitations. But, still a brief resume in few cases are cited here.

During 1970, RRL Jorhat opened a sub-station at Yaongyimsen village (Nagaland) by procuring 3 acres of land. An experimental-cum demonstration plant for distillation of citronella grass was started and the villagers were motivated to take up training in citronella cultivation. In 1971 out of 350 families of the village only five families took cultivation and brought an acre of land under cultivation.

Gradually more families of the village started participating in the RRL programme by bringing more land under cultivation. The Department of Industries, Government of Nagaland was brought into the scene and at their instance the Laboratory designed, fabricated and installed a distillation plant of 200 kg/batch capacity in the village. Government run units started distilling the grass supplied by the villagers. They also started earning money. With the increase in area under citronella cultivation, distillation plant was found inadequate to distil all that produced. Another unit of 200 kg/batch capacity was then installed. As the cultivation further extended, new distillation stills of the higher capacity had to be installed to meet the increased demand. The progress and enthusiasm shown by the villagers impressed the Government of Nagaland who provided Rs. 2·6 lakhs to RRL for design, fabrication and installation of a sephisticated distillation plant of turn-key basis, Accordingly, in 1979, another distillation plant (55 kg/batch) was installed in the village by the Government of Nagaland. Thus in 1971, the villagers produced 30 tonnes grass valued at Rs. 1500·00. Consequently till 1984, because of promotional activities of RRL, 257 families of the village brought 215 hectares of land under cultivation of citronella and produced 614 tonnes of grass valued at Rs. 30·57 lakhs (approx). Apart from

selling citronella grass, the villagers got the opportunity to sell fire-wood for the distillation plant. Some villagers were also got job in these distillation units as skilled and unskilled labourers who were trained by RRL.

The activities in Yaongyimsen village acted as a catalytic agent. Persistent requests were received by RRL to introduce such programmes in other villages of the region.

In the village of Yaongyimsen, a paper slate manufacturing unit has been installed by RRL and the local youths were trained. Three local youths not working in the unit have not only mastered the technology, but have also brought about some innovation like sun-drying of the slates in a six tier trays made of bamboos. The industry directly employed 3 semi-skilled labourers (trained by RRL Jorhat) and one skilled (carpenter) for making wooden frame for the slates. It employed a few more unskilled labourers who sell the slates in the nearby areas. Thus this industry with an investment of Rs. 5000·00 provided employment opportunity of 5-6 people. The paper slate making technology has been licensed to more than 100 parties in rural and semi-urban areas in different parts of the country which has generated employment opportunities to more than 500 unemployed youths.

RRL Jorhat with the financial assistance of Appropriate Technology Unit, Ministry of Industry, Govt. of India, New Delhi and Department of Industries, Arunachal Pradesh Pasighat worked out certain rural development programmes. The laboratory supplied the improved strain of Java citronella slips to the growers. A distillation still of 500 kg/batch capacity for extraction of oil was installed at Pasighat.

Pengeri village in Tinsukia sub division of Upper Assam is a cluster of nearly fifteen tiny villages with an area of more than 3000 hectares. The people, represented by different economic groups thrived gradually on citronella cultivation. The citronella cultivation at Pengeri was initiated in the year 1973 in a few patches of waste land. The idea caught up as an individual farmer could earn about Rs. 800.00 a month

from one hectare land under citronella cultivation by way of selling the grass at 50 paise/kg to nearby distillation units.

In order to meet the distillation demand of the area more than 50 stills of different capacities ranging from 50 kg/batch were installed. In 1984, all total 723 farmers brought around 2053 hectares of land under citronella cultivation and produced about 62,000 tonnes of citronella grass valued at Rs. 2·77 crores. The prosperity derived by the village people by adopting RRL technology is quite visible. It would be interesting to note that the Pengeri area is surrounded by thick forest and the villagers could not cultivate paddy or sugarcane due to depredation by wild elephants. Since, citronella grass is not eaten by elephants, the villagers are cultivating it safely.

AGRO-BASED TECHNOLOGIES

S.No.	Technology/ technique (laboratory)	Man feed stock/raw material	Status/scale of technology	Cost/capacity of plant	Energy source requirement	Employ-ment potential	Utilisation Status number of parties released to	Utilisation Status number of parties in production
1	2	3	4	5	6	7	8	9
1.	Anti-fungal paste (CFTRI, Mysore)	Banana, high polymorisation diluent accelerator, fungicide, food colour	Available (cottage)	Rs. 15,000/30kg per day	Electricity 6 KW/day	4	—	—
2.	Castor oil dehydrated (RRL, Hyderabad)	Castor seeds	In production (small)	Rs. 4,00,000/ 500kg per day	Electricity 300 KW/day	20	4	2
3.	Cocoa mass, refined Cocoa powder (CFTRI, Mysore)	Cocoa beans.	In production (small)	Rs. 5,33,000/ 0'25t beans per day	Electricity 350KW/day water 800 liters/day	11	4	1
	Coconut, desicated (CFTRI, Mysore)	Coconuts	Available (small)	Rs, 1,45,000/ 1000 coconuts per day	Electricity 75 KW/day water 6,000 gal/day	45	—	—
5.	Coconut water bottling of, (RRL, Trivandrum)	Ripe coconuts	Released (small)	Rs. 14,10,000/ 1000 litres of coconut water per day.	Electricity 41 Kw/day Light diesel oil 14 litres/day	10	1	—
6.	Coconut oil and defatted gratings (RRL, Trivandrum)	Fully matured coconuts.	Released (small)	Rs. 1,10,000/ 2000 coconuts per day	Electricity 400 Kw/day	18	3	—
7.	Cotton, chemical (RRL, Hyderabad)	Cotton linters	In production (small)	Rs. 30,00,000/ 4.5 t per day	Electricity 3,000 Kw/day	50	1	1
8.	Food, weaning malted (for infants) (CFTRI, Mysore)	Ragi and green gram	In production (small)	Rs. 4,00,000/ t per day	Electricity 85 Kw/day Fuel oil 120 litres/day water 20,000 liters/day	40	3	2
9.	Food colours, Plant based (CFTRI, Mysore)	Turmeric, Kokum, Beetroot, etc.	Available (small)	Rs. 15,00,000/ 2.8 t of raw material per day	Electricity 350 Kw/day Water 12,000 liters/day oil 400 litres/day	20	—	—

1	2	3	4	5	6	7	8	9
10.	Fruits & vegetables, debydration of (CFTRI, Mysore)	Fruits & vegetables	In use (small)	Rs. 7,18,000/ 500 kg per day	Electricity 200 Kw/day Water 15,000 liters/day.	54	Several	Several
11.	Grapes, sun dried (CFTRI, Mysore)	Grapes, preservative	In production (cottage)	Rs. 3,000/100kg per day.	Solar	Self employment	1	1
12.	Liquid fruits (CFTRI, Mysore)	Apple banana, guava, grape etc.	In production (small)	Rs. 1,00,000/ 1000 bottles (200ml) per day	Electricity 25 Kw/day Water 2,500 litres/day	8	10	1
13.	Maize mill including destoner (CFTRI, Mysore)	Maize	Destoner in production (small)	Rs. 2,00,000 400kg of maize grain per hour	Electricity 304 unit/day	8	46	3
14.	Papain (CFTRI, Mysore)	Papaya latex	In production (small)	Rs. 1,50,000/ 25 kg. of latex per day.	Electricity 135 Kw/day	39	12	2
15.	Papain, crystaline and concentrate (RRL, Hyderabad)	Papaya latex	In production (small)	Rs. 9,00,000/ 500 kg of crystaline and 500 kg of concent rate per annum	Electricity 700 Kw/day	28	4	1

1	2	3	4	5	6	7	8	9
16.	Pactin, peel oil, and calcium citrate (CFTRI, Mysore)	Lime (citrus aurentifolia)	In production (small)	Rs. 16,00,00/ 4 t of lime per day yielding i) cal. citrate 24 t ii) peftin 15 t iii) Oil 1800 litres	Electricity 350 Kw/day steam 7t/day water 50,000 litres/day.	73	4	1
17.	Potato chips, dehydrated (CFTRI. Mysore)	Potato	In production (cottage)	Rs. 15,000/50 kg chips per day	Solar (sun drying)	4	Several	Several
18.	Potato chips, fried (CFTRI, Mysore)	Potato refined groundnut oil	In production (cottage) (small)	Rs. 7,000/20 kg chips per day Rs. 2,00,000/ 500 kg chips per day.	Negligible Electricity 100 Kw/day Water 25,000 litres/day Fuel oil 600 t/day.	3 7	1	1
19.	Pulse mill, modern (CFTRI, Mysore)	Pulses.	In production (small)	Rs. 3,00,000/8 t pulses per day.	Electricity 680 units/day Water 350 litres/day	12	8	2

1	2	3	4	5	6	7	8	9
20.	Raisins (NBRI, Lucknow)	'Pusa' Seedless grapes.	Available (small)	Rs. 80,000/ 30-40 kg of raisins per day	Electricity 5 Kw/day	5	—	—
21.	Rice mill, mini (CFTRI, Mysore)	Paddy (Rough Rice)	Plant in Production (small)	Rs. 50,000/500 kg of paddy per hour	Electricity 65 Kw/day	5	43	2
22.	Sesame seed, dehulling of, (CFTRI, Mysore)	Sesame seeds.	Released (small)	Rs. 20,00,000/ 5 t seeds per day	Electricity 450 Kw/day steam 16 t/day Water 50,000 gal/day.	35	1	—
23.	Walnuts, processing of (CFTRI, Mysore)	Green walnuts	Machine in use (cottage)	Rs. 25,000/t per day.	Electricity 300 Kw/day	10	Several	Several.
24.	Wax emulsion for increasing shell life of fruits and vegetables (CFTRI, Mysore)	Fruits and vegetables, emulsifiers, fungicides and wax.	In production (cottage)	Rs. 10,000/20 litres per day.	Electricity 5 Kw/day	4	3	1

1	2	3	4	5	6	7	8	9
25.	Wheat milling (CFTRI, Mysore)	Wheat	Released (cottage)	Rs. 35,000-40,000/ 300 kg wheat per day (8 hours shift)	Electricity 25 Kwlday	4	11	—
				SPICE-BASED TECHNOLOGIES.				
26.	Asafoetida (Hing), powder tablets (CFTRI, Mysore)	Asafoetida (Oleo-gum resin obtained from root of Ferale plants).	In production (small)	Rs. 1,10,000/ 200 kg resin per day.	Electricity 160 Kw/day.	12	1	1
27.	Chilli, drying of (CFTRI, Mysore)	Chillies	In use (small)	Rs. 61,000/130 kg per day.	Solar Water 1,500 litres /day.	50	1	1
28.	Chilli oleoresin high pungent fraction and colour of (RRL, Trivandrum)	Dried Chillies	Released (small)	Rs. 22,00,000/t chillies per day.	Electricity 475 Kw/day Light diesel oil 70 litres/day.	30	3	—

1	2	3	4	5	6	7	8	9
29.	Garlic power (CFTRI, Mysore)	Garlic bulbs	In production	Rs. 1,30,000/ 225 kg powder per day.	Electricity 500 Kw/day water 5000 litres/day	25	17	3
30.	Ginger, drying & powdering of (CFTRI, Mysore)	Ginger	In use (small)	Rs. 3,80,000/ 1.2 t of raw ginger per day	Electricity 1,500 Kw/day	7	Several	Several.
31.	Mustard powder (CFTRI, Mysore)	Mustard seeds	In production (small)	Rs. 3,45,000/ 500 kg mustard seeds per day.	Electricity 150 Kw/day steem 1 t/day Water 5,000 litres/day	8	3	1
32.	Pepper, green, canning and bottling of (RRL, Trivandrum)	Fresh green pepper	In production (small)	Rs. 9,50,000/ 60 t per annum (60 working days)	Electricity 30 Kw/day Light diesel oil 120 litres/day Water 5,000 litres/day	16	5	5
33.	Pepper green, dehydrated (CFTRI, Mysore)	Fresh green pepper	In production (small)	Rs. 3,28,000/t pepper per day 150 working days	Electricity 1,20,000 Kw/ annum coal 20 t/annum	18	23	4

1	2	3	4	5	6	7	8	9
34.	Pepper, green dry packed (RRL, Trivandrum)	Fresh green	Released (small)	Rs. 1,55,000/ 15 t per annum	Electricity 5000 Kw/annum	6	2	—
35.	Pepper, powder (white) from black pepper (RRL, Trivandrum)	Dry black pepper	Released (small)	Rs. 6,30,000/ 300 kg of black pepper per day (8 hours shift)	Electricity 185 Kw/day Lightdiesel oil 100 litres/day	12	1	—
36.	Spice oleoresins (CFTRI, Mysore)	Pepper, ginger turmeric, chillies,etc.	In production (small)	Rs. 12,00,000/t of raw material per day	Electricity 180 Kw/day fuel oil 300 litres/ day Water 8,000 litres/day	27	26	7
37.	Spice oil (CFTRI, Mysore)	Cardamom, pepper and ginger.	In production (small)	Rs. 2,50.000 500 kg per day (100 working days)	Electricity 300 Kw/day	10	7	2
38.	Turmeric, curing and polishing (CFTRI, Mysore)	Turmeric gingers.	In use (small)	Rs. 90,000/500 kg raw material per day.	Electricity 300 Kw/day	10	Several	Several

1	2	3	4	5	6	7	8	9
			MUSHROOM CULTIVATION AND PROCESSING					
39.	Mushroom, cultivation of (NBRI, Lucknow) (RRL, Jorhat)	1) *Volvariella.sp.* Spawn and paddy straw-	Released (cottage)	Rs. 15/bed for cultivation of 3kg mushroom	—	Self employment	Several	—
		2) Button (*Agricus bisporus)* spawa, wheat straw sawdust and wheat bran	-do-	Rs. 30-25/tray for cultivation of 3kg mushroom (period about 60 days)	—			
		3) Dhingri (*Fleurotus saiorcaju*) spawn and paddy straw	-do-	Rs. 15/try for cultivation of 3kg mushroom (period about 30 days)	—			
		4) *Pleurotus flabbelatus* spawn, paddy straw, oat meat and polythene bags.	-do-	-do-	—			
40.	Mushroom, preservation of, by canning, dehydration, pickling and soup manufacture (*RRL, Jammu*)	Fresh mushroom	Released (small)	Rs. 2,75,000/ 450 kg fresh mushroom for 180 days.	Electricity 20 hp Water 2 kl/day	24	Several	—
41.	Mushroom, dehydration of (RRL, Jammu)	Fresh mushroom	Released (cottage)	Rs. 12,000/ 180 kg fresh mushroom per day.	Solar Wood & coal marginal	4	Several	—
42.	Mushroom, cultivation* and processing of (EFTRI, Mysore)	Master spawn, nutrients, paddy straw and packaing material	In use (cottage)	Rs. 50,500/ 50 kg fresh mushroom per day.	Electricity 5 units/ day Water 1000 litres/ day Fire wood 20 kg/day	Self employment	1	1
			FERMENTATION-BASED TECHNOLOGIES					
43.	Amylo-glucosidase (CFTRI, Mysore)	Strain of *A. niger* wheat bran	In production (small)	Being estimated	—	—	3	2

* **Fleuretus saiorcaju** variety of mushroom can be cultivated and harvested within 20-25 days in thatched hut under moderate conditions of 20-28°C temperature and relative humidity of 55-75 per cent. It can be grown for 6-8 months in a year at an estimated cost of Rs. 5/kg of mushroom.

1	2	3	4	5	6	7	8	9
44.	Curd, ready mix for quick setting of, (CFTRI, Mysore).	Chemicals.	Released (cottage)	Cost of mix works out to be 35 paise for making curd out of 1 litre of milk	—	—	1	.
45.	Microbial rennet (CFTRI, Mysore)	Strain of rhizopus.	Released (small)	Being estimated	—	—	1	—
46.	Orange, comminuted beverage base (CFTRI, Mysore)	Mandarin oranges.	Released (small)	2.8 t oranges per day.	Electricity 100kw/ day. steam 1 t/day	10	1	—
47.	Pectic enzyme (CFTRI, Mysore)	*Aspergillin* wheat bran	In production (small)	Rs. 4,60,000/ 35 litres concentrate per day	Electricity 300kw/ day Coal 0'05 t/day Water 30,000 litres day	12	4	2
48.	Vinegar from pineapple waste, or any sugary material (CFTRI, Mysore)	Pineapple ceels, corncobs. nutrients, bottles, etc.	In production (cottage)	Rs. 30,000/t per day	Water 5.000 litres/day	Self employment	1	1

FOREST-BASED TECHNOLOGIES

1	2	3	4	5	6	7	8	9
49.	Board, fibre, for packing purposes (RRL, Jammu)	Pire needles	Released (small)	Rs. 25,00,000/ 4.8 t raw material per day	Electricity 250 hp Coal 1 t/day	50 direct 100 indirect	5	—
50.	Board, paper (RRL, Jammu) (RRL, Jorhat)	Paddy/wheat straw. hagasse, pine needles. etc.	In production (small)	Rs, 8,00,000/ 2.5 t per day	Electricity 120 hp Coal 1 t/day water 150 kl/ day	16	8	4
51.	Board, straw (RRL, Hyderabad)	Waste paper, grass and straw	In production (small)	Rs. 3,00,000/ 500 kg. of board per day	Electricity 500kw/ day water 250 kl/ day	12	Several	Several
52.	Cedarwood oil (RRL, Jammu)	Cedrus deodara	In production (small)	Rs. 2,50,000/ 20 kg. per day	Electricity 5hp coal/ fuel wood 100 t/ annum	10	10	3

1	2	3	4	5	6	7	8	9
53.	Gum from 'dhaincha' (sesbania bispinosa) (NBRI, Lucknow)	Dhaincha seeds	Available (small)	Rs. 2,50,000/t seed per day	Electricity 20kw/day	50	—	—
54.	Pine wool (RRL, Jammu)	Pine needles	Released (small)	Rs. 3,80.000/ 1.6 t day needles per day	Electricity 50hp coal 100/t annum	16	4	—
55.	Resin, distillation of, and hardened resin, production of (BRL, Jammu)	Chir-resin	In production (small)	Rs. 5,00,000/t per day of resin distillation and Rs. 10,000,000/t per day of hardened resin	Electricity 15hp coal 100/t annum	20	5	3
56.	Tamarind powder (CFTRI, Mysore)	Tamarind pulp	In production (small)	Rs. 3,00,000/ 500 kg per day	Electricity 450 km/ day water 7,000 litres/day	25	17	5

POULTRY-BASED TECHONOLOGIES

1	2	3	4	5	6	7	8	9
57.	Broilers, dressing of (CFTRI, Mysore)	Broiler chicken	In use Poultry dressing gadgets developed (cottage)	Rs. 30,000/ 150-200 birds per day	Electricity 10 kw/day Water 2,000 ltrs/ day	10	Several	Several
58.	Egg albumen flackes	Egg	In production (small)	Rs. 4,00,000/ 40 kg flakes per day	Electricity 100 kw/ day water 10,000 ltrs/day	8	8	1
59.	Egg coating oil (CFTRI, Mysore)	Petroleum product, preservatives	Released (small)	Rs. 1,00,000/ 1000 litres per day	Electricity 40 kw/day	6	3	—
60.	Egg shell powder (CFTRI, Mysore)	Egg shells	In production (small)	Rs. 60,000/ 100 kg per day	Electricity 60 kw/day water 4,000 ltrs/ day	7	1	1
61.	Egg washing powder (CFTRI, Mysore)	Detergent	Released (cottage)	Rs. 2,000/ 10,000 to 15,000 eggs per day	Electricity 30 kw/day water 2,000 ltrs/ day	4	2	—

1	2	3	4	5	6	7	8	9
62.	Poultry feed CFTRI, Mysore)	Cereals, millets oil seed cakes and molasses	In production (small)	Rs. 3,70,000/9 t feed per day	Electricity 90 kw/day	10	5	1
			FISH-BASED TECHNOLOGIES					
63.	Chitosan (CFTRI. Mysore)	Prawn and squilla waste	Released (small)	Rs. 9,90,000/ 10 t per day	Electricity 300 kw/ day water 15,000 ltrs/day Stem 4 t/day	30	1	
64.	Fish mackeral and Bombay duck, sun drying and curing of (CFTRI, Mysore)	Fish	In use (cottage)	Rs. 7,000/100kg fish per batch	Solar	3	Several	Several
65.	Fish meal and oil from sardine (CFTRI, Mysore)	Sardine and fish waste	Released (small)	Rs. 8,76,000/ 30 t of raw material per day	Fuel oil 330 kl/ day Electricity 160 kw/ day	36	1	—

1	2	3	4	5	6	7	8	9
66.	Fish meal for poultry feed (RRL, Bhubaneswar)	Low grade fishery wastes	In production (cottage)	Rs. 6,700/50kg fish meal per day	Firewood 150kg/day	6	—	—
67.	Fish pickle, improved processing of (CFTRI, Mysore)	Fish (fleshy) cooking oil salt & spices	Released (cottage)	Rs. 20,000/100 kg per day	Electricity 50 kw/day	10	1	—
68.	Fish sausages (CFTRI, Mysore)	Fish & animal casings.	In use (small)	Rs. 1,10,000/ 40kg sausages per day	Electricity 40 kw/day	3	Several	Several
69.	Paddy-cum-shrimp culture (in paddy fields near sea shore (NIO, Goa)	Fast growing shrimp seeds (P. indicus) fish and shrimp waste meal ground nut oil cake, rice, wheat bran and tapioca flour	Available (field)	Rs. 6,500/965kg shrimp per hectare per year (NOV-April)	—	Self employment	—	—
			OTHER MARINE-BASED TECHNOLOGIES					
70.	Agar-agar from Indian sea weeds (CSMCRI, Bhavnagar)	Sea weeds (Gracilaria)	In production (small)	Rs. 4,23,000/ 10kg per day	Electricity 75 kw/day Water 65,000 t/ day steam 1 t/day	5	10	5

1	2	3	4	5	6	7	8	9
71.	Jajoba (Simmondsia chinensis) Cultivation of, for liquid wax (CSMCRI, Bhavnagar)	Jajoba seed coastal sand dune and water	Available (field)	Rs. 15.000 for cultivating 2.5 ha/year	Diesel 12. 51 litres/ day Electricity 12-17 kw/ day (for lifting water for irrigation 120 acre inch per annum)	6250 may days for 10 years		Being cultivated in the farm of the Institute.
72.	Vegetable and crops, cultivation of (CSMCRI, Bhavnagar)							
	i) Bajra, Babapuri (*Pennisetum typhoides*) (17,000-24,000 ppm of sea water)	Seeds, sand dunes, sea water	Available (field)	Rs. 4,070 for cultivating 2.5 ha yielding grain 14-16 q/ ha. Fodder 3-4 t/ha	—	Additional employment generation project		Being cultivated in the farm of the Institute
	ii) Onion (white) (*Allium cepa linn*) (10,000 ppm of sea water)	do	do	Yield 10-15 t/ha	—	150 man days for 150 days		do
	iii) Sugar beet (10,000-15,000 ppm of seawater)	do	do	Yield 12 t/ha	—	do		do

CULTIVATION OF MEDICINAL PLANTS

1	2	3	4	5	6	7	8
73.	Belladonna (Atropa sp.) (CIMAP, Lucknow)	Deep fertile soil of medium texture and temperate climate	3 years	Leaves 100kg/ yr Roots after 3 years 100kg.	Ist year Rs. 3,500 Subsequent years Rs. 2,500	Rs. 7,500 after 3 years (leaves @ Rs. 5/kg Roots @ Rs. 10/kg	Grown at CIMAP Farms.
74.	*Dioscorea Species* (CIMAP, Lucknow) (RRL, Jorhat)						
	i) *Dioscorea floribunda* Mart & Gall.	Medium loam deep soils	2 years	Dried tubers after 2 years —6 t	i) Ist year Rs. 12,500 2nd year Rs. 5,500 ii) Capital cost for erection of trellis Rs. 20,000	Rs. 12,000 after 2 years (@ Rs. 5/kg of tubers	Grown by one firm in Bangalore
	ii) *Dioscerea deltoidea* wall	Medium loam deep soils	3 years	Dried tubers after 3 years —5 t	i) Ist year Rs. 10,000 subsequent years Rs.4,000 ii) Capital cost for erection of trellis Rs. 20.000	Rs. 12,000 after (3 years @ Rs. 6 /kg of tuber)	

1	2	3	4	5	6	7	8
75.	Pyrethrum *Chrysanthemum cinerariafolium vis.)* (CIMAP, Lucknow)	Fertile deep and well drained soil, mold cool climate 10-24° C ; Annual rainfall 1000 mm, but well distributed	5 years	i) Flowers 200 kg/yr, with pyrethrins content of 10 percent in Kashmir. ii) Flower 440 kg/yr in Nilgiris with pyrethrins contents of 1.5 percent	Ist year Rs. 1,600 susequent years Rs. 1,000 (average) Rs. 1200 do	Rs. 1,000 (@ Rs. 6/kg of flowers) Rs. 4,000 (@ Rs. 12/kg flowers)	Being cultivated in Kashmir.
76.	Periwinkle *(Catharanthus roseus)* L.G. DON) CIMAP, (Lucknow)	All types of soils, except saline/alkaline	1 year	Roots-750kg Leaves-2000kg (rainfed)	Rs. 2,000	Rs. 7,500 (@ Rs. 10/kg of roots; @ Re. 1/kg of leaves)	Released to 50 farmers
77.	Serpentina root *(Rouvolfia serpentina* Benth *ex* Kurz) (CIMAP, Lucknow)	Sandy alluvial loam to red lateritic, loam acidic and meutral soil hot and humid tropical climate.	2 years	Dried roots after 2 years 100kg	Rs. 7,500 for 2 years	Rs. 12,500 after 2 years (@ Rs. 20/kg) Seeds are also saleable (@ Rs. 100/kg)	

CULTIVATION & PROCESSING OF AROMATIC PLANTS

1	2	3	4	5	6	7	8
78.	Geranium *(pelargonium graveolens* L. 'Her *ex* Ait) (CIMAP, Lucknow)	Well drained porous soil ; mediterranean type of mild climate with low humidity, warm winter and mildsummer temperature, annual rainfall 1000-1500mm	4-5 years	Oil-18kg/ annum	Ist year Rs. 7,000 Subsequent years Rs. 6,000	Ist year Rs. 10,700 Subsequent years Rs. 12,000 (@ Rs. 800/kg)	20 t
79.	Japanese mint *Mentha arvensis L subsp, haplocaly* Briquet var *piperascens* (Holmes) (CIMAP, Lucknow) (RRL, Jorhat)	Medium, deep soil pH 6-7.5 with adequate irrigation, tropical and subtropical climate	8 months	Oil-75kg/ annum	Rs. 3,000/ annum	Rs. 5,000 (@ Rs. 100/kg)	400 t

1	2	3	4	5	6	7	8
80.	Java citronella (*Cymbopogon-winterianus* Jowitt) (CIMAP Lucknow) (RRL, Jorhat)	Sandy loam pH 5.8 to 8, tropical and sub-tropical climate annual rainfall 200-250 cm, well distributed or assured irrigation. altitude 180-1200m	4 years	Ist year Oil-100kg Subsequent years Oil-150kg	Ist year Rs. 7,000 Subsequent years Rs. 6,000	Rs. 6,000 (@ Rs. 800/kg of oil)	400 t
81.	Lemon grass (*Cymbopogon flexuosus* (Stued wats) (CIMAP, Lucknow) (RRL, Jorhat)	Sandy loam soil ; warm & humid climate, attitude 900-1200m ; annual rainfall 250-300 cm, well distributed or assured irrigation	6 years	Oil-75-100kg/ annum	Rs. 3,000/ annum (@ Rs. 70/kg of oil)	Rs. 3,000	650 t
82.	Palmarosa (*Cymbopogon martinii var, motia*) (CIMAP Lucknow) (RRL, Jorhat)	Loamy soil ; annual rainfall about 150 cm or assured irrigation	4 years	Oil-50kg/ annum	Rs. 2,500/ annum	Rs. 6.000 (@ Rs. 160/kg of oil)	—

1	2	3	4	5	6	7	8	9
83.	Peppermint *Mentha piperita* L (CIMAP, Lucknow) (RRL, Jorhat)	Medium deep soil; pH 6-7.5 with adequate irrigation; tropical & sub-tropical climate/temperate climate	3 years	Oil-5kg/annum	Rs. 3,000/ annum	Rs. 7,000 (@ Rs. 200/kg of oil).	20 t	
				PLANT DRUGS				
84.	Palatable isapggl, granules for laxative (CDRI, Lucknow)	Isapgol (*Plantago ovata* seed husk)	Available (small)	Rs. 50,000 to Rs. 1,00,000/ 100 kg per day and upwards.	Etectricity marginal	5-10	—	—
85.	Pyrethrum for insecticide (RRL, Jammu)	Pyrethrum flowers	In use (small)	Rs. 5,00,000/ 50 t flowers per annum	Wood/Coal 100 t/annum	15	2	—

1	2	3	4	5	6	7	8	9
86.	Attars, perfumed water and oil from flowers (NBRI, Lucknow)							
	i) Rose oil/ water (from Damask rose)	Fresh flowers of Damask rose (*Rose demascena*)	Available (cottage)	Rs. 30,000/50kg flowers distillation percharge (one ha. of plantation yields about 3,000 kg flowers)	Fuel wood 60q for distilling 3,000kg flowers	6	—	—
	ii) Jasmine concrete & absolute	Fresh flowers of Jasmine (*Jasminum grandiflorum Linn.*) Petroleum ether 40-60°C or Normal hexane 65-70°C	Available (small)	Rs. 2.00,000/ 24,000kg flowers in 4 months in the year	Electricity 5 kwh	5	—	—

1	2	3	4	5	6	7	8	9
87.	Blue oil from Matricaria *Chamomilla Linn*, (NBRI, Lucknow)	Dried flowers	In production (cottage)	Rs. 5,000 for growers on a hectare of land plus Rs. 2,500 for distillation plant	Fuel wood 2.25q for 1,500kg flowers	10	Several	Cultivation-10 Processing-1
88.	Citronella oil (RRL, Jorhat)	Citronella grass	In use (cottage)	Rs. 20,000/ 200kg per batch	Wood/Coal 30kg/batch	2-3/ha	Consultancy given to 45 parties	
89.	Citronella oil (2-3 dihydrogeranoil) RRL, Jammu)	Eucalyptus citrodora oil	In production (small)	Rs. 2,00,000/ 10kg of finished product per day	Electricity marginal	10	4	2
90.	Citrus oil, terpeneless (CFTRI, Mysore)	Citrus oil (lemon/lime oil/ orange oil)	Available (cottage)	Rs. 40,000/2 columns deterpentation of 4-8kg of citrus oil per day.	Electricity marginal	2-3	—	—

1	2	3	4	5	6	7	8	9
91.	Essential oil (RRL, Bhubaneshwar)	Lemon grass citronella, Palmarosa grass Cinnamon leaves.	In production (cottage)	Rs. 7,000/100kg per day	Wood/Coal 30kg/day	2		
92.	Menthol (RRL, Jammu)	Mint oil from mentha leaves	In production (small)	Rs. 4,00,000/3t of menthol per annum	Electricity 5hp	6	39	7
93.	Rose oil (CIMAP, Lucknow)	Rose flowers	Pilot plant (small)	120kg of flowers per batch, cost being estimated	—	—	—	—

LEATHER PROCESSING/TECHNOLOGIES

Sl. No.	Process (Laboratory)	Traditional Process	Improved process at Rural Level
94.	Carcass-Processing (CLRI, Madras)		
	i) Carcass collection and transport to processing centre.	Carcasses are dragged, or transported by a hard-cart, to the village outskirts for flaying. A drawback is that hides in many cases get damaged because of dragging as well as because of delays in flaying. When animals die of natural causes and in plances where carts cannot ply, the carcasses have to be removed manually.	A carcass-collection cart with a hoist is recommended. Improvement in design with standard components like wheels, beams, pulleys and rollers for easy transportation of carcasses. For urban use, a jeep with trailor is suggested.
	ii) Flaying and curing	Done by an ordinary knife, this in an improper method. The drawbacks are that hides get cuts, and more flesh is left in some parts, such flesh putrefying and damaging the hides. The hides are not cured immediately and are mostly dried in the sun. Sometimes, the salt applied is inadequate, or contaminated, or used salt is re-utilised.	i) Two types of flaying knives should be used; (i) round-edged, and (ii) sharp and pointed. A flaying platform may be provided. ii) To remove blood and dirt, use of 30% Na Cl by weight of hides, or a mixture of salt and preservatives, is recommended. The mixture should be applied in 3 parts on the flesh side of hides. There should be washing pits and a good supply of water.

1	2	3	4
	iii) Carcass disintegration, per-processing /composting.	Flayed carcass is left as such to vultures and dogs and the bones are collected afterwards.	iii) A weighing machine should also be provided. i) Carcass parts should be separated into fallow, bones and flesh for animal food, manure, horns and hoofs. ii) Where there is no arrangement for carcass cooking the meat and bone shoul be buried and the bones recovered later for being sold to bone mills. iii) Pre-processing of bone flesh for bon flesh mill plant. iv) Composting of waste for manure. v) Recovery of tallow by scrapping and melting in pan. vi) Preservation of tallow before supply to processing units. vii) Recovery of guts for rackets ; hair for brushes ; hide trimmings, ear, and tails for glue-making and horns/bones for curios.

1	2	3	4
95.	Tanning (CLRI,Madras)		
	i) *Jawasee/ awk*/lime process (unhairing)	i) Fallen flint hides in mixed lot are used with no proper seaking. Old *Jawasee/awk* bath are used for years and these emanate a very strong foul smell, with the resultant stigma and social problems. It takes 20-90 days for unhairing. Similarly, jawasee treatment is done in two haths, and without being washed it is taken to old (*Malni) oza* bath.	i) The hides are soaked well in a preservative. A fresh jawasee bath is prepared and hides are treated for 5-6 days. The treated hides are unhaired, fleshed, washed and lightly pickled and taken for tanning. The processing period is considerably shortened and the foul smell is eliminated.
		ii) Lime process : Hides are partially soaked and immersed in an old-lime liquor with fresh lime for 15-20 days, unhaired, fleshed and washed.	ii) Lime process—The hides are well soaked : Liming is done in two stages, spanning a period of 6-8 days. These are unhaird, fleshed, washed, delimed by using (NH4) 2S4 and lightly pickled with salt and sulphuric acid. The drudgery of the beam-house operation is thus eliminated. Use of water is minimised by using chemicals for deliming.

1	2	3	4
	ii) Tanning	Tanning is done by the pit-or bag-tanning method, by using aval or babul bark or any other locally available bark. The drawbacks are that the quantity of bark used is often insufficient, and the leathers are unevenly tanned. As a result, the final products are disfigured with dark patchy colours, while some are hard leathers, with a foul smell.	Tanning is done by the following method using locally available barks : i) E. I. tanning ii) Improved bag-tanning iii) Wet-blue chrome iv) Rural chrome process for sole/lace v) 'Novotone' finishing.
	iii) Post tanning	Salt dissolved in old tan liquor is sprinkled on the flesh side of pit or bag-tanned leather and dried as such on ground. These are then processed, dried, beaten and stored. The leathers are creasy and uneven in colour, emit a foul smell, and are mostly used for rural footwear, *Charas* (water-lifting leather bag) and *mashk* (water container for sprinkling), buckets, and agricultural accessories.	The tanned hides are treated with myrab and oil, using locally available oil, epsom salt, and jaggery. These are hooked for semi-drying, following by setting by slickers, and are dried. The finished leathers are of uniform light colour, smooth, soft and plain, and are free from foul smell. Thus, this leather can be used for sboes and other footwear and leather products to meet the demand from rural and urban markets.

1	2	3	4
96.	Leather products (CLRI, Madras) Footwears and leather goods manufacturing	*Desi juti* (native shoe), irrigation leather (*charas*), leather bucket, agricultural accessories. etc., are made to meet the local village demand. For this, old traditional tools are used.	With the improved technology, shoes, chappals sandals, school bags, shoulder bags for upper-class men and women, pouches, waist belts, sport goods like football and volleyball, industrial leather goods, etc. could be produced to meet the demand of rural as well as urban markets. Use of improved tools and improved designs are recommended.
97.	Leather-processing management (CLRI, Madras)	Hardly any concept about management except where there is some organised structure. Because of constraints in the availability of sufficient quantities of carcasses within easily transportable reach, processing becomes uneconomical and unproductive, Rural artisans are also exploited by the urban-based industries and their agents.	Improved management considerations : 1) After the death of the animal, its immediate removal from rural homes, farms and other places in the village is absolutely necessary. Hence, appropriate transportation from the place of death to the disposal ground is a must. The expenses in this regard have to be incurred by the owner of carcass, the flayer, the tanner or any agency. Expenditure cannot be avoided even if the carcass is to be buried, and hence need not be brought into the economics of utilisation.

1	2	3	4
			2) The development of growth centres with common facility/service centres by location depends on : a) Size of procurement of dead animals. b) availability of hereditary flayer/leather artisans. c) Promotional objectives and policies and the current consumption pattern of leather goods for local consumption and for catering to urban demand. d) scope of subsidiary occupation to the rural poor. 3) Given necessary training, supply of required materials, services, facilities and supervision and R & D support, it is possible to establish a technology appropriate to rural areas. 4) By-product utilisation should also be organised simultaneously.

1	2	3	4
			5) Product on and fabrication depend on local demands, nearness to market, ancillary contacts, etc. a) Introduction of improved tools and equipment ; b) Utilisation of locally available resources and technologies ; and c) Introduction of improved and newer designs in combination with traditional crafts/ skills would be necessary to help the villager to earn a higher income, which in turn would improve the socio-economic conditions of the rural leather artisans.

OTHER TECHNOLOGIES

Sl. No.	Technology/technique (Laboratory)	Main feed/stock raw material	Status/scale of technology	Cost/capacity of plant	Energy source/ requirement	Employment potential	Utilisation status (number of parties)	
							Released to	*In production*
98.	Cabinet drier (solar for fruits /vegetables) (RRL, Jammu)	Glass pans, black paint, vegetables, fruits.	In use (cottage)	Rs. 1,600/80kg per batch (size 2.5x2.5 metre ground area)	Solar	Self employment	Several	Several
99.	Cashew nut decorticator (CNERU, Durgapur)	Cashew nut in mild roasted form	Design available (cottage)	Rs. 350 for one shelling unit, excluding mounting and seating arrangement	Manual	do	—	—
100.	Clay flooring and roofing tiles (Mangalore type) (CRRI, Roorkee)	Alluvial clay of suitable composition.	In production (small)	Rs. 1,50,000/ 75000 tiles per year (8 hours/ day shift)	Wood/Coal 450 t/annum crank press screw press operated manually	Skilled-2 unskilled -18	5	5
101.	Cupola. mini (NML, Jamshedpur)	Pig iron, pig ironscrap and coke	Released (cottage)	Rs. 18,000/25 kg per hour molten metal	Electricity 10-15 kw/day	5	3	—

1	2	3	4	5	6	7	8	9
102.	Ferro-cement Unit, grain storage bins, water tanks, septic tanks, biogas digestor and holders, etc. (SERC, Roorkee) (RRL, Jorhat)	Cement, sand water proofing chemicals wire meshes. M.S. barspwires.	In production (small)	Rs. 1,20,000/ 200 units per month.	Electricity 3-5 kw/unit	Skilled-6 Unskilled -14 (masons and carpenters)	15	6
103.	Flowers and foliage, dehydration of (NBRI, Lucknow)	Fresh flowers, foliage, etc.	In use (cottage)	Rs. 10,000/ 50,000 flowers per annum	Electricity 25 kwh	Self employment	10	1
104.	Hand tools, harvesting and tilling (MML, Jamshedpur)	High/medium carbon steel plates, 6mm approximately	Available (small)	Rs. 1,00,000/ 3-5 t per annum	Electricity 10-51 hp	do	—	—
105.	Juto gunny bags pest-proofing of, (CFTRI, Mysore)	Chemicals.	In use (cottage)	Rs. 16,000/ treatment of 3000 bags per day	Manual	do	2	2

1	2	3	4	5	6	7	8	9
106.	Leaf cup-plate making machine (CFTRI, Mysore)	Dry leaves of banana, areca sheets, etc.	In production (cottage)	Rs. 3,500/ 3,000 cups per day	Electricity 300 kw/day or Kerosene oil	do	90	3
107.	Mineralised salt lick for cattle (CSMCRI, Bhavnagar)	Salt and minerals	In production (small)	Rs. 1,02,000/ 200 salt licks of 2kg each per day.	Electricity 5.2 kw/day Water 500 k1/ day	5	39	15
108.	Musk melon sees, dehulling of (CFTRI, Mysore)	Seeds of musk melon	Released (tiny)	Rs. 30,000-40, 000/100kg of seeds per hour	Electricity 8hp	5	—	—
109.	Speciality paper (RRL, Hyderabad) (RRL, Jorhat)	Cotton rags and cotton linters.	In production (small)	Rs. 6,50,000/ 270kg per day	Electricity 500 kw/day Water 150 k1/ day	108	4	1
110.	Slate, paper (RRL, Jorhat)	Paper board, wood, resin	In production (cottage)	Rs. 15,000/200 slates per day	Electricity 0'02 kw/day	5	58	9

1	2	3	4	5	6	7	8	9
111.	Slate; plastic (RRL, Jorhat)	Plastic sheets, chemicals.	In production (small)	Rs. 50,000/200 slates per day	Electricity 20 kw/day	5	18	3
112.	Sodium silicat from rice husk ash (I.S.S.) (CGCRI, Calcutta)	Rice husk ash, soda ash.	In production (small)	Rs. 25,000/0.5t sodium silicate per day	Electricity 16 kw/day Fuel (Coal) 120 kg/day	4 per shift	8	1
113.	Water filter candles for domestic use (RRL, Jorhat)	China clay and non plastic material	In production (cottage) (small)	i) Rs. 20,000/ 50 candles per day	coal marginal	4	17	2
				ii) Rs. 6,46.000 /1000 candles per day	Coal 300 q/ annum	25		

ABBREVIATIONS OF CSIR LABORATORIES MENTIONED IN THE PAPER

1. CBRI—Central Building Research Institute, Roorkee (UP) 247672
2. CDRI—Central Drug Research Institute, Lucknow (UP) 226001
3. CFTRI—Central Food Technological Research Institute, Mysore, (Karnataka) 570013
4. CGCRI—Central Glass & Ceramic Research Institute, Calcutta (West Bengal) 700032
5. CIMAP—Central Indian Medicinal & Aromatic Plants, Lucknow (UP) 226016
6. CLRI—Central Leather Research Institute, Madras (Tamil Nadu) 600020
7. CMERI—Central Mechanical Engineering Research Institute, (Durgapur) 713209
8. CSMCRI—Central Salt & Marine Chemicals Research Institute, Bhavnagar (Gujrat) 364002
9. NBRI—National Botanical Research Institute, Lucknow (UP) 226001
10. NIO —National Institute of Oceanography, Dona Paula (Goa) 403004
11. NML —National Metallurgical Laboratory, Jamshedpur (Bihar) 831007
12. RRL(B)—Regional Research Laboratory, Bhubaneswar (Orissa) 751013
13. RRL(H)—Regional Research Laboratory, Hyderabad (AP) 500007
14. RRL(Jm)—Regional Research Laboratory, Jammu (J&K) 180001
15. RRL(Jt)—Regional Research Laboratory, Jorhat (Assam) 785006
16. RRL(T)—Regional Research Laboratory, Trivandrum (Kerala) 695019
17. SERC—Structural Engineering Research Centre Roorkee (UP) 247672.

Science and Technology in Tribal Development

B. K. Roy Burman*

1. The issues in application of Science and technology in tribal development are to be considered at three levels ; first at the conceptual level, second at the empirical level and third at the analytical level.

2. A At the conceptual level the issues are
   I) Relation between Science and technology
   II) Source of scientific creativity.
   III) Parameters of technological change.
   IV) Conceptualisation of development.
   V) Conceptualisation of tribal development.

   B. At the empirical level it is necessary to examine
   a) The resource base.
   b) The people, the production units, social organisation of labour and the skill level.
   c) The motivational aspect in production.
   d) The system of circulation of products.

   C. At the analytical level one has to examine the nature of the social formation and its wider articulation.

3. There is a widespread misconception, equating science with technology.
   Science is a cognitive process : technology is a manipulative process.

Even in Science what properties are perceived depends on the context, which in turn is fixed by priorities and

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values that govern the use of natural resources. It is thus that values get built into scientific facts about nature. There is nothing like an objective property possessed by natural systems independent of the value injected into it by human cognitive and economic activity. Much of mythification of science takes place because of the failure of understanding this basic reality about science to the detriment of the development of science itself.

4. Parallel to the mythification of science is also a tendency towards mythification of technology or a world view of new obscurantism.

5. For quite sometime however when we speak of technological progress it conjures up in the mind the imagery of industrial development. Wilbert Moore has defined industrialization as extensive use of inanimate source of power for economic production and all that entails by way of organization, transport, communication and so on. This is unexceptionable in so far as it goes. But he looks for "a total transformation of preindustrial society into a type of technology and social organization that charactise the advance economically prosperous and relatively politically stable nations." The model of industrial modernization that is held is the model of capitalist modernization : and in terms of this model Tawney could tell us in 1926 that the significance of industrialisation is not so much in terms of economic growth as in decline of moral aesthetic standards. In 1960, Kerr suggested with teleological certainity "If industrialization is to succeed traditional institutions must give way to new type of social structure consistent with machine technology." In other words technological development as perceived by this brand of scholars is that man must be the slave of machine. This perception is a legacy of European history in a very specific context. As pointed out by Levy Strauss it is generally overlooked that the crystalisation of the so-called renaissance in Europe coincided with colonial expanstion. It is in this context.

that as pointed out Toynbee, the essence of industrial revolution is the substitution of competition for medieval regularities, which had previously controlled the production and distribution of wealth. It is easy to perceive that the dehumanising face of technology as revealed in the poisonous gas leak of Little Island in U. S. A., Bhupal in India and Chernaby in U. S. S. R. is the outcome of such rectless competition. The moot question is whether scientific and technological development of the tribal area would go along the same line or whether an alternative science and alternative technology is possible.

Source of creativity of alternative science

Immediately after independence the Educational Commission set up under the Chairmanship of Sarvapalli Radhakrishan stated that the Great Tradition created by the people through their meeting challenges of life is the major source of learning. Those were days when the ethos of our freedom struggle inspired our vision. But shortly after that our friends from the west began to tell us that elite institutions, ancient and modern are the custodians of the Great Tradition and what the people live by, is Little Tradition, to be patronised and romanticised. In the name of science and knowledge what has been created is loss of faith in man and dependence on esoteric establishments.

Parameters of technological change

In this relationship of dependence there has been a rush for technology transfer like the goldrush of the last century. The understanding assumption is that whatever the priests of science and the lords of the establishments of knowledge have created are good irrespective of the ecology, history and social structure of the people and if the people fail to accept these good things there is something wrong with them. The task of social science

is to help in manipulating the people's attidude, either through identifying the leaders who can be induced to collaborate or through symbolic action so that the people can be hoodwinked. The essential task was seen as that of communication manipulation ; rather than that of looking into the task of bringing about changes in structural relations.

It was however soon found that transfer of technology approach does not work by itself. Where somehow it could be pushed through uncomfortable questions began to come up : transfer of technology for whom ? Who are benefitted by the same ? What happens to those who are left out ? What happens to the recources on the basis of which they have been sustaining themselves ? It was not difficult to find the answer. It was found that transfer of technology approach rather than building up technology man the experience of the people and with reference to the situation embedded in the ground was leading to accentuation of disparities, the rich were becoming richer and the poor were wondering where they were moving to. Societies here laden with tension and confidence about the future was being eroded and at the same time reckless exploitation of natural resources was leading to irreparable damage of natural environment.

New Quest for the meaning of development

Faced with this crisis a new quest for the meaning of development has ensured under the aegies of international and national forums. The united Nations General Assembly Resolution 2542(XXN) adopted in 1971 on social program and development emphasised the following operative aspects.

Social progress and development require (a) full utilization of human resources, creative initiative, information participation, opportunity.
(b) right of work and free choice of employment.
(c) Participation of all members in productive and

socially useful labour and establishment of forms of ownership of land and means of production which precede any kind of exploitation and create conditions leading to genuine equality.
(d) rapid expansion of national income and wealth and their equitable distribution among all members of society.

Conceptualising tribal development

Within the general framework of concept of development the meaning of tribal development is to be analytically appraised. There is one prevailing point of view that tribal social formation represents a stage in the development of human societies. There is also a growing point of view that certain aspects of tribal social formation represents a differential pattern of organisation of life other than stage on one evolutionary scheme of human societies. The essential attribute of this differential pattern is the regulation of the affairs of man through reciprocities and moral solidarity, rather than through the coercive scale, but the national of that organisation is not hierarchical ; it is egalitarian and rather than being based on balance of power of moves towards maximisation of consensus.

It is not necessary for the present purpose to evaluate the merit or the demerit of this perspective. But it is necessary to keep an alternative to the prevailing view in perspective.

Empirical fact

After examining some of the fundamental conceptual issues it is now proposed to go into the relevant empirical facts.

A. Resource base

There are rough estimates that while the tribals constitute only about 7 percent of the population of the country more than 80 percent of the mineral, timber and forest resources are located in the tribal areas. But about

the resource holding pattern here is a hiatus in the perception of the State and the people. Historically and in practice, the concerned population not only have right of approach, to the resources, but frequently have right of management and control of the same. But in the perception of the state bureaucracy guided by legal positivism introduced during the colonial rule, the ownership absolutely vests in the state. This hiatus of perception is an important inhibiting factor in the technological Development of the tribal areas. The National Committee on the Development of Backwards Areas set up by the Planning commission has recommeneded that in the interest of progress the communal rights should be privatised. The validity of this line of thinking will be considered shortly; but before that, some of the realities of the conditions of life in North East India will be briefly mentioned here.

B. Occupation pattern

As in 1981 population census did not take place in Assam, leaving out Assam in the other states of the region, in the other states it was found that the precentage of workers engaged as agricultural labourers to the total population varied from 0·85 pernent in Nagaland to 7·08 percent in Tripura. If Tripura was left out, the highest percentage was in Maghalaya (4.38 percent). In the sector of household industry, manufacturing processing, servicing etc. it varied from 0.20 percent in Arunachal to 4.54 percent in Manipur. The rest were in other occupations. Among them the percentage of cultivators to the total population varied from 12.90 percent in Tripura to 35.56 percent in Arunachal. It is to be noted that these figures include the non-tribal population of North East India, agricultural labour sector is even now not a major problem and manufacturing sector remains negligible.

Problem of technological development

Agriculture being the predominant occupation, the problem of technological development in North East India

naturally revolves around agriculture. One important fact about agriculture particularly in the hill areas of North East India is the practice of shifting cultivation on a fairly wide scale. But there are controversies about the area under shifting cultivation, also there are controversies about the level of productivity under different techniques of shifting cultivation and different forms of agriculture. Though these have been discussed times and again in different forums, after myrecent review of available and several field level verifications, I am convinced that even the fringe of the problem has not been touched. Most of the studies have been made with extremely limited focus. To go into all the issues it will be necessary to have a Seminar lasting for a few days. I, therefore, refrain from taking up the question of technological development in agriculture including shifting cultivation on the present occasion. But I shall make a reference to some of the experiences in introducing plantation crops and also to some of the neglected aspects of indigenous technology

Technological development in forestry sector

Technological development in forestry sector can be considered with reference to two vantage points ; first with reference to so-called minor forest produce and non-descript forest species ; and second with reference to timber industry. With the assistance of a team of bio-physical and social scientists including botanists and agronomists recently I conducted a survey of the resources, peoples' cognitive pattern about the resources, and the technology involved in processing and using the same in 12 villages of Manipur Nagaland and Assam. During the survey about 1400 botanical specimens were collected, out of which about 400 were common and the rest were duplications. These specimens have been preserved in herbarium sheets for future research. The local names and uses of all the specimens have been recorded. Broadly these are food plants, fodder, medical herbs, fuel wood species, housing materials, fibres used for

village industries, leaves used as containers, ornamental specimens and specimens of other use.

With our limited resources and during the short period at our disposal we have tried to examine in the laboratory the validity of some of the beliefs and practices that prevail among scholars of the tribal population. For instance our collection included five specimens which the people believe to have insect repelling properties. In our preliminary investigation in respect of two of them in the laboratory, we found confirmation of the validity belief, but the intensity of the insect repelling properties and the durability of the same are yet to be studied.

While conducting these studies in the field and in the laboratory we tried to find out whether the development agencies are aware of the same. We found that ignoring the knowledge base of the people insecticides were being pushed among them. It is not necessary to comment whether this is the right way of technological development.

What impressed us most during our study is the indigenous system of soil conservation and water harvesting practised by many of the people engaged in shifting cultivation. We hope to bring out a document in this regard in the near future.

Housing materials and housing technology

Our study of housing materials and housing technology seems to be an extremely promising one. One enthusiatic young Meitei engineer is associated with the team. He has identified 16 house types in 10 villages. He could not conduct the study in two villages. He found that some villagers have rudimentary techniques of even making the thatched houses fire-proof. But what is most important is that even with the same type of thatch while the roofs in some houses last for 5 to 6 years in some it last, for more than 20 years. The difference is caused by the spacing and curvature of the prellies work, the pattern of distribution of the thatch, the direction of the house with reference to the wind, particularly of the cyclonic season, the technique of tyeing of the king post and the queen posts and so on. A further study shows that these differences are not caused by the lack of knowledge of the technology, nor even by economic considerations all the time, but sometimes by such considerations as the household level demography, time budgeting of male and female labour, the calculation about the optimum relation in the durability of the roof and the wall and such other factors.

This study is important on two counts. When we are planning to have a massive programme of having shelter for the shelterless, we can ill afford to be ignorant of indiegenous technologies and skill, second if the techniques by which longevity of the houses can be augmented much of the forest materials would be saved and the strain on the environment would be reduced to that extent. We should not also ignore that this will reduce dependence on contractor Raj and scope of corruption on the plea of welfare.

Problem of herbal of medicine :

Though particulars of more than 100 medicinal plants have been collected we feel that the basic research for scientific extraction an processing of the same so as to serve the interests of the tribal and other local population, have not been done. These plants do not exist in isolation. They exist in plant communities and depending on the presence of dominat and recessive type the composition of plant communities go on changing. Hence any large scale extraction programme should be preceded by phytosociological research. According to the botanists associated with the study, the status of phytosociological research in this field is extremely unsatisfactory. In the meantime the Botanical Survey of India is going on publishing lists of herbal medicines and their use in various tribal areas under the cover ethnobotany. It is very difficult to say that what is being done is science. It rather appears as commercial intelligence work on behalf

of the monopoly concerns so that they can set up network of collecting agencies to extract the plant species without bothering about the problem of regeneration of the same.

Problem of generation of biogas :

The Seventh Five Year Plan of some of the states in North East India reports that due to local climatic conditions biogas programme has not been successful here. The question is whether there is enough research base. There are two types of problems in this. One is the problem of finding the appropriate component elements for generating the gas ; the other is the specification of the generating plant.

So far as the component elements are concerned I was told at the Regional Science Laboratory, Jorhat, that they have found cow-dung and water hyacinth as a suitable combination.

The team working with me in Manipur is making experiments with varying combinations of component materials in different proportions. It will not be possible for me to give the technical details, but the combinations of materials are as follows.

1. Cow-dung 2. Cow-dung and water hyacinth 3. Cow-dung and a creeper called Naga creeper which is menace to crops 4. Pig's dung 5. Pig's dung and Naga creeper 6. Naga creeper alone.

The best results have been obtained from cow-dung; cow-dung and water-hyacinth and pig's dung. Naga creeper in varying proportions seem to have a negative effect in methane generation. The study is not however yet complete. We are trying to find out whether some of the vagetal types which are harmful for agriculture or health can be put to positive use for generation of bio-gas. One must envisage prolonged study with varying permutation and combination of the materials. At the same time, perhaps more fundamental research in this line will also be necessary to strengthen the theoretical base.

As regards the bio-gas generation plant, none of the types attempted to be introduced here,— suggested by the Khadi and Village Industries Commission, the Janata type and the one suggested by IIT Kanpur, do not appear to suit the varying climatalogical regions with the same degree of efficiency. Considerable decentralised research is needed; but available information does not indicate that much initiative has been taken in this matter by the concerned agencies. There is more talk about gas in the air; but less action to generate gas on the ground.

Timber-based technology :

At present there are 100 ply wood industrial establishments in North East India. Several studies in respect of them have been made by various organisations. Some of these studies have brought out their extremely negative ecological impact. But there is another aspect which in equally disturbing. There are indications that these industries while disturbing the land holding systems of the tribals have generated only nominal employment opportunities for the tribals and other local people. Particularly employment at the level of skilled manpower and management level is extremely negligible.

Plantation development programmes :

It is generally expected that plantation development programme like those of coffee, rubber will generate more employment opportunity for the tribals. But investigations in Nagaland, Manipur and Tripura show that some of these programmes were introduced without adequate research base about the local conditions and about the infrastructural facilities. As a result none of these programmes is having smooth sailing and some have practically been abandoned. About some like the rubber plantation in Tripura, which at this moment seems to be in a reasonably good condition, the prognosis about the future is not too bright. On a closer look it is difficult to get away from the feeling that

some of the programmes have been taken up under the aegies of tribal welfare, not keeping in view the expected result but the immediate political gain.

Questions of entrepreneural development and manpower Planning.

There is a point of view that if the various programmes of technological development among the tribals have not proved too much of a success, it is because of absence of the entrepreneural competence and skilled manpower.

At the instance of the North East Council the then Small Industry Extension Training Institute, Hyderabad, had submitted a report in 1977 on enterpreneural and management needs of the North Eastern Region. Its tentative conclusions include the following.

i) General lack of stimulation of entrepreneurship among the tribal and backward communities.

ii) Left to itself the supply of entrepreneurs from tribal and backward communities will be less and

iii) At the same time tribal people are capable of taking up the entrepreneural pursuits.

The most interesting observation here relates to the question of 'stimulus'. Why is it that the stimulus for entrepreneurship is lacking among the tribals ? And is it really lacking for all types of enterprises ?

If entrepreneural stimulus is lacking for some types of enterprises can it have something to do with any disharmonic aspect in the nature of the stimulus that is being imparted among them from outside, as a part of technological development programme.

In many tribal areas of North East India it has been found that individuals have been encouraged to take up horticultural plantation and other land based development programmes ignoring the communal basis of there access to the resources. As a result, either neo-feudal rights tend to be created or a-social if not un-social attitude to economic

activities is promoted. Both meet with resistance from the communities and as a sequal to such resistance in some areas at least the exogeneously promoted enterprises had to be abandoned. But such approcach seems to be on a completely misconceived assumptions about the motivational aspects of economic enterprises. In North East India itself there are a number of a communal productive and management enterprises which have come about through the people's own initiative and the incomes of which are contributed to the running of educational, health care and socio-cultural institutions. The development planners turn their blind eye to these commuity based successful enterprises. Outside India, in New Zealand the Maoris, the indigenous population of tribal origin are managing international, commercial and industrial enterprises based on their communal rights. It seems that there is a stubborn resistance among a section of official and non official agencies, to learn from the national and international experiences.

With a fresh look the problem of entrepreneural leadership and manpower planning can certainly be dealt with in a very different manner from now it is being done at this moment. In this matter Gandhij's concept of trusteeship, as revised in 1945 with the assistance of Prof. Dantwala is of great relevance. According to this revised version trusteeship envisages abolition of capitalism, production primarily for meeting the needs of the community and not for profit. At the same time it does not operate in an antarchic manner; there should be circulation of goods as a part of global reciprocity and equity. There should be celling of income of the trustees and they be removed by the people. In parts of the North East India the spirit of trusteeship already prevails and entrepreneural development and management system as well as motivational dimension of production should be related to the same.

Problem comprehensive analytical approach to the social reality.

One of the impediments to have a fresh approach is a pseudo progressive segmental approach to social reality. In recent years some analysts are speaking about mode of production prevailing in the tribal societies as retarding factor to technological development. There are diverse connotations of the term mode of production. Broadly it is the system of reproduction of the productive forces, social relations of production and concomitant matters. The cono-comitant matters include system of circulation of products under socially prescribed norms. There is also the question of articulation of the system tribal's access to productive forces with the national system. Ignoring the issues of external articulation, and of internal circulation, the analysts of the modes of production in the tribal societies project a picture which provide allibi to bureaucrative intervention in the interest of national monopolies. Thus progressive placards are used for most intensive exploitative purposes.

Planing for development of science and technology in the tribal areas will thus need a really scientific bias free approach to the issues raised here.

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Technological strategy for Tribal Development in the North-East

B. K. Paul *

INTRODUCTION :

Although rich in natural resources, the north-eastern region has been rightly described by many as an 'island of poverty in the midst of plenty'. Over 90% of the 26·6 million people of this region live in villages which are located at different altitudes varying from 100 to 4,000 metres and having different climatic and topographical features and diverse living practices. Most of these villages comprise of tribal areas beset with difficult terrain and poorest of the poor communication facilities and they have got special circumstances not known in most of their counterparts in the country. The technological strategy for tribal development in the North-East, therefore, calls for a perspective appraisal of these special circumstances. Technologies are as much necessary for physical and mental well-being of the tribal people as they are for their economic emancipation. Thus, not only we need appropriate technologies in the field of agriculture, animal husbandry and industry for strengthening the economy of the tribal areas, but we also need suitable technologies for housing, health and hygiene, transport and communication, recreation, education and energy needs of the tribal people for their survival without agony.

TRIBAL HOUSING :

The majority of the vast multitude of tribal population of the North-East cannot afford to live without traditional

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bamboo and thatched houses whose longevity is poor and which are prone to fire hazard. It is a common sight in our interior hill areas that at times during dry season accidental fire causes destruction of an entire village because the houses are built in a community pattern adjoining to each-other with fire prone materials. Again, almost invariably a rural hillman in this region desires to use the centre of his home as a fire place for the multiple purpose of cooking, heating, lighting and smoke utilisation towards protection of his house against insects and moths and towards preservation of perishables like meat, etc.

In such circumstances, we not only need to adopt extensively the existing technologies for low-cost housing with fire and water proof devices, but we also need to give serious thought towards evolution of suitable technologies for improving the design of the tribal houses using the materials they use and causing least disturbance to their mode of living. Such measures are necessary till the time when our persuasive efforts will succeed to change the age-old way of tribal living with provision of alternative technologies to take care of all the requirements.

HEALTH AND HYGIENE :

There are many tribal pockets in this region where annual death rate is much higher that in the plains. Many of the unfortunate health hazards are attributively to poor medical facility, but a major cause is the lack of appropriate amenities for scientific sanitation and drinking water supply which constitute the cause of over 80% of the diseases in the tribal villages. Realising the miserable pace of progress in this field in the country, the Union Ministry of Works & Housing has reportedly drawn up a scheme for giving income tax concession to business houses who will participate in the programme of providing safe drinking water and scientific sanitation facilities to the rural and tribal areas so as to cover 100% of population in the country with adequate amenities in this regard by March, 1990. But

the business houses, at the most, can be expected to provide this facility in the areas close to their places of operation. It will be unrealistic to expect them to undertake such activity in remote areas even with the availability of tax-concession, and this is where the problem of the North-East particularly lies.

The menace of goitre, a disease caused by iodine deficiency, is widely prevalent in the hill villages of this region. In view of the recent decision to make it obligatory for supply of iodized salt to all the areas in the North-East, it is considered desireable to establish salt iodization units in this region to ensure uninterrupted supply of iodized slat in the whole region including the tribal areas. Ecological imbalance caused by indiscriminate destruction of forests is another factor affecting the health of the tribal people. Widespread adoption of technologies for afforestation with fast growing species is the dire need to tackle this problem.

TRANSPORT AND COMMUNICATION :

Although various schemes providing easy transport and communication facilities are in operation under the aegis of N E C and other state agencies of the north eastern region, the hard fact is that still today heads and backs of human beings are the only mode of transport in most of the hill areas of this region. The drudgery of the human beings and colossal wastage of the human energy is unimaginable. Reportedly, the Central Road Research Institute, Delhi, has undertaken a comprehensive programme towards development of appropriate technologies for construction of all-weather road for villages in the country. In order that such a programme is of any meaningful utility to the hill villages of the North-East, it is essential to undertake location specific investigation towards construction and maintenance of hill roads keeping in view the special topographical features, soil and weather conditions and other relevant factors prevalent in the hills. Another aspect of surface communication is the development of inland water-

ways in the hill areas, such as river Longai in Mizoram, as a cheap means of movement of agricultural and other commercial commodities from interior hills to the markets in the plains.

Regarding postal and telecommunication facilities in the hill areas of the North East, the less said the better. The people in our far-flung hills still depend on the age-old method of shouting and sound reflection to establish contact between different villages. With the artificial satellite like INSAT I-B in operation, it is not at all impossible to provide our hill villages with a net-work of micro wireless communication facilities accessible to all the people in the remote areas.

EDUCATION AND TRAINING :

The tremendous economic and educational distance between the hill people and the agents responsible for hill areas development often accounts for the failure of our efforts towards educational upliftment of the hill tribes. Since independence, many experiments have been and are being conducted towards improvement of method of teaching and towards raising the standard of education, but the light of even the elementary education is yet to reach many of the interior villages in the north-eastern hills which is a sad point to the failure of our plan for making education compulsory for children upto 14 years of age. Extensive arrangement for use of electronic and audio-visual mass media like the radio and television will be the quickest and the surest way of spreading education among the masses. This will also facilitate the avenues for mental recreation of the hill people, which is so much necessary for greater productivity.

The importance of education of the hill tribes should also be judged by its impact on their socio-economic life through improved production and productivity. Such an objective can be achieved only through the creation of widespread facilities for vocational training cum-demonstration

of appropriate technologies in the hilly terrain set up with the involvement of the local people. The impact of the so-called appropriate technologies will continue to be negligible in the hill areas if our 'know-hows' are not appropriately backed up by 'show-how' arrangements.

ENERGY NEEDS :

The current awareness for renewable resources of energy is undoubtedly relevant for hill areas development in the North East where we have plenty of forest and agro-wastes and fairly good wind velocity in the foot hills. Nevertheless, the hill villages of this region will continue to depend predominantly on fire-wood for their energy needs for cooking, heating and also for lighting because even the use of kerosene is unknown in many places, not to speak of electricity. The most pragmatic proposition to meet the challenge of energy needs of the north-estern hill areas will be to make massive efforts for energy plantation with fast-growing species. From scientific point of view also, photosynthesis by plants is by far the most efficient means for tapping solar energy, which is the most fundamental source of energy on earth.

AGRICULTURE AND HORTICULTURE :

The climatic conditions, topography and land holding pattern in the hill areas of this region call for a different strategy for technology utilisation in agriculture and horticulture. The pernicious effect of shifting cultivation has been well recognised and much talked about. But the fact that jhumming is still the preferred mode of agricultural practice with the tribal people and this is still their major economic activity suggests that there ought to be some merit and some reason for the survival of the jhumming system upto the present time. The major problem of jhumming is due to the compulsion of shortening of jhum-cycle from about ten years to bare three years now. So, while making every effort for settlement of the jhummias to organised cultiva-

tion, it will be appropriate to make simultaneous efforts towards evolution of suitable technologies for modification of the jhumming system itself. This demands orientation of R & D efforts for quick building up and maintenance of fertility of the soil so that the tribal farmers may find some means of earning enough basically through their traditional economic system, even at the reduced period of jhum cycling.

The agro-climatic condition of the hill areas in this region is admirably suitable for growth of almost every kind of horticultural crop. Unfortunately, most of the economic gains from such crops have often gone to others, rather than being available to the local inhabitants. It has been reported that the apple grown in Arunachal Pradesh is being sold in some markets in this region at the rate of Rs. 2/- only per kg. whereas apple imported from Kashmir sells at as high a rate at Rs. 16/- per kg in the same market. Lack of adaptation of suitable post-harvest technologies for storage and packaging, coupled with poor marketing facility, is the major factor responsible for this appalling situation.

ANIMAL HUSBANDRY :

Although a traditionally practised activity, the animal husbandry of the hill areas of this region has remained almost at static level, due to lack of adequate attention towards breeding and rearing with requisite nutritional care. Whatever attention has been given to this field has mostly remained confined to cross-breeding, but hardly any attention has been paid towards the nutritional need of animal population. Though the average livestock population in the hill region of the North-East be much above the national average, the yields of meat and milk are much below. It has been established that, among other things, the trace minerals like copper, cobalt and manganese, which are essential needs for lactation and general health of cattle, are very much inadequate or absent in the diet available to the cattles of the hill areas. The 'Cattle Lick Salts' containing

essential nutrients which have been proved to be a very popular and are being used widely in many parts of the country with substantial increase in yield of milk and improvement in general health of cattle, is yet to find requisite attention in any area of the North-East.

INDUSTRY :

In a sense the tribal areas in the North-East are more industrialised than many of their counterparts in the country. The traditionally practised handloom and handicrafts of the hill areas of this region bear testimony to this view. But the products of such traditional industries are now facing stiff competition from outside with urgent need for suitable technologies towards upgradation and improvement of technique, design and quality. Among the handicrafts, cane and bamboo products of this region occupy special position and enjoy unique reputation. While some efforts are already existent for bringing about improvement and excellance in design and finishing of these products, no effort has yet been made to economically utilize the huge by-products, which in some cases constitute over 80% of the raw materials used in the handicrafts industry.

Of late, awareness is afoot towards economic exploitation of waste land in hill areas for cultivation of various cash crops based upon which small scale industries could be easily operated with local skill, Need and suitability for cultivation of essential oil bearing and medicinal plants and extraction of oil/active principles there from are too well-known to merit any elaborate mention here. *Java Citronella* introduced by the Regional Research Laboratory, Jorhat, has become popular in some hill areas of this region, but its prospect is not as bright as it was a decade ago. Technologies for commercial exploitation of other species need to be adopted and utilized extensively. Rubber plantation has caught the attention of the authorities in the region admirably, but little effort has been made to set up cottage scale industries based on rubber latex.

Minor forest and agricultural wealth like wild banana, wild seeds, pineapple, betel leaves and other tree leaves widely grown in this region are yet to find remunerative commercial utilisation for dearth of appropriate technologies or utilization of available technologies appropriately. Despite huge potential, there is hardly any industry based on diary products and animal wastes like hides and skins, bones and other animal by-products. Appropriate technologies are yet to be used in tribal sector based upon mineral wealth. Particular mention may be made of the commercially exploitable clay in several hill areas of this region for pottary industry, with the involvement of local artisans.

CONCLUSION :

The special conditions and circumstances prevalent in the tribal areas at different altitudes of this region demand a special strategy for application of already existent technologies or evolution of newer appropriate technologies suitable for different ethnic tribal people living at different altitudes. Such a strategy should continuously take care of the traditional skill, crafts and occupation of the tribal people and their needs, aspiration, constraints, limitations and inherent capabilities. Because of the prevalent diversity, no single set of technologies will be applicable uniformly for all the hill areas. In most cases, it may be more necessary to evolve appropriate technologies upon the local conditions than to transfer already existent technologies. It may be quite often necessary to reorient and restructure suitably the existing modern rural technologies for application in the hill areas of this region. Above all, strenuous efforts towards generating awareness about the utilities and usefulness of the newly developed technologies need to be mobilized as a pre-requisite for their introduction with the purpose of tribal development.

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Appropriate Technology and its Transfer Strategy for Tribal Development

B. S. N. Reddy*

N. V. Rao**

The North Eastern Region of India comprising of Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland and Tripura, having a geographical area of 2,55, 083 sq. km. is inhabited by large number of ethnic tribal groups. About one fourth of the total population belongs to tribal category. The percentage of tribal population in different states of the North-Eastern Region is 70.28 in Arunachal Pradesh, 10.99 in Assam, 28.55 in Manipur, 80.99 in Meghalaya, 93.58 in Mizoram, 83.99 in Nagaland and 43.56 in Tripura. The present paper attempts to discuss the problems and potential of North Eastern Region, appropriate technology for agricultural development and its transfer strategy.

Problems

Historically this part of the country is characterised by backwardness with most of the states deficient in foodgrains production, lower agricultural productivity, heavy soil erosion, deforestation and floods causing environmental degradation. Barring Assam plain, most of the area was covered by high mountain ranges interspersed with rivers and narrow valleys. The annual rainfall of the region varies from

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2000 to 4000 mm. Low temperature, less sunshine, high rainfall and humidity are the serious problems hindering agricultural development. Almost all the tribal groups are drawing sustenance from agriculture. The tribal people practise primitive form of agriculture called Jhuming which offers little scope for introduction of modern technology. The extent of soil loss due to some of the traditional systems of cultivation is shown in table 1. Communication and transport are the severe constraints for the development of the region.

Table 1. Soil erosion under some traditional land use systems.

Land use system	Soil loss (t/ha)	Reference
1. Shifting cultivation	30.2 to 170.2	Singh et al (1980)
2. Bun method	40.0 to 50.0	Singh (1981)
3. Pineapple along slope	24.0 to 62.6	Ghosh (1976)
4. Home stead areas	Upto 67.2	Singh & Singh (1981)
5. Natural bamboo forest	0.04 to 0.52	

Potential :

On the other side, North Eastern Region is endowed with rich natural resources. It has a variety of agro-climatic zones ranging from tropical to alpine. The entire area falls under the assured rainfall zone. North Eastern Region is believed to be the origin of several crops. Almost all types of crops and fruits are grown here. The extreme differences in temperature, rainfall, elevation from mean sea level, soil types etc, made the region one of the richest source of genetic variability, which is essential for improvement of plant and animal resources. The region also has enormous hydel power potential. It has got rich forest resources and more than 30% of the income for the tribal families come from forest only.

Technology and Development :

More than 90% of tribal people are engaged in agriculture and hence any attempt at alleviation of poverty of these people must start with agricuture. Development depends upon optimum exploitation of physical and social resources (human capital). According to Holt and Schoorl (1985) neither general nor economic development can occur without the adoption of new technologies in agriculture, health care, industry, education and the organisation and management of these activities. Technologies are bodies of skills, knowledge and procedures for making, using and doing useful things. In other words, technology is the practical area of producing goods and services and therefore, technology and development are directly related.

Appropriate Technology :

There are two components of technology, namely, (i) hardware component (machines, factories, land, products and other material aspects), (ii) software component (knowledge, knowhow, experience, education, organisation, etc.). Often the protagonists of development emphasise the hardware component with less or no concern for the latter. It is very much obvious in recent times that the range of new hardware available in the market is sufficient to meet the heavy chunk of immediate requirement at least in the field of agriculture. What is really lacking is the system of cultural values which can accept the technology and bring the necessary economic change.

Jequier (1976) rigtly pointed out that hardware and the technical ability to produce it in an imitative way can be transferred from one countury or culture to another. Organisational forms and social values are by contrast, much more culture specific and hence generally more difficult to transpose deliberately from one society to another. This kind of approach is increasingly gaining importance in the field of agriculture.

As a result, attempts are made to develop technologies that can fit people rather than the people having to fit the technologies. This kind of technology is termed as appropriate or low cost technology. Appropriate or low cost technology can be defined as technology which is low in terms of capital (physical plus working), foreign exchange, labour, skills and any other inputs which are often scarce in the rural areas of developing countries in particular and in the economy in general. It is high in terms of aboundant local resources eg. indigenous materials and unskilled labour (Bhalla, 1976). It gives more emphasis on socio-cultural dimension of innovation. It has been revealed from the example of China and other developing countries that the value of new technology not only lies in its economic viability and its technical soundness but in its adaptation to the local social and cultural environment. In order to accept freely by the tribal people, technology should be responsive to the needs of the people and fulfil certain conditions :

1. Technology must be produced locally, utilizing the local resources/materials abundantly.
2. It should be simple, low cost, less cumbersome and must be able to absorb large number of unskilled labour for productive purpose.
3. The agricultural technology suggested should meet the balanced nutritional requirement of the tribal people without much change in the agri-eco-system.
4. Technology recommended should be based on large scale on farm testing.
5. Agricultural technology suggested should be capable of checking the resource degradation likesoil and water which are vital for agricultural development in hilly areas.
6. The technology advocated should serve the needs and interests of the tribal masses.

In addition to the above characteristics, Rogers (1971) noted that the acceptance of the agricultural innovations depends on (i) relative advantage of the innovation that it

superseedes, (ii) its compatability with the existing values, beliefs, past experience and needs of the receivers, (iii) how difficult it is to understand (complexity) and (iv) the degree to which a new technique can be devisible to try on a limited basis (trialability), (v) the degree to which the results of an innovation are visible (observability).

Besides the characteristics of innovations a strong commitment for innovation servicing or strong follow up action is very much essential to harness the full potential of new technologies. Another important factor is that the technology should be in consonant with policies of the Government and development of infrastructure like marketing to avoid the problems of glut. It is necessary to examine the consequences of the technology thoroughly to check the negative aspects.

Sources of Appropriate Technology

There are three main sources of appropriate technology- (i) developing indigenous (traditional) production system, (ii) technology borrowing and (iii) carrying out research (Iyengar and Rao, 1977).

Indigenous Production System :

People over centuries of experience developed excellent production techiques and tested their performance for a long time on the real farm situation. These techniques can be popularised for large scale adoption. Cultivation on bench terraces by Angamy and Chakachang tribes in certain areas of Nagaland, bamboo drip irrigation system in Muktapur area of Meghalaya and valley land management techniques by Apatanis in Subansiri district of Arunachal Pradesh are excellent examples of indigenous production techniques of North Eastern Region. There are more such techniques practised by the people. For instance besides the detrimental features shifting cultivation has got some strong positive aspects. Borthakur et al (1983) reported that the burning of the vegetation temporarily increases soil pH (5.10 to 5.50),

increases available potossium (210 to 510 kg/ha) and enhances the exchange of calcium (7.15 to 9.46 meg%). The alternative to replace this traditional method of cultivation, must have these positive effects. Otherwise it is bound to face stiff resistance.

Technology Borrowing :

Technology borrowing is widely practised in the past and present through various overseas aid programmes and from other regions within the country. Borrowing is mostly from the developed Western countries. The technology is modified or adapted to suit the local conditions. There is a danger in borrowing the hardware components when our cultural needs and values are not developed to accept them. Hence care needs to be taken in borrowing technology.

Carrying out Research :

India has got a strong research system based on western model. Only after recognising the fact that indiscriminate production of hardware will not help in the socio-economic transformation of the people, there was a major shift in technology generation system of agriculture. The recent innovative tool in the field of agricultural technology generation is farming system research.

Farming Systems Research :

The primary objective of farming systems research is to improve the well being of individual farming community by increasing the productivity of farming system given the constraints imposed by resources and the environment (Norman and Collinsom, 1985). It underlines the assumption that technologies incompatible with the socio-economic enviroment of the farmers are bound to face resistance. Therefore, it is a basic technique or tool to understand fully the interrelation within the economic system under which the farmer is operating and to determine his choice of technology.

Potential New Technologies :

The ICAR Research Complex for N. E. H. Region since its inception in the year 1975 with a mandate of developing appropriate technologies for agricultural development in hill region mostly inhabited by tribals has standardised a number of technologies. These technologies were tested in its research farm and some under the field conditions and were found to be suitable for this region. Some of the promising technologies appropriate to the hilly region are given below :

1. Checking land degradation using local natural resources viz. earth, stone, vegetation and manpower.
2. Conservation of 80-100% of annual rainfall in situation steep hill slopes by following the principles of water shed based farming system.
3. Regeneration of degraded hill slopes by afforestation with promising fast growing tree species.
4. Crop production techniques for major crops.
5. Correction of soil acidity for better crop yields and management of iron and alluminium toxicity.
6. Rejuvenation of declinging citrus orchards for better fruit yield and income.
7. Artificial induction of flowering in pineapple for increased production.
8. Hand tools and implements to save labour and increase labour efficiency.
9. Plant protection techniques for all major crops.
10. Mushroom production with the use of local materials.
11. Pig, poultry and rabbit production as viable subsidiary source of income.
12. Livestock based land use system for management of nature and fodder scarcity in lean season.
13. Composite and paddy-cum-fish culture by harvesting excess rain water.

The technologies listed above are not only useful in improving the level of living but also help in checking the resource degradation and protecting the environment which is a major concern (of the nation) in the region.

Technology Transfer Strategy :

1. Integrated Approach : The multitude of Government and non-Government institutions involved in tribal development created more confusion rather than bringing concrete changes in the behaviour of tribal people. Often it is observed that messages from different sources are conflicting in nature. A time has come to arrest such unhealthy trend and establish coordinating mechanism with necessary power and responsibility at different levels. Otherwise the efforts of these institutions will be counter productive.

A comprehensive and holistic approach of agriculture and allied activities like livestock production in which the tribal families are engaged will be paying in the long run when compared to single activity as it demands adjustment in other resources and activities.

2. **Single Window Service** : In order to avoid duplication of effort and exposing the tribal people to conflicting messages the development authority should adopt a single window servicing. In other words, only extension agent should advise farmers on best land use and cover the entire range of farming including seasonal cropping, horticulture and trees farming, forage, fodder and pasture for livestock (Suresh Kumar, 1987).

3. **Planning Resource based Extension Strategy** : Normally, planning is done according to fixed pattern of administrative boundaries. Planning for any particular region should be based on the existing material and social resources. Specific land use farming situations having similar characteristics should be identified and extension staff must be

trained on these particular farming aspects to provide better quality of extension service. In other words, extension service should be organised along the lines of local farming systems (Suresh Kumar, 1987).

4. **Input supply and support** : Adoption of improved technology is essential for enhencing the agricultural productivity of tribal households. The appropriate technology packages demand certain material as well as non-material (advisory support) inputs hitherto unavailable in the social system. Continued and timely supply of such inputs is vital for any concrete change in their behaviour. Tribal farmers characterised by small (size of) holding and poor purchasing power require inputs in small quantities. The development authority should make arrangement to avoid malpractices in loose handling of inputs. The extension worker should understand that the non-availability of inputs recommended by him will bring discredit to extension system.

5. **Socio-cultural Aspects Indispensable** : The experience of transfer of technology programmes in the third world countries suggests that technological ignorance is not the important reason for non adoption of improved technology in agriculture but their socio-cultural and resource problems are vital importance. A decade experience of frontline extension programmes viz. National Demonstration, Operational Research Project, Lab to Land programme and the outcome of extension research projects of the Institute suggest two factors of utmost relevance in North Eastern Region. (i) Tribal women play significant role in agriculture. It has been observed that tribal women participate in almost all farm operations and they participate in larger proporation when compared to men atleast in six operations, namely, sowing, weeding, harvesting, threshing & winnowing, seed storage and care of animals (Singh, 1984). As remarked by Keppel and Ahmed, 1987 farm houses are collective decision making entities and most of the farm decisions were influenced by

women. Their influence is more in the light of the fact that customary right of property lies with them under matrilinial pattern of social system. Involvement of tribal women in various programmes and training them in various farm operations including use of tools and implements will accelerate the process of technological change. (ii) Village headman occupies central position in the community power structure. He is the local head of the Government and vested with several customary rights. Headman is the key source of information and almost all the people consult him on matters relating to farm and home (Samanta, 1980). Establishing rapport with the headman and training him on the optimal land use etc. will go a long way in the rapid development of agriculture in the region.

6. **Training :** Regular pre-season workshops between the researchers and extension staff will be of great help in exchange of upto-date technical information. Organisation of systematic quality training programmes will bring lasting changes in the behaviour of farmers. National Demonstrations, Operational Research Projects and KVKs must be reoriented to serve as centres of learning.

7. **Professionalisation of Extension Staff :** Extension is a teaching profession and the personnel involved in it require a specific set of skills to tackle the problems in the field. It demands two kinds of skills, namely, subject matter skills and communication skills. It is observed that there is lack of proper training materials such as leaflets, folders, bulletins, slides, audio and video cassettes related to the area he operates. This is a serious set-back in the extension work. The extension system should ensure production and development of such materials on a large scale to strengthen field level extension personnel. They require a thorough understanding of the field problems as well as up-to-date knowledge of technical information.

8. **Media Strategy :** Most of the tribal villages are scattered and located is remote and inaccessible places. Mobility of hill farmers is poor and the frequency of change agent contact is less. In view of the special problems faced by tribal farmers the media has to play a significant role. All forms of media such as radio, T. V., printed and interpersonnel should have a combined and comprehensive strategy to cater the needs of tribal people. Each component of the media has to play complimentary and suplimentary role to bring about planned changes among the audience. The agricultural messages delivered by mass media like radio and T.V. should be supported by printed and interpersonnel media. In order to obtain best results the agricultural messages should penetrate the traditional art and culture of the tribal people.

9. **Reorganisation of Extension :** Over and above, the extension system in the states of North Eastern Region needs structural reorganisation. The middle and field level extension staff continue to be under the dual control of Block Development Officer and District Agricultural Officer. Such structural weaknesses should be rectified and single line authority and optimum span of control should be established to keep high morality and commitment to work. Reasonable pay and promotion avenues should be created to make the working environment of extension work more congenial to render quality service.

Conclusion :

Improvement in the quality of tribal life can be brought through modernisation of the system in which they operate. The technological transformation of the tribal farming system should be responsive to the needs and in consonance with the cultural values of the people. There is tremendous scope for popularisation of excellent indigenous production techniques. The new technologies should be subjected to large scale on farm testing before recommending to the farmer.

Involvement of village headman and women in developmental programmes will bring rapid changes in the tribal farming system. Extension system should be geared up to meet the rising demands of the tribal people.

References

1. Ayres, Robert U (1985) Social Technology and Economic Development, *Technological Forecasting and Social Change* Vol. 28, 141-157.
2. Bhalla, A. J. (1976) Low Cost Technology, Cost of Labour Management and Industralisation, in Jequier N. (Ed) *Appropriate Technology Problems and Promises, OECD, Paris.*
3. Borthakur, D.N. et. al (1983) Shifting Cultivation in North East India (Monograph) ICAR Research Complex for N.E.H. Region, Shillong.
4. Byra Reddy, H.N. (1986) Strategies for Effective use of Mass Media in Teaching and Communicating Developmental Messages to Rural Masses, paper presented at an International Conference on "Investing in Agricultural Extension Strategies and Goals," organised at AERDC. Reading University, U.K.
5. Holt, J.E. and Schoorl, D. (1985) The Role of Innovation Servicing and Obsolescence in Agricultural Extension, *Agricultural Systems.* 18,239-250.
6. Jequier, Nioclas (1976) *Appropriate Technology Problem and Premises*, Development Centre of the Organisation for Economic Cooperation and Development, Paris.
7. Koppel, B. and Ahmed, S. (1987) "Management of Agricultural Extension for Poverty Alleviation". The Technology Adoption Challenge, paper presented at the International Workshop on Management of : Agricultural Extension for Poverty Alleviation, National Centre for Management of Agricultural Extension, NIRD, Rajendranager, Hyderabad.

8. Kumar, S. (1987) "Management of Agricultural Extension for Poverty Alleviation" proceeding at the International Workshop on Management of Agricultural Extension for Poverty Alleviation, National Centre for Management of Agricultural Extension, NIRD, Rajendranagar, Hyderabad.
9. Norman, D. and Callinson, M. (1985) Farming systems Research in Theory and Practice in J. V. Remenyi (Ed) *Agricultural Systems Research for Developing Countries* ATCAR, proceedings No. 11, Canberra, Australia.
10. Rogers, E.M. and Sheemaker, F.F. (1971) *Communication of* Innovations, New York, Collier Macmillan.
11. Samanta, R. K. (1980) Farm Leadership and Decision Making in Tribal Villages of Meghalaya, R.B. No. 4, ICAR Research Complex for N.E.H. Region, Shillong.
12. Singh, B (1984) Role of Tribal Women in Agriculture, A. R. ICAR Research Complex for N.E.H Region.
13. Singh, A. (1986) Watershed based Farming Systems for Hilly Regions, *Journal of Agricultural Engineering, ISAE*, Vol. 23, No. 4 pp. 318-322.

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Role of Forestry in Economic Development of Tribals

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1. Forestry and the tribals :

The human beings lived a pastoral life in the forests of hills and plains before the dawn of civilization. As population started increasing, the primitive dwellers began to clear the forests for their inhabitation and agriculture. With the pace of civilization, the people started to give up their hunting habits and accepted some definite social customs and culture. Those people who were left behind adhered to the forests entirely for their subsistence are termed as tribals.

1. 1. Tribals the original dwellers of forest :

The tribals are usually surrounded by thick forests or they live in the hilly regions away from the modern world. Traditionally, the tribals use the forests as their major source of economy as it provides food, wood and serves as pasture ground for their cattle. Any forest policy should aim at the economic development of the tribals. The economical base indicates four types of tribals : (i) those who live in the forests and have no permanent dwelling place. They move from one place to the other depending on edible roots, fruits etc. of the forests (ii) those who remain in the forests, have their permanent dwelling places and depend completely on forests. They collect minor forest produce and sell in the local markets and also they work in the coupes and other departmental work carried out by the Forest Department. Either they have very little of agricultural lands or do not have at all, (iii) those who have plenty of lands for growing agricultural crops and are educated with minor business and (iv) those who remain in the cities and work in the govt. offices having little connection with the forests. The forest policy should draw the economic benefits for the tribals specially for the first three categories. The tribals who live in the dense forests have the characteristics of hunting wild life, shifting cultivation and fishing, in addition to geographical isolation, demographic concentration in contiguous areas, dependence on forests and illiterate. They have their own society and also move in their own society.

In India, the scheduled tribes occupy 18.74 per cent of the total area of the country with a population of 40 million constituting about 7.15 per cent of the country's total population. India has about 75,155 hectares of forest area out of which Assam occupies only 2,855 hectares. During 1951-52 to 1975-76, the state has lost more than 72.6 thousand hectares of forest land due to hydroelectric power project, agriculture, roads, industries and any other purposes. In 1951-52 the area of reserved forest in Assam was 33,550 sq. km. which has been reduced to 17,317 sq. km. in 1981-82. According to National Forest Policy, 1952, Assam should maintain 33 per cent of the total geographical area of the state under forest for environmental safety. During 1961-81, about 11,251 hectares of reserved forests have been under occupation due to population pressure and more than 135 thousand hectares of land are under the occupation of the immigrants in the state of Assam. About two-third of the total population of scheduled tribes of Assam are found in Goalpara, undivided Kamrup, Darrang, Nowgong Karbi Anglong and N. C. Hills. In the country as a

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whole, there are 250 scheduled tribe communities speaking about 105 languages and 225 subsidiary languages. The main tribes in Assam are Mikir, Miri, Misimi, Boro, Rava, Kachari, etc. They use the forests as their production base for subsistance in drought, flood and famine. It provides timbers edible roots, leaves, fruits, wild genes and herbs. In some states community festivals are also related with forests in time of fruiting and flowering the trees.

2. Environment and Forest :

Forest plays an important role in maintaining the environment. It is the main source of purifying the air, keeping the hydrological balance and conserving the soil. Deforestation may result to soil erosion, floods and droughts which will affect agricultural production. The country at present has 22.7 per cent of total land under forest against 33 per cent in plains and 66 per cent in hills recommended in National Forest Policy, 1952. In the cities and towns, control of air pollution is largely met by planting trees under the scheme of social forestry, community forestry, urban forestry, recreation forestry, environmental forestry etc. Agro-forestry is the multiple use concept for better land management. By judicious use of species combinations every piece of land can be made use of to produce maximum goods and services required for the growing human and cattle population. Other forestries like Mixed forestry, Village forestry, Rural forestry, Farm forestry, Extension forestry, Tree farming, Forest farming, Multidimensional forestry (conservation, tree crops and livestock forestry) etc. help controlling erosion and other environmental degredations like deforestation of land, land slides, agricultural production, fish population, siltation and affect on hydro-electric power, navigation, growth of urban slums, disruption in communication, wind erosion and health and hygiene during flood and drought. Natural forests also maintain desirable relationship between 'land cycle' and 'water cycle', thus moderating the flood and drought hazards. It also

controls the hydrological responses which are different for flood and drought.

3. Forestry and Ecological Balance :

Forestry is an integrated part of eco-system development which is one of the important and most threatened of life support systems specially for the tribals. The population pressure on land and its mounting demand for fuel and fodder has already denuded the forests. The yearly requirement of fuel wood in India is about 150 million tonnes and the country has the potentiality of producing 242 million tonnes of fuel wood. Upto 1982-83 the forest products in Assam in terms of rough log are 27,2870 Cu.m with an area of 36,750 hectares of regeneration. There are more than 3 medium sized factories, more than 263 industries on wood products and 176 small scale industries on paper products. In 1980-81, the Govt. of Assam has earned Rs. 122 Million from Assam forest in the form of timber, fuel wood and minor forest products. The forests of Assam with sufficient wasteland, Govt. reserve, rivers and rivulets need comprehensive effort to protect the production base of forestry, fishery, agriculture and animal husbandry in the plains as well as hills of Assam by preserving the ecological balance. Deforestation caused by the need for domestic fuel and timber supplies and livestock fodder, over grazing of natural grass lands, indiscriminate cultivation on steep slopes combined with poor agricultural practices and badly designed roads have led to general ecological imbalance. As a result, there is increasing soil erosion threatening the productive capacity of the habitable areas of the tribals resulting to irregularities in monsoon creating flood in one season and drought in the other inviting more famine and poverty to the tribals. To maintain ecological balance agro-forestry can also be practised as it serves as a multiple use systems of land and agri-silviculture. It is a suitable land management system which increases the yield of the land, combines the crop including tree crop and forest

plants or animals simultaneously or sequentially on the same unit of land and applies management practices that are compatible with the cultural practices of the local people. It can be practised under several nomenclature such as agri-silviculture system, silvopastoral system, agro-sylvo-pastoral system and multipurpose forest tree production system. Such nomenclature may also be extended to cover the protective and aesthetic aspects of forestry including conservation of soil and water, regulation of stream flow, ameliorating effect on soil and climate, beautification etc. A list of tree species suitable for agro-forestry and for raw materials of forest based industry has been shown in the *Appendix 1* which are considered to be suitable for various climatic zones. There is considerable scope of agro-forestry in intercropping programme to be adopted with crops, on field boundaries, on roads, on aquatic sites like farm ponds, irrigation canals and drains, roads, ravines and weste land.

3. 1. Integration of crops, trees and grasses may be achieved through several agro-forestry systems. Such a system utilises different soil depths, space and light efficiently and consume soil and water improving the environment. A few agro-forestry combinations have been cited below :

Top canopy	Middle/ground canopy	Agro-forestry system
I. a. Multipurpose trees and shrubs	Agricultural Crops -Grasses/pasture -Agricultural Crops + grasses	Agri-silva Silva-pastoral
b. Multipurpose trees	-Varying level forest trees including fruit trees	
c. Fruit trees	-Agricultural crops -Grasses/pastures	Agri-horti-system Horti-pastoral

II. Inter changing or rotating the area under tree and agricultural crop on the same piece of land, so that, the land under trees may follow agricultural crop and vice-versa

III. Multiple rows of trees mixed with multiple rows of crops ;

IV. Combination of tree and shrubs according to the light requirement and root distribution ;

V. Incorporation of legume crops as tree and crops ;

Based on land capability classification, agro-forestry can be practised broadly on arable and nonarable land and as an entire farming system. On nonarable land, silvipastoral agro-forestry systems are ideally suited for protection as well as production point of view. Bouldery river beds can be utilised for fuel and fodder plantation of *Dabergia* sisso +*Crysopogon fulvus* and *Acacia catechu*+*Eulaliopsis binata.* Bhabar grass from fuel-fodder plantation of *Albizzia lebbek, Grewia optiva, Bauhinia purpurea, Leucaenea leucocephola* and *Crysopogon fulvus* and *Eulaliopsis binata* grass. Industrial aromatic grass like *Cymbopogon citrates* can also be cultivated in such bouldery sites.

On arable land agri-silvi system can be successfully grown. Fuel-fodder and multipurpose trees may be grown with crops in fields as sporadic plants as inter crop or farm bunds. In rainfed paddy and wheat fields, the plants like *Grewia optiva, Mosus ablba, Eucalyptus* can be raised. Soobabul can be raised in the bunds of upland arable land which will provide fuel and fodder.

The plants which will provide fuel-fodder, timber and grasses can be raised on the field boundaries. These plants should be planted at a sufficient distance from the crop root zone. Agro-forestry can also be developed for the entire farming system. Shifting cultivation is one of the major causes of forest denunation in the hills. The ICAR Research Complex for N.E. India, located at Shillong, has developed an agro-forestry system for N.E. Hills region.

It is an alternative to *Jhumming* or shifting cultivation in which the lower one-third area of hills slope is terraced and utilised for raising field crops for the requirement of the farmers. Crops like maize, ragi, mustard, seasame, black gram and root crops like ginger, turmeric may be grown on terraces. The terraces can be stabilised by planting with fodder grass and legumes like *Stylosanthes hamata, Stylosanthe nyanensis Clitoria ternatia, Setaria sphacolata* and thin napier. The middle one-third may be utilized for horti-pastoral system leaving top one-third steep slopes for forest including fuel fodder plantation. *Citrus limon* can be intercropped with cowpea, gardenpea, french bean and sweet potato in agri-horti system. Lemon and pineapple can also be grown together. Under such a system, there is a great scope for pisciculture, dairying, bee-keeping and flower industries to increase the income of the hill tribes.

Ecological balance can also be maintained by practising extension forestry which can be developed in the areas devoid of tree growth and other vegetation situated away from the conventional forest areas and waste lands. Mixed forestry can be practised to raise fodder grass with scattered fodder trees, fruit trees and fuel wood trees on suitable waste lands, municipality lands and village commons. Shelter belts can also be developed with belt of trees and or shrubs maintained for the purpose of shelter from wind, sun etc. Linear strips of plants can also be planted in the roadside, canals and railway lines. Deforestation should be done in the degraded forest areas. In the urban and rural areas flowering trees and shrubs can be planted for recreation. To maintain an ecological balance multi-disciplinary approach concerning plant sciences viz. agronomy, forestry, horticulture, agrostology etc. supported by related disciplines like soil science, soil conservation, economics and social sciences should be co-ordinated. Massive afforestation should be made to maintain ecological balance based on its needs for commercial and industrial use. Productivity of forest land should also be increased by improved practices.

4. Forest Based Industries and Tribal Economy :

A proper ecological balance can lead to industrial growth generating additional income to the tribals directly or indirectly. The general health of such forest based industries will mainly depend upon the rate of deforestation, afforestation, minimum govt. reserves for both hills and plains, different systems of forestry, land laws in the forest and conservation practices. Tribal economy will be strengthened only when there is integration of forestry, agriculture, horticulture, animal husbandry, pisciculture etc. Apart from such subsistance the tribals can have gainful employment in the industrial sector of forest based products with simultaneous employment in the agro-based industries. The main forest types round in this region are (i) riverine forests (ii) dry deciduous forests (iii) moist deciduous forests (iv) tropical semi-evergreen forests (v) tropical evergreen forests (vi) temperate forests and (vii) swamp forests. There is immense scope for forest based industries in the State of Assam as it is full of varieties of trees species, bamboo, cane, enormous quantities of other cellulosic raw materials like reeds and grasses, aromatic and medicinal plants of high value from the cellulosic raw materials paper, paperboard and ancillary industries, wood-based industries, agro and forest based industries and extraction from medicinal and aromatic plants.

This region has more than 8000 species of plants and out of more than 100 species of trees only 70 species are being exploited so far for various commercial purposes. There are various kinds of cellulosic raw materials like bamboo reed and grasses available in the state. Out of the 136 species of bamboo occuring in India, 61 species have been from this region. Its annual availability is estimated at about 8.1 lakh tonnes in Assam. Reeds and grasses available in this region amount to 4 million tonnes. The medium scale or small scale industries can be established for gainful employment through furniture making, construction works, paper pulp, manufacturing of bidi and extraction of industrial oils. If such industries are established in the forest areas, it will

reduce the transportation costs of the raw materials. This will provide employment in a large scale to the tribals. Handicrafts and cottage industries can be developed with the help of local initiatives and tribal art and crafts can be developed through such industry. Handmade paper industry based on raw materials in the tribal forest area can also be established.

The industries based on major forest produce include plywood, veneer flush door and plywood products. Sawing and plaining of wood rather than plywood, sawing rough wooden products, wooden frames, wooden boxes and barrels, electrical wiring bits, ice cream spoons, wooden rulers and seales, hangers, plywood chest for tree, wooden rolls and trays, wooden structures like doors, windows, beams and posts, looking glass, wooden ploughs, cots and cradles, wooden powas, wooden cleap board, hard board, cable drums, wooden tool handles, wooden blocks, packing boxes, wooden slates, rifle butts and other wooden industrial goods, wooden furniture and fixtures, wooden storage, cup boards, wooden storage shelves and racks, table tennis table, photo frames, tooth pricks, rack slates, match splints, veneers for safety matches and racks, badminton-cricket bats from bhel, carrom board frames, wooden tools, wooden radio and T.V. cabinets, wooden shutters, wooden sindoras, apparatus cases, wooden sewing machine cover, matches, wooden bullock carts, push carts, drawing boards, mathematical instrument etc. A sizeable quantity of logs in the farm of semi raw materials is carried outside the state and fed these industries. Industries based on minor forest produce may include cane and bamboo craft industries, cashew shell oil, sal seed oil, sandal wood oil, pine oil, cedar wood oil, eucalyptus oil, agar, turpentine and resin from pine forests, cashew processing shellac, katha from khair, bidi manufacturing, reading of tassar silk worm, saw mills and carpentry, toy making, rope making from sisal fibre, apiculture, aviculture etc. Large scale cultivation of *mohua* plants (*Madhuca latifolia*) can supply the raw materials for *mohua* oil for industrial use, soft wood and

quality country liquor from its flowers which are considered as one of the best cattle feed. It has been estimated that tribal economy can generate gainful employment of 10 million standard persons in a year for collection, processing and marketing of various minor forest products. Oil and fruit bearing species can be specially grown as food security reserves during drought *(Appendix-2)*.

The waste products from forests can be utilised for medium and small scale industries. Bamboo and raw dust can be utilised for making moulded plugs for use in paper industry. Oxalic acid can also be manufactured from raw dust. Compost manure plants can also be established from the barks of various plants. Viable cottage industry can also be established in the tribal areas for making 'kot' and 'pati' from *'patieoi'* and *'kathbon'*. There is ample scope for cottage industry on making bamboo splits for household purposes like fencing wall, roofing and inner walls from *'Kakoabah'*.

There is such a scope for social forestry to improve the nutritional value of food by supplying many edible materials e.g. fruits, seeds etc. from the social forest of Assam. Small scale industries can be established on arecanut and its by-products, coconuts, jack fruits, mangoes, lemons etc. Small scale industries can be established on fruit processing industries in the hills. Extraction plants on ginger and turmeric in the hills will be highly remmunerative. *Som* and *mulbery* plantation in the tribal belts will not only improve the growth of silk industry in the rural areas but will also increase the income and employment. This will provide fire and soft wood for industry. Hybrid seeds of silk worm alongwith improved technology of silk industry, coupled with scientific management of mulbery and som plantations will change the economic contour of the rural tribals.

The following labour intensive schemes may be undertaken with priorities as far as possible for the betterment of the tribals by the forest department.

i. Intensive Forestry Work

This needs a large labour force which is generally from the tribals. The forest department should provide better amenities, medical service and social service to the tribals.

ii. Farm Forestry

It envisages raising of plantations over areas of community land in small plots outside the area of forests.

iii. Plantation of General Utility Timber

Forest areas have large potential for plantation of valuable tree species based on domestic, commercial and industrial needs. This is a labour oriented scheme which will provide employment to the tribals.

iv. Establishment of Central Nurseries

To raise adequate plant stock central nurseries are proposed in the tribal sub-plans. Various tree species to feed the industries as well as to maintain the ecosystem be raised for modern propagation method creating employment to the tribals.

v. Forest Exploitation

Power driven hand saws are to be introduced for cutting of timber to avoid wastage of timber and human energy for earning more.

5. Training, Extension and Transfer of Technology :

Forestry Extension Organisation was recommended in 1976 by National Commission on Agriculture. It suggested that such organisation should be set up at centre as well as in the states. To implement the programmes of social forestry, the Commission recommended the involement of Panchayat, Co-operatives and village school staff. The forest extension organisation should also work in close co-ordination with agriculture and other welfare departments.

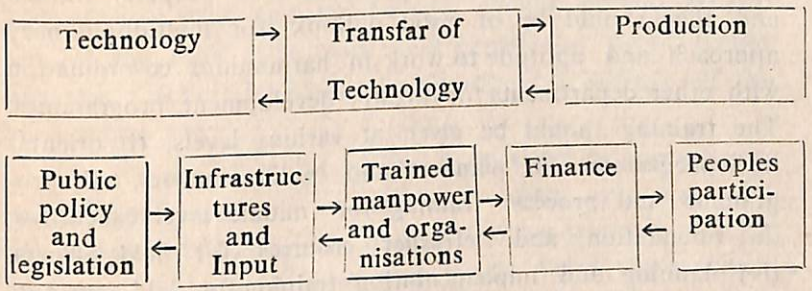
At present the forest department organises training mainly in the field of silviculture, forest management, protection and utilisation. The main aim of such training is to create a cadre of officers/workers for forest protection and its commercial utilisation. The aspect of extension education in the forest education by them is lacking. The forest officers have to be trained in public relations, social systems, motivation etc. Cultivators are also to be motivated to take up tree planting on their own holdings. In order to meet their basic needs for fuel wood, fodder, small timber and bamboo, the individual farmers should be encouraged to take up tree farming. Proper publicity should be given about the advantages of forestry programmes. Training camp by the forest department may be organised in the tribal areas with seeds/seedlings of desired species. Booklets, leaflets, package programme etc. for raising nursery beds, planting, tending and harvesting of forest crop may be distributed freely. Voluntary organisations should also come forward in the tribal area for economic development of the tribals. They should establish cottage industries based on forest products, viz. basket making from canes and bambooes, silk cloth from silk cocoons, household decorative items and other handicrafts, dairy, pisciculture, apiculture etc. These voluntary organisations can also educate the youths in leisure time so that they are made literate and are fit for skillful employment.

Apart from the District Industry Centre, Tribal Development Corporation should take special care for educating, motivating and training the people in tribal areas establishing small and medium scale industries based on the forest products. Special consideration should also be put to provide financial assistance at concessional rate to the scheduled tribes to establish industries on minor forest products. Training Institute for cottage and ancillary industries may be established in the tribal areas which will train the local youths for different industries. Such institute should also provide the feasibility reports of various forest

based industries, raw materials required, availability, financial assistance, capital turnover etc. in local language. Such viable units may be established individually, in joint centure or through co-operatives. Marketing of the products should be done through the corporation. Training programmes may also be organised for the tribals outside the state. Trainees from outside the state in handicrafts, cottage industries etc. be engaged in the training institute. The Govt. should restrict the denundation of forest to maintain the ecological balance and forest laws. Reserved forests in the tribal belts should be preserved and the encroachment should be prohibited. The future of mankind greatly depends to a large extent on the capacity of the earth to produce adequate food, fuel and fodder and to absorb usefully the wastes of various kinds to keep the environment clean. The best utilisation of the mother earth will depend upon the wisdom and foresightedness of the people for its best use of land and water resources. Development must be done in forestry, animal husbandry, fisheries etc. which are the basic sources of primary survival system. The development strategies adopted so far have not brought any significant impact on these systems. Commodity development approach has been adopted for promoting/regulating the production of selected commodities. Beneficiary approach selects the target farmers and programmes are planned and implemented for enhancing their production/capacity/competence to sustain production. Area Development Approach is followed for development of identified areas to achieve specified objectives. Watershed development approach is also an Area Development Approach but the geographical unit of planning and implementation is a watershed which permits scientific utilisation of natural resources. This needs to be combined with production, soil conservation, reclamation of degraded land and sustainable development of rainfed agriculture.

The main elements of transfer of technology are public policies and necessary legislation, developmental

infrastructures and availability of needed inputs at right time and in adeduate quantity, trained man-power and appropriate organisational structures, necessary finance and credit and people's participation. The involvement of policy makers, scientists, developmental agencies and the farmers as well as a pre-requisite for judicious untilisation and scientific management of the forest resources. The technology should be sound and economically viable. Research should be directed for development of orchard, forests,



agroforestry, social forestry etc. in the light of (i) suitability of trees, (ii) biomass production, (iii) growth of trees, (iv) yield of fodder, fruits, fuel etc. (v) canopy, (vi) copying studies, (vii) nursery technique and plant propagations like tissue culture, (viii) soil working technique, (ix) natural vegetation, (x) studies of flora and (xi) problems. Agronomical practices like (i) suitability of crops/crop rotation, (ii) crop yields, (iii) farmers' vs improved practices, (iv) lab to land programme evaluation, (v) minimal irrigation/conservation irrigation, (vi) disease and pest infection, (vii) optimization of resources, (viii) agricultural practices-tillage, mulch and agricultural chemicals. (ix) identification of problems. Land management practices, cropping systems and crop management practices, technology of mixed cropping and technology of forest and fodder development. Technology should be tested, refined and reinforced in the areas of pasture, grass land, afforestation and shelter belt plantation, horticultural and livestock management.

A sound technology followed by appropriate public policy should be supported by infrastructures and physical

availability of inputs required for developmental activities for effective transfer of technology. Development of infrastructures like road, market, machine and implements are essential for transfer of technology.

Trained Manpower and Organisation :

Technologies are generated by the scientists but the same are transferred to the field by field workers and extension staff. The field staff should be properly trained and they should be of good outlook for multidisciplinary approach and aptitude to work in harmonious co-ordination with other departments for forestry development programmes. The training should be given at various levels, (i) orientation programme for planners and policy makers, (ii) programme and process training for middle level executives, (iii) Foundation and Refresher crourses for field officers, (iv) planning and implementation training for field assistants and (v) farmers training. The persons trained in forest schools and colleges will be appropriate to bring integration between forestry, agriculture and animal husbandry.

A short term orientation programme for planners and policy makers in various departments/ministries like agriculture, forest, irrigation, animal husbandry, rural development, Planning Commission, Ministry of Finance, science & Technology, meteorological department etc. is essential to orient them in multidisciplinary approach and to promote exchange of views among themselves.

The middle level executives in the department/ministries as mentioned above including Deputy Secretaries, Directors/Joint Directors of the State Goverments, Conservators of Forests, Superintending Engineers in Irrigation and Public Works Department etc. may also be trained. Such training should include processing of project formulation and implementation. They should also visit the areas where success of the project has been observed.

The field officers should also undergo foundation and refresher courses. This programme should also include

environment and ecology, economics and extension, sociology and anthropology etc. to meet the current developmental needs. In addition to this, specific training programmes should be arranged for field officers of Agriculture, Animal Husbandry, Forestry, Irrigation, Public Works Department, Banks etc.

The field assistants should be trained on location specific technology based training for project planning, implemenation and maintenance. It should be done by the State Government and the trainees should include the officers of the state govt. with field experience, subject matter specialist from Agricultural Universities, officers of the local banks etc.

The farmers should also be trained for any programme of scientific utilisation of land and water resources and restoration of ecological balance. Appropriate training institutions should be developed by the State Government. The Developmental Blocks can be properly utilised for such training to farmers in utilisation and conservation of natural resources.

Tribal economic development will need an integrated approach which will involve administrators, scientists, executive bodies and farmers. The organisations that should be involved are Govt. of India, local agricultural university, state departments and farmer's co-operative. The following four committees can be cited for quick implementation and execution of works in any operational project.

(a) State Co-ordination Committee.

(b) Scientific Consortium—scientists of various research organisations, state research station, university of various disciplines for technical support should meet twice in a year to review the progress and prepare action plan for the future.

(c) Project Implementation Committee— consists of officers from various departments of State under the chairmanship of the Deputy Commissioner. The committee should

review the progress and plan for the activities of the next season.

(d) Village Resource Development and Management Society—it will be a registered society with the membership of beneficiaries and farmers. This will bring physical, mental economic and social involvment of the people. The society will be responsible for development, management, conservation and utilisation of natural resources and common facilities.

The operational research project for development of tribal economy through system approach will integrate the following.

i. Soil Conservation—land improvement and water storage and engineering structures.

ii. Agriculture—crops, varities, plant protection measures, crop demonstrations etc.

iii. Forestry—agroforestry, farm forestry, plantation of fuel and fodder on govt. land, common land and on farmers' field.

iv. Animal husbandry—improved breed of cows and buffaloes, fodder and grass production.

v. Minor irrigation—embankment for water storage, open and tubewels.

vi. Plant Protection

vii. Fisheries/poultry/pigs.

viii. Cottage industries.

ix. Horticulture

x. Sericulture, apiculture etc.

Budgetary finance should be provided for the development of common grazing lands community forests, social forests etc. Institutional finance may be arranged for resource implement works on individual holding. The small farmers belonging to the scheduled tribes may be subsidised for permanent improvement works as well as the capital items.

New Directions in Forest Policy

The recent forest policy of the govt. has emphasised more on afforestation by the forest based industries to meet their own requirement for raw materials. This will check the large scale deforestation in the country. The indusrties should seek the people's support for growing the required raw material to establish a direct people-factory link. This will encourage farm forestry, social forestry, community forest etc. which will have direct link with the factories. The new govt. policy will be more liberal on import of wood and wood products instead of deforesting its own. Under such a policy the tribals who largely depend upon the wood for their fuel have to think for bio-gas and solar energy as its alternative. The new policy seeks not only to involve local people including the tribals in forestry operations and cultivation of timber and fuel wood plantations but simultaneously give high priority to the local people's need for fuel wood, fodder and timber. The massive programme to be launched by the Govt. for afforestation for fuel and fodder development on all degraded and denunded land in the country will generate large scale employment of the tribals. This been emphasised to meet the National Forest Policy of 33 per cent in the country. In the hills this area will be 66 per cent to prevent erosion and land degredation and to ensure stability in the eco-system. Village and community land required for productive use will be converted to mini forests for meeting the requirements of fuel wood and forests. In this case the revenue will be earned by the municipality or panchayat. In other cases, the revenue will be shared with the local people as an incentive for growing trees. The projects which will cause deforestation should provide in their budget fund for regeneration and compensatory afforestation. Labour co-operatives and govt. corporations will be formed to prevent the degradation of forests so that illegal cutting of trees and exploitation to labour are prevented. The policy will not allow encroachments in the

forest areas even the existing encroachments will not be regularised. The degraded lands and wastelands will be made available to the forest based enterprises for raising plantations provided such industry will meet the basic fuel wood and fodder needs of the people.

Further Readings :

Bene, J. G. Beall, H. W. & Cote, A. (1977) Trees, Food and people, I. R. D. C., Ottawa.

Borthakur, D. N., Prasad, S. N., Ghosh, S. P., Singh, A., Awasthi, R. P., Rai, R. N., Verma, A., Dutta, H. N., Sachan, J. N. and Singh, M. D. (1981) Agroforestry Based Farming System as an alternative to Jhuming. Proceedings of the Agroforestry Seminar (ICAR) held at *Imphal from 16-18th May, 1979.*

Chaudhuri, B. Tribal Development in India, Inter India Publications. 1982.

Dewan, M. L. and Sudhirendar, Sharma (1985) People's Participation as a key to Himalayan Eco-System Development. Report of the Non-Governmental Organisations meeting at Centre for Policy Research, *New Delhi from* 16-18th March, 1985.

Douglas, J. Sholto. Forest Farming Prosperity for India, Natraj, Dehradun, 1982.

Hukam Singh, Joshi, P., Vishwanatham, M. K. & Khybri, M. L. (1982) Stabilisation and reclamation of eroded area and wastelands—Utilisation of boundary riverbed lands for fodder, fibre and fuel, AR, CSWCRTI, *Dehradun.*

Karare, R. L. (1985) Lead Papers National Seminar on Soil Conservation and Watershed Management, held at *New Delhi from 17-18th September,* 1985, organised by Indian Association of Soil and Water Conservationists.

Prasad, V. N. Principles and Practices of Social cum Community Forestry, International Book Distributors, Dehradun.

Puri, G. Forest Ecology, Oxford and IBH Publication Co., New Delhi, 1983.

Ramaiah, P. Tribal Economy of India, Light and Life Publishers, New Delhi, 1981.

Saikia, C. N. (1987) Forest and Minor Forest Resources of N. E. Region : Scope of Utilisation. Paper presented in the seminar on Economic Development of N. E. Region organised by Marwari Yuva Manch at *Jorhat from Jan. 10-11th, 1987*

Tiwari, D. N. Tribal and Forest Development, article published in SILVATIKA

Waddell, L. A. Tribals of the Brahmaputra Valley Sanskaran Prakash, 1985

APPENDIX—1

List of Tree Species Suitable for Agroforestry

Species	Climatic zone	Uses
Acacia nilotica	Tropical, Sub-tropical semi arid and arid	ABCD Fuel, fodder, Ag. implements, dye and gum
Acacia tortilis	Tropical, Arid and semi arid	ABCD Fuel, fodder and small timber
Acacia catechu	Sub-tropical, sub-humid (dry)	CD Fuel, heart wood decoction (katha and fodder)

1	2	3
Acacia auriculi-formis (L)	Sub-tropical, sub-humid	C Fuel
Acer Spp.	Montane, temperate (dry)	BC Agril. implements, fuel, fodder wood cups
Ailanthus excelsa	Tropical to sub-montane	BD Plywood, match, fodder,
Albizzia lebbeck	Sub-tropical and montane, sub-humid	CD Fodder (medium), posts, fuel, cart frame, boats.
Bauhinia variegata	Sub-tropical and sub-montane, sub-humid	Fodder, fuel, vege-table
Bauhinia purpurea	(lower hills)	D Agril. implements
Boehmeria regulosa	Montane to sub-tropical, sub-humid (dry)	CD Fodder (medium) carving wooden bowls, pots etc.
Casuarina equisetifolia	Tropical, coastal, humid	C fuel, posts, boats
Celtis caucasica	Montane and sub-humid	CD Fooder (medium), timber, furniture, bobin, carving.
Dalbergia sisso	Sub-tropical, sub-montane and plains	BCD Timber, plywood, furniture, Agril. implements, poles, cart frame, spokes etc. fuel, fodder (medium).

1	2	3
Dendrocalamus strictus	Sub-tropical and sub-montane, sub-humid to semi arid	C Posts, sticks, rafters for huts, young shoots pickles, pulp etc.
Eucalyptus hybrid	Sub-tropical and sub-montane, sub-humid to semi arid	ABC Posts, pulp, fuel.
Ectereticornis	Sub-tropical, sub-humid to semi arid	ABC Posts, pulp, fuel.
E. globulus	Montane, sub-montane humid	ABCD Leaf, oil, fuel, posts.
E. citrodora	Semi-arid, sub-humid sub-tropical	ABCD Leaf, oil, posts, fuel.
Fraxinus Spp.	Montane, sub-humid	AD Oars, plows, fodder, fuel.
Gmelina arborea	Sub-humid, semi-arid sub-tropical	BCD Timber, boats, posts, plywood.
Grewia optiva	Sub-tropical to montane sub-humid	ABD Fodder, fibre, fuel.
Melia azadirch	Montane to sub-tropical sub-humid to semi-arid	ACD Fodder, fuel, local timber, medicine.
Morus Spp.	Montane to sub-tropical lower hills, sub-humid and valleys	ACD Sports goods, silk-worm baskets, fodder.
Moringa oleifera	Sub-montane to sub-tropical hills and plains, sub-humid to semi arid.	AD Fodder, fuel, fruit gum.

1	2	3
Prosopis eineraria	Sub-tropical to tropical semi arid to arid	ABCD Fodder, fuel, fruit
Populus Spp.	Sub-tropical to sub-montane, sub-humid	Match sticks, plywood, pulp, fodder.
Phyllanthus emblica	Sub-tropical to sub-montane, sub-humid semi arid	AD Fruit, fodder (medium)
Quercus Spp.	Montane to temperate sub-humid (dry)	ACD fodder, fuel, furniture
Ricinus cummunis	Sub-tropical to tropical oil, semi arid	D
Sesbenia aegyptica	Sub-tropical, semi arid	D Fuel, fibre, fodder
Salmalia malaricum	Sub-tropical, to montane semi arid to sub-humid	CD Match, floss, plywood
Zizyplus Spp. (Budded)	Sub-tropical, to tropical semi arid to arid	BCD Fodder, fruit and fuel
Salix Spp.	Sub-montane to temperate sub-humid	CD Gun powder, basket, sports, goods, fuel, fodder

LIST OF GRASSES SUITABLE FOR AGROFORESTRY

Arundinella nepalensis	Sub-montane, sub-humid	Fodder
Cenchrus ciliasis	Sub-tropical/tropical	B
C. retigerus	semi arid light soil	Fodder
Dichanthium annulatum	Sub-tropical, tropical Sub-humid to semi arid (Heavy soils)	Fodder
Lasiurus sindicus	Tropical, arid (sandy soil)	AB Fodder

1	2	3
Chryspgon fulvus	Sub-tropical to montane sub-humid	B Fodder
Eulaliopsis binata	Sub-tropical semi dry	B Fodder, fibre (green)
Phalaris tuberosa	Temperate sub-humid	B Fodder

A=Agro-forestry ; B=Silvo-pastoral ; C=Multi-row and D=Field Margin.

APPENDIX—II

Fruits and Oil Bearing Species

Oil Bearing	Fruit Bearing
Pongamia pinnata	*Anthocephalus cadamba*
Schleichera oleosa	*Aegle marmebs*
Melia azedarach	*Tamarindus indica*
Madhuka Indica	*Moringa oleifera*
Cashew shell oil	*Emblica officinalis*
Sandal wood oil	*Mangifera indica*
Linolac oil	*Syzyginm cumini*
Lemon grass oil	*Artocarphus Letrophyllus*
Sal seed oil	*Cocos nucifera*
Pine oil	
Cedar oil	

APPENDIX—III

Revenue of Forest Department, Assam during 1980-81 (Rs. in Lakhs)

Particulars	1980-81
1. Timber	907
2. Fuel wood	12
3. Minor Forest Products	302
4. Misc.	—
	Total 1221

APPENDIX—IV

Forest Based Industries in NE Region (in No.)

State/Union Territories	Medium sized		Small scale	
	Factories	Hard board	Wood products	Paper products
Arunachal Pradesh	—	—	9	—
Assam	—	1	263	176
Manipur	—	—	242	12
Meghalaya	—	—	33	11
Mizoram	—	—	45	23
Nagaland	1	—	3	4
Tripura	—	—	41	1

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Identification of existing tribal technologies including handicrafts and their problems

Mohini Mohan Brahma*

The tribal population have been spreading almost all over Assam. In the plains they occupy the Brahmaputra Valley right from Sadia on the East to Shrirampur on the West. In the hills tracts they are predominantly occupying in Karbi Anglong and North Cachar hills districts. Among the tribes of Assam the Boros form the greatest part in population and their next are the Misings who form a dominant section in the riverine areas in Upper Assam. The exact population of the tribal population is still remaining obscure. The demographic study of these people is made yet on the basis of conjecture because of the fact that a considerable number of tribal people living in the most interior places have been left out of the census due to inaccessibility to their habitation. Moreover some of them hesitate to identify themselves as tribals. Therefore, the census figure of tribal population of Assam shown at 13,44,020 only in 1971 census can be hardly beyond doubt.

The tribes of Assam have a traditional socio-cultural treasure. They have been found to possess technological skill. In this paper attempt has been made to deal with a profile of their technologic identity with special reference to the Boros confining mainly to these living in Kokrajhar district.

It is a well known fact that the Boros are agriculturists. They are well acquinted with the technique of agricultural works. All the agricultural implements such as plough,

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yoke, harrow, rake and other wooden materials are their hand products. Wooden hand-barrows were also seen made by them till the recent past. Wood craft of making weaving apparatus may be termed as their rustic technology. They manufacture by their own hands with their simple tools like dao, knife and axe-the handloom appliances namely shuttle, beam, sley, bamboo reed, swift, creel, cross bar, temple, heald pipe, pully, charkha etc. and with those home made appliances the women folk weave out beautiful clothes of various of designs.

It may be mentioned that late Dhanu Ram Brahma of Kazigaon village in Tipkai area under Dhubri district invented a new type of wooden reeling machine. It is of course operated by hand. But it is surprisingly new typed quite unknown and unseen previously to any inventor. As has been informed by an official of Sericulture Department, 5 k.g. cocoons can be reeled a day by this machine. It rapidly came to the notice of the Sericulture Department of Assam which named it "Dhanu Type Pat Reeling machine" after the name of inventor. But due to lack of encouragement with financial aid from the Government side the productivity of Workshop could not develop to the expectation. Rather along with death of the inventor the manufacture started being extinct.

Fishing and hunting are said to be pastime of the tribal people of Assam. They are fond of fishing and hunting collectively and individually. Nets, spears, arrows, sticks and daos are the main implements of their hunting of beasts while various types of nets, jakhra (spear), Jekhai (bamboo net), Khobai (bamboo basket for keeping fish in), Pholo (implement made with bamboo sticks), Sen (bamboo trap), khokha (a long and big bamboo trap) etc., are used as their fishing appliances. All the above materials are made by themselves.

With a view to growing paddy, water is indispensible in fields. The Boro cultivators were said to have introduced for the first time the art of irrigation system in

Assam by excavating channels and erecting dams to make artificial water course to their fields. That was the simple and ordinary irrigation system. In the present scientific age, the new system of irrigation known as "Lift irrigation" has been introduced. By observing this scientific method of irrigation one Boro cultivator Dharani Brahma by name of Dihira village in Nalbari district introduced a hydro-dynamic hand machine for irrigating water to paddy fields. But after death of the inventor, the machine has been done away with.

Beautiful wood carving is also seen to have been practised among the Boros. It is surprising to note that one illiterate Boro villager named Debicharan Brahma of Dotma in Kokrajhar district was a good sculptor. He carved a good number of aesthetically pleasing images of various animals, birds, objects and human beings in varied shapes and designs. All the idols are wooden and carved only with the help of dao, knife and axe. His sculpture appears to be of high imagination and reveals his skillful art. The artist is dead now and the images are either being lost or damaged due to lack of care by the members of the family of the deceased sculptor. Another sculptor late Birendra Brahma of Adabari village near Kokrajhar town is also worth mentioning. He also carved a number of idols of birds and animals of various species at his own imagination. But for want of consciousness of the family members of the deceased artist the carved images are being spoiled and lost.

Presently Toy theatres (putola theatre) are being staged by Boro young artists. The artificially artistic gestures, dialogues and songs of the toys are presented so nicely and interestingly in the stage that the Toy theatre now seems to be more popular than the man-staged theatre among the Boros. Toys are mostly wooden and made by the young artists. Now the skill and the crafts of these young people need help and encouragement from the society

as well as from the State Government for growth and development of technology among the unemployed youths.

Craftsmanship in gold also is not totally absent among the tribals. One Atul Boro of Tipkai in Dhubri district and another one Arjun Narzary of Kokrajhar were once known as skillful gold smiths. They made gold ornaments of select designs which were popular among the tribal women. But they were not encouraged with any form of help by the State Government and thus their technical activities were untouched by the developmental scheme.

Iron technology among the tribal people is also not unknown. Late Ana Ram Boro and late Bircharan Brahma of Tipkai were Popularly known as black-smiths. Both of them produced daws, axe, knives, arrows, spears etc. But they could not develop their craft due to want of raw materials. Moreover they did not take the craft as their profession. Brass metal works are seen among the tribals in Dudnoi area. But for want of raw materials and money the craftsmen can not stand promising.

At one time tribal carpenters used to construct houses and make furniture. But since the coming of carpenters from outside Assam the number of tribal carpenters has been on the down. Laxity in taking carpentary as a profession can be ascribed as one of the causes of the down come of tribal carpenters. Lack of working capital is also another cause that discourages tribal carpenters to stick to the activities.

History tells a us that great section of tribal people used to collect gold dust from Sonasri (Subansiri) river in Upper Assam. They did not only collect gold dust but they were surely familiar with the process of refining the crude gold dust as well as with the art of jewellary works. The descendents of those tribal people are at present identified as Sonowal-Kacharis. The Sonasri river no longer produces Sona (gold dust) and the Sonowal Kacharis are also not in the practice of making jewellaries now.

Once the Boros developed a distinctive civilization which is reflected till now in the ruins of royal buildings, temples, tomb-stones and gate-way of Dimapur, Khaspur and Haritikkar. These ruins have still been bearing indelible evidences of architectural skill of the Boro people. It may be mentioned that very recently a news appeared in a local news paper that a stone plate of a Kachari King has been unearthed by Dr. Sumitra Hagzer at Khaspur. The plate is found inscribed in Assamese scripts in 1720 Saka. The engravings and inscriptions on walls, stones or copper plates apperently bear testimony of the Boro Kacharis' sculptural art. But the relics are lying uncared, unattended and unpreserved by the Government. The above mentioned stone plate should be immediately preserved if not already done so, in a museum, not in an individual custody.

The tribal technological knowledge of making household articles of wood, cane and bamboo also can not be ignored. In their day to day life they require mortar, pestle, basket, fan, wooden stool, cane stool, betelnut tray, strainer, umbrella and winnowing fan etc. All these articles are made by themselves.

The tribal activities in art and technology are not negligible. But they are lacking in scope for development. In many ways the tribal technologies are hampered from running on and development.

The problems and the causes of tribal technologies being undeveloped may be analysed as below :—

1. Tribal people are not prone to take technology as their profession. They do not produce articles on commercial basis.
2. Absence of facilities for undergoing training in Government sponsored institutions.
3. Lack of systematic plan for developing the arts. This is due mainly to absence of proper training in the subject.
4. Lack of patronage and encouragement by the State Government.

5. Non-availability of raw materials.
6. Want of market facility
7. Handicrafts generally cost more than the machine products. So the hand products can not compete in market. Of course to compete in market and to get popularity hand products should improve quality and their durability.
8. Absence of suitable Workshop
9. Laxity in enterprise combined with economic hardship.

SUGGESTIONS :

Technology may exist, but cannot flourish in tribal areas. So with a view to encouraging the tribal youths in technological activities the following few points may be taken into consideration :—

1. Government should provide tribal youths with monetary help through the I. T. D. P. or D. R. D. A. Scheme under tribal sub-plan.
2. To motivate the tribal youths by giving them facilities for undergoing training in I. T. I.
3. Industrial loan through banks should be extended to tribal youths in easy and liberal terms and conditions.
4. Establishment of Technological Institute in tribal areas by the Government.
5. Financial assistance should be extended to run the private Workshop or business on Co-operative basis.

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Role of Science and Technology in poverty alleviation, self employment and income generation in tribal areas : Role of Human Resource Development.

S. A. Khan*

Geographically, the entire North-Eastern region consisting of the States of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura is almost isolated from the rest of the country. The area is surrounded by Bangladesh, Burma and China and there are two entry points for this region i.e. Bihar and West Bengal. This area has difficult terrain with high mountains and lovely green valleys traversed by innumerable rivers. With these characteristic features, this region is quite unique.

The State of Assam which ranks thirteenth amongst the State of India on the basis of population (1971 Census) can geographically be divided into two distinct and natural physical regions—the high hilly lands in the middle of the State and the plains. The plains consist of the great river valley of the Brahmaputra or the Lohit and the Barak. The valley of the great river consists of wide alluvial plain. The State of Assam has approximately 11 per cent tribal population which is spread over the entire State. The concentration of the tribal population varies from district

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to district. The percentage of tribal population in the above districts varies from 10.4 per cent to 28.8 per cent of the total population. In the other districts the percentage of tribal population varies from 1 per cent to 7.4 per cent of the tribal population.

Poverty alleviation, self Employment and Income Generation Programmes :

Developmental programmes of any government are aimed by and large at improving the general condition of people. Whatever may be the sectors but they all have a focus on eliminating the poverty. The country can march towards progress only when its people are well fed and country takes care of its human resource.

Keeping the above aim in view, our country, through its Five Year Plans has developed and implemented various programmes for eliminating the poverty, providing income generating schemes, and schemes for self employment. A few of them are listed below :

i) Integrated Rural Development Programme (IRDP)
ii) Training of Rural Youth for self employment (TRYSEM).
iii) National Rural Employment programme (NREP).
iv) Development of Women and Children in Rural Areas (DWCRA).
v) Rural Landless Employment Guarantee Programme (RLEGP).
vi) Project for Assisting Small and Marginal Farmers for increased argicultural production (PASMFLAP)
vii) National Project for Bio-gas Development (NPBD).
viii) Social Forestry.
ix) Integrated Child Development Services Schemes etc.

These programmes are being implemented in Assam in a big way. Some of these programmes are fully funded by the Central Govt. and some others by State Govt. Inspite of these programmes, there is not significant progress in

eliminating the poverty. There are sizeable number of people who are still below poverty line.

Role of human resource development :

We are very much concerned as to how science and technology could be taken to remotest tribal areas to make the life of tribal people much better. There is a feeling that as soon as better technology reaches to tribals they would, presumably, adopt it and there would be economic upliftment. The focus have, to my mind, is on economic aspect only. Because economic development can be measured. But there is one more factor which is very important indicator to judge the progress of any nation and that is concern for one generation towards other Development of Human Resource. Though this could not be measured but it is an equally important factor for Nation building. To emphasise, this point, I would like to quote Noble prize winning poet from Chile, Gabriela Mistral : He says "we are guilty of many errors and many faults, but our worst crime is abandoning children, neglecting the fountain of life. Many of the things we need can wait. The child can not. Right now is the time his bones are being formed his blood is being made, and his senses are being developed. To him we cannot answer 'Tomorrow'. His name is 'Today'. Assuming that it took you about eighteen seconds to read this quotation, while you were reading it twelve children were born in our country. Let us leap 15 years into the future and see what is likely to happen to those twelve :

—Two died in early childhood
—Of the surviving ten, Five never went to school
—Of the Five who did go to school, only two completed the elementary grades.

Now the question arises that must twelve children, each one full of new born promise, dwindle into just two young people who are prepared for life, work, and persuit of happiness : The answer is No. Because all these twelve children have right to health right to education and right to better life.

India's population as per 1981 census is 683 million. According to 1971 census, 42% population consisted of children upto 14 years of age. Children under six years of age constituted about 17% of the population.

There were significant achievements in India in the first Four Plans in all spheres of development from which children too derived benifit. Nevertheless, various problems concerning child welfare are still of fairly large dimensions. The incidence of mortality, morbidity and malnutrition. among children continue to be high. Although the infant mortality rate varies in different parts of the country and is influenced, among others by physical, geographical, economic and social factors and the level of social and economic development, it is more than a 100 per thousand in most areas. Various surveys have indicated a fairly high incidence of malnutrition among pre-school children, Vitamin A defeciency is reported to be common among children and is considered as a major contributing factor to the large incidence of blindness in India. The occurrence of diarrhoea, dysentery, parasitic infection, skin disease, respiratory infection, whooping cough, measles etc. is also fairly common. Physical growth (hight and weight according to age) and the development of mental capacity of children are consequently affected. Unsatisfactory dietary habits (both in terms of choice of food as well as the preparation), weaving practices, poor knowledge of nutrition and of health and hygiene aggravate the problem.

Keeping this alarming factors in view, Govt. of India adopted a National Policy for children in the year 1974 which recognises the nation's Children as a Supremely important asset and stipulates that children's programmes should find a prominent place in all national plans for the development of human resources so that our children grow up to become citizens, physically fit, mentally alert and morally alive, endowed with the skills and motivations so necessary to support our social and national development objective. To achieve the objective of National

Children's Policy a comprehensive scheme for child development was launched in the Fifth Five Year Plan in a few tribal development blocks, urban slums and developmentally backward rural areas.

These projects aimed at :

i) Laying a solid foundation for physical, mental and social development in early childhood,
ii) reducing early childhood mortality, morbidity and malnutrition,
iii) improving the capacity of mothers to look after the normal and nutritional needs of their children and,
iv) Coordinating the various child welfare policies and activities of different departments.

These projects provide an integrated package of services like immunisation, health check ups, supplimentary nutrition, referral services, health and nutrition education and non-formal pre-school education to children below six years of age, pregnant and nursing mothers. Efforts are made for convergence of other supportive activities like safe drinking water and environmental sanitation. The health infrastructure in ICDS project areas is strengthened in order to provide physical access to all mothers and young children in the project area.

The basic functional unit is a child care centre called Anganwadi Catering to the needs of young children and mothers in a population of about one thousand though this limit of population may sometimes be much smaller depending upon the habitations, number of villages and topography. Each centre has an Anganwadi worker and a helper, both of whom are local women. The anganwadi workers are trained for a variety of health, nutritional and educational tasks. They are supported with material supplies like food commodities, basic medicines and simple and locally made play materials for pre-school activities. Spportive supervision in the form of guidance and continous education is provided by trained supervisors, para-

professional and project level medical and child Development project Officers. Medical colleges, home science institutions and schools of Social Work have been involved in independent survey and evaluation studies.

ICDS started with 33 experimental blocks in the country in the year 1975. Today we have 1646 projects all over the country.

ICDS IN ASSAM :

There are 134 blocks in Assam out of which 51 are covered under this scheme. Of the 134 blocks there are 26 tribal development blocks. ICDS is at present covering 18 tribal development blocks. In these 18 tribal development blocks children upto six years of age are provided. health check up, immunisation, referral services, supplimentary nutrition, non-formal pre-school education. Pregnant and nursing mothers are provided health and nutrition education.

ICDS thus provides :

i) Employment to two local ladies of each village covered under this scheme.
ii) an opportunity to local people to produce food material which could be purchased by the Anganwadi Centre for providing supplimentary nutrition to children. This will generate income.
iii) an opportunity to local people to understand the value of local food and its nutritive value.
iv) an opportunity to local people to educate their children locally and avoid school drop out.
v) an opportunity to local people to improve the health and nutritional status of their children as well as safety from childhood diseases.
vi) an opportunity for safe delivery of children.

ICDS thus have become a major developmental project in the country as well as in Assam. Preference

is given to tribal blocks. It is expected that by the end of Seventh plan all tribal projects in Assam would be covered under ICDS.

SUGGESTIONS :

1. Tribal research institute through their training programmes educate people to take advantage of ICDS activities. They should also include early child care as one of the component of their training curriculum.

2. State govt. should accelerate the process of implementation of ICDS projects.

CONCLUSION :

To emphasise the importance of human resource development, I conclude with remarks of Hans Singer, the international development economist who once said :

"Human gifts, talents, latent genious, are more or less equally distributed over the world. Of all the children born into the world, 80 per cent— four out of five— are in the developing countries.

For every Einstein born in an industrialised country, there are four in developing countries who will never have the opportunity to realise their full potential."

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Technological Innovations and Acceptance by the Tribal Communities of N.E. India

P. D. Saikia*
S. N. Buragohain**

The North Eastern region of the country comprising seven states has an area of 255,037 sq. km. which is nearly 8·0 per cent of the total geographical area of India. This region is inhabited by more than 265 lakhs of people (1981) constituting about 4'0 per cent of the total population of the country. Tribal people constitute nearly 25 per cent of the total population of N. E. India. In Assam, the tribal's share to total population is about 11·00 per cent, while in all other States of N. E. region, the share of tribal population is very high. It ranges between 22·00 per cent in Tripura and 94·00 per cent in Mizoram, Meghalaya, Nagaland, Mizoram and Arunachal Pradesh are inhabited mainly by the tribal communities. The whole of N.E. region is a mosaic of diverse racial types, cultural forms, language, dialects with different traditions of origin. Diversity is a characteristic of the tribal population in N.E. India. According to their habitat the tribal groups of this region may be classified into two broad divisions plain tribes and hill tribes.

The hill areas of N. E. India present variegated physio-geographical and Socio-economic features that distinguish them from other regions of the country,

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Development of these areas started late and until recently modern technology had little role to play in the process. There is need for evolving specific strategies for socio-economic development of hill areas. The shifting *(Jhum)* cultivation is practised extensively in the hill areas of N.E. India, which is a source of livelihood for half a million tribal families. On the other hand it is considered uneconomic and also a menance to forest wealth. Surplus production in such system of primitive agriculture is inconceivable. The system of agriculture prevalent amongst the tribal people in the plains is by and large, similar to that of the non-tribal people.

In this paper an attempt has been made to focus some aspects of technological innovations and acceptance by some of the tribal communities of N. E. India based on case studies. A change in the mode of production does not just mean a change in the agricultural production technique alone, it also includes the whole fabric of socio-economic and cultural life of the people involved or affected.

Transition from shifting to settle cultivation :

A few tribes in N. E. India simultaneously practise shifting cultivation in the hill slopes and settled agriculture in terraces in the low altitude and wet paddy cultivation in low lying areas. They practise slash and burn cultivation where plough cultivation is virtually impossible due to sloping of the land and other ecological factors. These tribes are clinging to shifting cultivation not because of any cultural moorings but because of constraints of nature and non-availability of other suitable method.

A significant change has been noticed among the Miju Mishmis who have settled down recently in the plain/valley areas of Sunpura of Lohit district, Arunachal Pradesh,*

* Goswami, N. R. & Buragohain, S. N. (1982) ; Hatiduba, Socio-Economic Survey of a Miju-Mishmi village in Lohit District, Arunachal Pradesh, A.E.R.C., Jorhat.

bordering Assam. It was recorded that after 1960, as many as 200 families belonging to Digaru and Miju Mishmis have established their villages under rehabilitation programme in the areas located between Sunpura and Paya reserve forest of the Lohit District of Arunachal Pradesh. Formerly, they were hill dwellers and their main agricultural activities was confined with *Jhuming* only. Now they are in transition from shifting to settle cultivation. They have reclaimed suitable low lying forest land for wet rice cultivation and high flat land for *Ahu* paddy (autumn paddy), mustard and maize cultivation. However, they are partly maintaining their traditional *Jhum* type of cultivation in the available jungle land, which again are ultimately converted into settle cultivation land. It can be assumed that, in near future all the available *Jhum* land will ultimately be turned into settle cultivation land.

Hatiduba is one of the recently established villages in this valley area inhabited entirely by the *Miju* Mishmis, the total household being 22 only. The economy of the village is dependent mainly on settle cultivation rather than *Jhuming*. In the changed situation they have largely given up their attachment to more primitive form of production and have taken up advance technology of cultivation which affiliates them with the more prosperous communities living in the neighbourhood.

The land where *Jhum* cultivation is done are actually elevated plain jungle land. Practically this is not *Jhum* cultivation in true sense as there is no rotation and abandonment of fields like other *Jhum* fields and they are not situated in the hill slopes either. The operational methods are only similar to *Jhum* cultivation. *Jhum* cultivation is carried on the selected plots of jungle land for the three consecutive years. Along with the cultivation, levelling of the land to the possible extent goes on side by side. Thus after three years of *Jhum* cultivation. The reclamation works of the *Jhum* land is done either by the owner himself or by hired immigrant Nepali

labours. They usually employed Nepali farm workers as hired labours in their settled cultivation.

Land for wet paddy cultivation as provided to the immigrant Nepali farm workers for cultivation on 50:50 share cropping basis but seeds, plough and draught animals required for cultivation are generally supplied by the owner himself. The farm owner rarely participate in cultivation works on settle farm except occasional visits. While the male-folk have failed to learn ploughing and other operations of wet rice cultivation, the tribal women-folk take part in transplanting seedling in wet rice field and in harvesting paddy, and other crops. The agricultural technology involved in adopting settle cultivation is however quite a new experience for them.

It is interesting to note that within a short span of two decades, the primitive mode of production has transformed into a settled economy after reclamation of suitable forest land. Out of 146.46 hectares of cultivated land in the village, a total of 22.12 hectares was used for wet rice cultivation, 91.94 hectares for high land cultivation to raise mustard, maize and *Ahu* paddy, 2.42 hectares for horticulture and rest 29.98 hectares for *Jhum* type of cultivation.

Mustard is the most important cash crop in the village. A total of 672.57 quintals of mustard was produced in 76.13 hectares of land which gives a per hectare yield of 8.83 quintals. Besides it, 384.44 quintals of maize was produced in 30.89 hectares of land. The average yield of maize was 12.44 quintals per hectare. The yield rate of wet paddy was 10.24 quintals per hectare. It was raised in 22.12 hectares of land.

The production of cash crops brought the tribal community in contact with the market economy. In Hatiduba village almost every family has started the cultivation of mustard in the high land cultivable area because it accrues more profit. To sell mustard they interact with the market town like Sunpura, Sadiya etc.

As the plough cultivation has been introduced the villagers have adopted cattle rearing in recent years. They now use to purchase agricultural tools particularly plough and *dao* from market of the nearby localities. The use of wooden dehusking implement (Dhenki) in the village is of recent introduction which is used by a small section of them. There is also an instance of having a bullock cart in the village owned by the village headman. These are some of the examples of technological change in a tribal community. It is however true that the Miju-Mishmis who have settled in plain valley area obviously are not conversant with the details of raising wet paddy rice and other cash crops by plough cultivation. They had started establishing close and frienly relations with the neighbouring plains Assamese cultivators or Napali farmers who gladly pass on the necessary informations and details of techniques involved in it. It has shown that socio-cultural barriers are not insurmountable if other objective conditions are favourable for the transition to settled cultivation. However, it is true that the Napali immigrant farmers indirectly worked as change agents.

Intregated Hill Area Development Project :

The Intregrated Hill area Development Project (IHADP) was launched by the Ministry of Irrigation, Govt. of India as Central Sector Project in 1974 in the Nungba, Sub-division of West Manipur. The IHAD Project aimed at improving the economy of the hill tribal people, first, by introducing improved farm technologies covering improved seeds, fertilizer, plant protection measures, high yielding crops and multiple cropping systems. These idea were practically unknown in the project area. The cultivators mainly relied on a traditional mono-crop system. The people in the area adopted the agricultural development schemes of the project enthusiasti-

* Saikia, Dr. T.N. (1979), An Study on Integrated Hill Area Development Project Nungba, West Manipur District, Manipur, A.E.R.C., Jorhat.

cally. They cultivated peas, mustard and potato which were, by and large, new crops to them. Agricultural demonstration were held by the project staff in compact areas for propagation and adoption of the full package of improved farm practices. These increased the cropping intensity and per acre yields in the region. The beneficiaries recorded a better overall performance than the non-beneficiary households.

The project authorities purchased 12 power tillers. 20 Japanese type of weeders, sprayers, dusters etc. and used these for demonstration in the farmers' holding free of cost for the first two to three years. Beneficiary households now know to use such improved tools and implement for better ploughing of land for higher production.

The project introduced land development and terracing scheme for replacing shifting cultivation by settle cultivation and for conservation of soil resources in the hill areas. Upto the end of the March, 1978, 226.5 hectares could be terraced. The beneficiaries were also provided with tools and implements for construction of terraces and farm inputs for the first two to three years. The newly terraced lands were producing less than average yield of the area as the terraced land had not regained natural fertility.

It is however observed that the IHAD project could evoke keen interest among the hill tribal people in the project area for adopting improved farm technologies. They are now aware of benefits of settled and irrigated agriculture. Multiple cropping system has been accepted wherever feasible. A sense of onwership of settled area is likely to lead to future investment on land.

Khejurband : A Dimasa Village in N.C. Hills District, Assam* :

The Dimasas of N. C. Hills District of Assam was traditionally shifting cultivators, but a considerable section

* Borah, D. (1985) ; Khejurbond, Socio-Economic Resurvey of a tribal village in N. C. Hills District. A.E. R. C. Jorhat.

of them started wet paddy cultivation from the long past by reclaiming the narrow river valleys. In the Mahur river valley they even constructed temporary dams themselves in the river to get their paddy fields irrigated. At present with the introduction of irrigation facilities in certain pockets by the State irrigation department, they have proved themselves to be efficient wet paddy cultivators and in such areas the traditional shifting cultivation is fast losing its popularity. Many families even gave up shifting cultivation totally.

The village Khejurbond, with 47 households, is inhabited exclusively by the Dimasas. Some important changes in the socio-economic aspeets of the village have taken place recently. The total *Jhum* areas was 49.07 hectares in 1977 which has declined to 23.03 hectares in 1983· It is mainly due to giving up of *Jhum* cultivation by some households in the village.

Plough cultivation is now popular among the Dimasas. Buffaloes are used to draw the ploughs. Engagement of hired labour in settled cultivation is a common feature. This is because of introduction of wet paddy cultivation with which the local Dimasa people are not so much conversant as they were traditionally shifting cultivators. However, some of the Dimasas of Khejurbond reported that they had ploughed their fields themselves with buffalo and bullocks without the help of any hired labour. The womanfolk of the village has learnt and participated in different operations in the wet paddy cultivation.

The introduction of improved iron plough is a recent phenomenon in the village. Two households have procured three improved ploughs for wet paddy cultivation. Recently some cycle carts have also been introduced in the village for carrying agricultural commodities or other goods. The village people now introduced 'dhenki' an improved type of dehusking implement in place of mortar and pestles. Fly shuttle loom is gradually becoming popular among the womenfolk of the village. On the whole there is awareness and egarness among the villagers for accepting new ideas or innovations which is proved to be

remunerative. The noteworthy part is that such changes have not created disruption in their socio-economic life.

Apple Cultivation in Kameng District, Arunachal Pradesh * :

The introduction of apple cultivation in Kameng district of Arunachal Pradesh was undertaken at the initiative of the administration in the year 1971. Apple saplings of several varieties were brought by the District Agricultural Authority from Himachal Pradesh and other apple growing states, and distributed amongst the Monpa tribal growers at a very nominal price. Fertilisers and pesticides were supplied free of cost. Many farmers started small apple orchards enthusiastically in Dirrang, Kalaktang, Thrizine and Bomdila area in the district which had initially covered a scattered area of about 157 hectares.

At the time of survey the average size of the apple orchards of the sample farmers was 0.88 hectares only. The average production per apple bearing plants was nearly 20 kg. and net annual return per fruit bearing apple plant was Rs. 58.21 during the year, 1975. The annual gross and net income of the fruit bearing apple plants per farm was Rs. 1602.00 and Rs. 1560.28 respectively. For the shifting cultivators such income was quite substantial.

The total coverage of apple cultivation has now significantly increased to 1286 hectares in 1977-78. This increase is mainly due to introduction of apple cultivation in other district of Arunachal Pradesh since 1973-74.

The acceptance of such a fruit crop as commercial basis by the shifting cultivators of Arunachal has created new possibilities for widespread horticultural development. Transport facilities to important places have made the marketing of the product outside the Arunachal Pradesh feasible.

* Gohain, D. (1977) : Apple Cultivation in Arunachal Pradesh, Agro-Economic Research Centre, Jorhat.

Now, the apple cultivation in the upper regions of hill slopes of different districts has proved to be better alternative to shifting cultivation. Many shifting cultivators of the Arunachal have accepted this new agricultural crop with keen interest.

In a few cases of micro-level studies it is also observed that once the tribal farmers are convinced of the utility and benefit of any new agricultural technology, they readily accept it. The majority of Khasi farmers of Meghalaya have adopted various types of horticultural crops viz. potato, pine apple, oranges, pears, peach, betal nuts and leaves etc. since several decades past. They now raise three potato crops in a year by applying chemical fertilisers, organic manures and pesticides. These farmers produce cabbage, cauliflower, raddish and many other vegetables as commercial crops. Some of them cultivate two crops in mixture (e.g.potato and cabbage) in the same plot of land simultaneously. These farmers use optimum quantity of chemical fertilisers and cowdung in their fields and have proved to be an advance horticultural community.*

The tribal farmers of the Assam valley are gradually adopting improved agricultural practices and in many cases at their own initiative. A few examples are cited below.

Namoni Borpomua : A Mishing Tribal Village * :

The village is located at Majuli, the world's biggest river island of the Brahmaputra. The Mishings exhibit a traditional habit of preference for living along the banks of river. Though the village Namoni Borpomua is situated in a flood affected area, the basic economic resource, viz. land under the command of the villagers is fully utilised in the flood free seasons. The cropping pattern of the

* Borah, D. (1981) : Factors Affecting Use of Fertilisers and Pesticides in Hilly Regions of Meghalaya, Agro-Economic Research Centre, Jorhat.

village has much improved in recent years. The land is used for both double and mixed cropping. In case of double cropping, the people raise *Ahu* paddy (Autumn Paddy) as the first crop and mustard as the second crop, while in case of mixed cropping they raise both *Ahu* and *Bao* paddy together. Mustard is the main cash crop contributing a major income for the village. The cultivation of a new cash crop viz. pea is now gaining much popularity. In 1982, a record area of 81·47 hectares were utilised in the village for raising pea, Next to mustard, pea is now another important cash crop.

The use of tractor since 1977 at the instance of the village Development Committee on hired basis from State Agriculture Department is playing an important role in tilling the soil which has encouraged the villagers to bring more area under cash crops. In the year, 1981-82, about 277 households of the Borpomua area were benefitted in getting their land ploughed by tractor, the total area being about 202.35 hectares. A rich farmer of the village has recently purchased a power tiller at subsidised rate. Ploughing is also done mostly by bullocks and horses. Introduction of horse as draught animal is of recent origin and is now very popular among them. In 1975, there were only three horses in the village, but this number has increased to 76 in 1982. The changing trend in the village economy reflects an advancement in agricultural technology and acceptance of new ideas by the farmers of the village.

Nam Deuri, A Deuri Tribal Village* :

Nam Deuri is an exclusively homogenous tribal village inhabited by the Deuris, the number of household being 115 only. The village is experiencing some changes in

* Buragohain, S. N. (1983) : Namoni Borpomua : A Village Resurveyed in Sibsagar District, Agro-Economic Research Centre, Jorhat.

respect of agricultural production in recent years. The cultivation of mustard as cash crop is much popular in the village. Of late, most of the Deuri families in the village have introduced patal (Trichosanthes Dioica, R.) cultivation on commercial basis which contributed greatly to the village income. Pea is also another recently introduced cash crop in the village. Pea seems to have gained popularity in the village and is now adopted by a large number of families. Larger coverage of areas by peas would not only benefit the farmers directly but the process would also help them in learning about the crop rotation. The raising of potato as horticultural crop is also gradually gaining popularity in the village.

The use of modern agricultural tools such as hiring of tractors or power tillers for tilling the soil, pump set for irrigating water etc, are the indications of their awareness towards modern agricultural technology. A few farmers of the village possessed several number of diesel pumping set, which they procured from state irrigation department at fifty per cent subsidised rate. One big farmer of the village has owned a power tiller which is often hired by the co-villagers. Ploughing by horse is a recent introduction in the village, which they might have learnt from their neighbouring Mishing villages. The adoption of cash crops on commercial basis also reflects their technological advancement in the field of agriculture.

Concluding Remarks :

From the case studies mentioned, it can be concluded that there is no such inherent inhibition among the tribal people against adopting new ideas and improved techniques of production as well as other development activities pro-

*Saikia, Dr. T. N. (1981) : Nam Deuri, Socio-Economic Survey of a Plains Tribal Village in Sibsagar District, Agro-Economic Res. Centre, Jorhat.

vided they are convinced of the utility and benefits. Like other non-tribal village folks tribal people in rural areas of both plains and hills are also conscious about the necessity of their social and economic, development. The case studies indicate that tribal people are not averse to change. Scientific innovations cannot be different for tribal people, but there is an urgent need for location specific strategies for socio-economic development of the tribal areas. The recent emphasis on an appropriate technology also underlines the need to evolve programmes that are best suited to local conditions. Depending on the existing conditions, fostering development would require removal of constraints, increasing agricultural productivity, ensuring efficient use of resources and creation of suitable institutional infrastructure. Utmost importance should, however, be placed on the development of local skills on various technologies, so that the tribal people can diversify their occupations.

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Application of Science and Technology in Tribal Development Planning of Assam

Medini Choudhury *

Tribal development has become an obsession with our planners and administrators. But all their past calculations have gone away and the whole planning exercise has become virtually counterproductive in as much as it has, far from improving, adversely affected the economic condition of the tribals.

In most cases they have been shifted from their old environ and left in a blind alley. A recent survey has come out with a startling revelation that during the three decades (1955-85) indebtedness among the tribals has increased many times. From a little more than 14 percent in the fifties it has now risen to a staggering 34 percent.

So the entire model of tribal development planning needs a fresh look.

Our planners and administrators have held numberless seminars, advanced innumerable solutions to problems of tribal development ; but all throughout, they have ignored a basic, simple question. They have all the answers with them, but then they have so far failed to find out what is the problem. As a result all their endevours have gone haywire and we have come back to square one.

In a developing country like ours it is very difficult to strike a balance between economic growth and distributive justice and to put thereby country's economic health on an even keel. Country's polity has been ailing from this malady. So its fall out will naturally affect all and sundry, tribal and non-tribal alike. That does not however justify a singularly dismal picture of tribal development in the country. Unless whatever little is left of their original economy is restored to some measure of health without any loss of time. I am afraid the tribal problem will elude us to remain as an innocent growth on our neck only to erupt one day and catch us all suddenly with fatal consequences.

In my opinion this is exactly where the proposed sector of science and technology in Tribal Development Planning becomes relevant.

In Assam, in about 5000 villages live 25,50,000 (approx) heads of tribals, one sixth of them in the two hill districts. 95 percent of them are agriculturist. Of late, however, the number of agricultural labourers amongst the tribals has increased considerably. In some areas their number is more than 50 percent of total agricultural labourers. In pre-independence days, they were regarded as the main architects of state's rural economy. Now they have been reduced to a non-starter.

At one time Assam's tribals were good sericulturists too. During the Pre-British period it was they who supplied most of the clothes of the poorer section of the Assamese society. Now also 85 to 90 thousand tribal families of both hills and plains are connected with the sericultural activities of the state. But they have so far not been able to give a spectacular fillip to the state's economic progress.

Adept no doubt they are in various traditional persuits like piggery, poultry, brewing, etc, but they have so far not been able to better their economic condition through these pursuits, let alone contributing towards strengthening the economic foundation of the state. They have the potential but not the infrastructure ; they have the experience but not the knowledge of keeping pace with the time.

Recently I had been to a remote hilly village of our state. Shemkhor they call it. It is a Dimasa Kachari village

*Ex-Director of Sericulture, Assam.

said to have been established in the mid sixteenth century by the Kachari King. One has to walk a long seven kilometer patch through deep forests and hills and vales from the nearest road-point to reach it. There many truths startled me, one of them was about their sericulture. Of the 208 households that are there in the village, all of them grow Eri. The womenfolk are generally adept in spinning, also in weaving. But it is really hard to believe that they (i.e. the entire village) cannot sell, if they at all sell, more than 5 pieces of eri fabric annually. With such low speed of production one may call it a pastime or any thing, but not an industry.

So what ails their sericulture is not the want of experience or zeal. It is the want of required material inputs e.g. improved technique, healthy rearing etc. which acts as a deterrent. In respect of this trade the picture is more or less same in all the tribal households. They are everywhere taking to the same age old methods of food plant plantation, worm rearing and spinning. Generally 50% of the seeds do not hatch, because these are not disease-free. Again generally 50% of the larvae die because of either malnutrition or disease, infestation of posts etc. Whatever harvested are spun with age-old distaff which required full 15 days to spin a meagre half a k.g. of silk. Now new techniques are available which can make Eri spinning 15 times more speedier. This will ensure production of quality yarn too. With the help of advanced technology, healthy food plants can be raised keeping land utilisation at the minimum, disease free seeds can be produced, rearing condition can be improved and thus the industry can be made economically viable.

In the case of pig and poultry rearing also, the tribals are pioneer. A family, apart from maintaining, can even prosper solely depending on poultry or pig-rearing. But what do the tribals gain from this. It is generally found that whatever little gain they obtain from either piggery or poultry fails to offset the depredation to their

property caused by these animals. At times owing to ignorance the tribals also suffer from animal-borne diseases. So this sector also needs a fresh look.

In agriculture sector, state's total winter rice lands measure 16 lakhs 62 thousand and odd hectares. Half of this are tilled by the tribals, a good percentage of whom are agricultural labourers. "They (tribals) belong to poorest strata of the society who are having average holding size below 2 hectares" (Sic.) says a state govt. report.

In a recent survey of 11689 land owing tribal households of Morigaon in the district of Nagaon, it was found that 5270 of them own lands less than one hectare each. All these 11689 households taken together own 16080'82 hectares of land including homesteads, bambo-arecanut orchards etc. From these figures one can well imagine what will be per capita farm land for these tribal households.

Regarding the gravity of rural indebtness in that area, the survey reveals that 1348 tribal families have taken loans from private money lenders. Again in the 19 Integrated Tribal Development Project areas of the state the number of indebted tribal families is 36473. The investigator has however cautioned that this figure may not speak the whole truth in as much as "the tribals generally feel shy to mention their indebtedness."

Be that as it may, the fact remains that the Tribals of Assam are emerged deep in debt, although they till half of the total agricultural farm land covered by the main crop.

To save the tribals from this malady, we must inculcate in them modern idea of applying science and technology in agriculture,

The tribals are by and large adept in brewing rice beer ; they also brew from tapioca roots and yams. With a bit of technical improvement I wonder whether this can be made a commercially viable pursuit. Regarding tapioca, it is a raw material for manufacturing quality starch. Given

the technical know how, the tribals will be able to generate a very attractive commercial activity for the state.

Tapioca roots, they use as distress food ; its leaves are used as food for Eri worm in some parts of state along with castor and *Keseru* leaves. Castor plants have another utility. Castor oil can be extracted from its seeds. Of course it can allow the plant to bear seed, in the process it loses its foliage and becomes useless for Eri-rearing. So we may leave castor alone while allowing keseru or tapioca leaves for Eri-rearing so that we may utilise the castor plants purely for production of oil. All this needs an elaborate culture which cannot be done without the help of science.

Now the tribals use leaves of all these three plants for rearing Eri-worms. Most of them use castor leaves, because they consider it best. Castor and tapioca are seasonal plants unlike kesero which is permanent. The last needs small land area while the former two need wider land area. Analysing all these points we may fix a particular food plant which is best suited in Assam's condition and try to utilise the other two for other more fruitfull purpose. They could have fixed it much earlier ; they could not for want of scientific knowledge.

So these are a few of the areas where this new idea of applying science and technology for tribal development will be very much useful.

In the tribal belts and blocks there are altogether 3153 tribal villages, we may first start the work there keeping a particular village under micro plan where final point of reference will be a household. While keeping in mind that development is an integrated exercise, we must first intensify our endevour in those sectors where the tribals have aptitude.

Our scientists and technological experts in general have a penchant for unintelligible tooth breaking jargons. These must be scrupulously avoided and they must be very

plain, easy and straight forward while communicating with the tribals. Also while applying higher technology in these areas one must not cross the limit of economic wisdom. The inputs must not be too expensive, difficult to procure and must not involve complex processes. One must bear in mind that application of sephisticated technology does not itself pay ; what actually pays is its balanced and effective utilisation. It therefore calls for an intensive, and also elaborate training and motivation.

Along side the application of technology in production the planner must evolve a different strategy to aid the small farmers, particularly in the hilly region where the value of per capita daily food intake is about 1200 calories. Such low level of diet and the aloofness of their habitat have worked to create a permanent disincentive to improve their production. So while our planners draw up measures to step up production, they should simultaneously take care of the consumption side also.

Tribals traditionally live near or inside the forests. In recent years modern development has taken a heavy toll of the forest's wealth. At one time most of the tribal areas were considered fertile areas. But now that has become only a myth. Fast disappearing forests, erosion of soil are all affecting the fertility of land and thereby the economic condition of the tribals. In a number of states, the Govts. have enlisted active participation of the tribals living in the forests in various works pertaining to environmental improvement. Necessary technical training for such works has been imperted to them by the Govt. experts. This can be experimented in our state too.

List of references :

(1) Dr. Sarma Thakur's article in Alienation of Tribal Land and Indebtedness compiled and edited by Shri B.N. Bordoloi of the Tribal Research Institute, Assam.

(2) Agricultural Guide Book 1985-86.

(3) Planning for Tribal Development Edited by Ranjit Gupta.

(4) Approach to Tribal Development in the Sixth Plan Ministry of Home Affairs, Govt. of India,

(5) Guidelines for Tribal Sub-Plan, issued by the Planning Commission, 1978-83.

(6) Welfare Measures for the Backward Classes in the Plains Districts of Assam, published by Govt. of Assam.

(7) The News Letter of Oct 1979, Tribal Development Division, Ministry of Home Affairs, Govt. of India.

(8) Dispur, a study in Rural Change in Assam, by P.C. Goswami, Agro-Economic Research Centre for N. E. India.

(9) Area of Tribal Concentration in India, Ministry of Home Affairs, Govt. of India.

(10) Projected Population, Assam, 1971-91, by Directorate of Economics and Statistics, Govt. of Assam.

(11) Scheduled Tribes and Schedule Areas in India, Ministry of Home Affairs, Govt. of India.

(12) A list of villages in the Tribal belts and blocks of Assam collected & published by All Assam Tribal Youth League.

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Areas of new technologies, their potentialities transfer, utility and applicability in the context of tribal development

A. K. Das *

1.1. The tribal population in Assam, which only is relevant in the context of this Seminar, constitute around 11% of the total population of the state, scattered all over the state, in plains & two hill districts. Agriculture is the main source of livelihood of most tribals. However, agriculture in tribal areas is most under developed and backward, in general. Development of agriculture is, therefore, important for improving socio-economic conditions of tribal population. For accelerating the pace of socio-economic development of tribals, the State Govt. has formulated tribal Sub-plan, giving priority to agricultural development. However, the task of agricultural development in tribal areas is so complex and formidable that, it needs imaginative and concerted effort and well designed thrust. Therefore, before we talk of potentialities, utilities of any new technology, we must know the existing practices and probable encountering forces.

1.2. In formulating and planning strategy for tribal areas, their special features must be recognised. In tribal areas, resources are mostly owned by community as a whole and so, decision of use of available local resources is made by the community, and not by individuals. Though reasonably well balanced, the tribal economy is basically a subsistance economy. It spheres over forestry, horti-

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culture, animal husbandry, cultivation of some staple crops etc. The skills in tribals, which are not highly specialised and sophisticated, but being developed over centuries, are suitable to particular environment, in which they live, cover a wide spectrum, such as hunting, weaving, basket making, fruit picking, agriculture, etc, and so, given the traditional skill endowment, the tribals are slow in accepting new skills. Most of the tribals, having egalitarian ethos, with great concern to the community, attach great importance to their traditional values, morals and institutions. This one way is a sociological constraint, because, individual oriented development programme will not be appreciated but is an advantage otherwise, as desired impact can be achieved, if the community could be involved. The tribal areas are handicapped by inadequate modern institutional infrastructure, and even where these exist, because of difference in perception between those who run these, and the tribals ; they are generally not attuned to specific local situations. The basic parameters of planning for national economy, based on labour surplus hypothesis donnot necessarily hold good in tribal areas, the man-land ratio, being lower, than in plains.

1.3. The constraints, which are likely to be faced in introducing new technologies are also required to be known for necessary preparatory arrangements. Agro-climatic conditions and resource potential in tribal areas vary widely. Very little fertile plain lands are in the possession of tribals. Most of them occupy slopy, undulating, rocky or hilly lands, where, only some low value crops can be grown. The level of socio-economic development differ from region to region and sub-regions within the region. On the basis of level of socio-economic development, the tribals can be grouped into four major categories. The primitive tribals, living mostly in isolated inaccessible areas, practising primitive agriculture and other allied activities ; shifting cultivators, engaged in slash and burn method of cultivation ; communities changed to settled agriculture, and accultured

communities living in the vicinity of developed towns. The improvement in the socio-economic status of the first three categories are our main concern. The officials of the forest department are the only outsiders, who come in cantact with the first category of tribals. Hence, developmental programmes for these type of tribals, good in tending trees, animals, should be taken up through specially oriented officials of the forest department. They need to be handled with great care and understanding and are required to be protected from forest contractors and poachers. The shifting cultivators are required to be resettled. As far the third category, absence of commercial outlooks, infrastructure, such as proper irrigation, modern methods, equipments and inputs for improved agricaltural practices have been offering disincentives to increase productivity, illegal land alienation is a big problem in many tribal areas. Owing to extreme poverty, reliance on money-lenders for their cash needs, many tribals mortgage their land to nontribals or, even to some priviledged tribals. These non-tribals or priviledged tribals, being not dependent solely on agriculture, donot invest, to improve productivity, and seek to increase their income by exploiting tribal labourers. Due to absence of developed infrastructure like markets, communication, etc. most of the tribals are deprived of their due price for produce. Easy non-availability of finance for purchase of inputs, compells the tribals to approach money lenders or business men, to get exploited, Financial institutions are needed to modify their procedures to make these simpler and repayment modes easier. If necessary, Govt. should extend support to these financial institutions. Due to poverty and illeteracy, tribal farmers are not in a position to make use of improved technology. Attempts to impose such technology may prove even counter-productive. Therefore, there is need of special adoptive research stations, in tribal areas, which can adapt and develop suitable technology. Indiscriminate deforestation in certain areas has reduced the income of tribals, dwelling

in forest areas, from forest produce. Absence of practice of multiple cropping, compells the tribals to migrate, to avoid starvation.

2.1. Having known the constraints and special features, the strategy to introduce new technologies should be planned differently for different areas and different categories of tribals, at different paces. The area of these new technologies may extend from agriculture to forestry, animal husbandry, poultry, goatery, piggery, weaving and sericulture, handicrafts, pisiculture, horticulture and many others, where they are presently engaged in, or can be engaged with slight motivation.

2.2. As tribals are not able to take risks and are slow to assimilate new skills and attitudes, within a short period, a step by step introduction of modern technology would show better results. Use of non-monetary inputs in tribal areas should be encouraged.

2.3. Adaptive research stations set up, or to be set up, for promotion of suitable technology in tribal areas, should conduct regular field trials on various programmes, such as "lab to land" projects. These should also act as a channel for transmission of feed-back to the state level, and as a field extension agency. Only proven practices should be introduced in the tribal areas, as any failure, will seriously impair the confidence in the community.

2.4. Shifting cultivation may not be possible to be eliminated in near future. Hence, tribals should be persuaded to plant some fruit trees at the time of shifting, which would protect soil erosion, improve water harvesting and increase soil fertility over a period. Since, tribals usually hold fruit trees as sacred, this should not be difficult. The Govt. could also consider forming a Corporation, to undertake cultivation of horticultural crops in such land, who will engage tribals on daily wage basis. After the crops

mature, the land may go back to the tribals and the Corporation may continue its activities to help the tribals in input supply, extension and marketing.

2.5. In tribals regions, area under irrigation is negligible. Improvement of dry farming practices in unirrigated areas, as well as development of suitable varieties would help boosts production. Micro-watershed development should be given priority. Development of irrigation facility would improve cropping intensity and so priority should be accorded to minor irrigation. The community organisations of the tribals should be adapted comprising the benifeciaries of micro-watershed development project or command area of an irrigation pipe outlet, to ensure optimum utilisation. In command areas of surface irrigation projects, many tribals are not able to avail of benifit, because, their lands are not developed and they are not in a position to invest in construction of field channels. So, land shaping and development should form an integral part of irrigation project in tribal areas and this should be taken up by the Govt. For making full use of irrigation facilities, in tribal areas, much more intensive extension support is necessary.

2.6. In marginal and submarginal lands, and areas affected by acute soil erosion, soil fertility is very low. In these areas, fruit, fodder, fuel and medicinal plants should be grown to provide better avenues of income to the tribals. While developing fruit and vegetable cultivation, in tribal areas, a standard commercial variety should be encouraged in each compact area. This will facilitate marketing, avoiding exploitation by traders and ensuring lower transporation cost. Wherever applicable, low cost technology to dehydrate fruits/vegetables should be introduced, so that, farmers can avoid distress sale and get better price for better produce and ecomony in transporation.

2.7. Wherever, paddy cultivation is not preferable over other crops on economy point, Govt. should ensure supply

of ration to the farmers at door step, including their need for making country liquor. This will promote productivity of other crops.

2.8. In some tribal areas, good scope for poultry, piggary, goatery, pisiculture, sericulture etc. are there. Tribals seem to prefer meat animals to milk animals. Development of these allied activities would help improve the socio-economic conditions of the tribals specially in the vicinity of towns with good road connections. The tribals should be offered a 'package deal' i.e. supply of inputs, transport, storage and marketing facilities. Artificial insemination of local breeds, to upgrade the animals should be given priority.

2.9. Women play an important role in the tribal areas and therefore they need to be drawn in a significant way in the training programmes, alongwith men.

2.10 Forests are an important part of tribal life. The tribals get food, fodder, fuel, manure, timber and oils from forest. The forest also is a source for pulp needed in paper industry. Therefore, forest development is very important from tribal, as well as national point of view. Marginal and submarginal barren lands, not suitable for agriculture remmunerative return, can be allotted for tree plantation by the tribals. In some cases, this may mean dereservation of barren forest land and should be allowed.

3.1. To facilitate marketing of farm/forest produce, development of infrastructure, like roads and transportation system is essential. Institutional credit for purchase of bullock cart or cycle rickshaw can reduce this drudgery. Adequate subsidy should be available form the Govt. Banks should also provide credit for vehicles to LAMPs/Co-op. Societies for transportation of farm/forest produce to different markets.

3.2. LAMPS/Co-operative Societies should establish linkage with regional/State/National Apex Organisations for marketing farm/forest produce.

3.3. Value addition to the farm/forest produce in Cottage scale, with appropriate technology will ensure better income to the tribals, e.g. extraction of oil from sal seeds, castor seeds, ginger, ete. etc. These processing industries would not only provide employment to the tribals, but would also utilise the services of women and children, in their traditional habitat.

4.1. Implementation of various developmental programmes in tribal areas would depend on dedicated and efficient cadre of Govt. servant. Liberal allowances and promotional opportunities should be available to attract good Govt. servants. Care should be taken, not to post officers belonging to communities, generally considered as exploiters, by the tribals. For supplementing regular Govt. officers, services of some experienced technical officers, who retired from service, could be availed as Advisers. with attractive honorarium through voluntary organisations, to avoid bureaucratic control.

5.1. The task of tribal development is gigantic and only, Govt. can provide needed resources. However, voluntary organisations can play more effective roles, as they are not subject to rigidities of rules and regulations. The Govt. should therefore encourage and provide necessary help to genuine voluntary organisations. However, assistance from Govt. should be channeled through some non-political commission or agency, for specific projects, subject to periodic independent evaluation. Direct intervention of Govt. should be eschewed.

5.2. Involvement of tribals at grass root level in formulation and implementation of various developmental pro-

grammes would also accelerate the pace of development. These may be through organisations formed at village level. Apart from identifying genuine needs, providing help in formulating strategies, they may have their own extension workers to inculcate modern practices, and to help implementation of small projects like dugwells, supply of inputs etc. Such organisations need to be helped by the Govt.

5.3. Special radio, television, video cassette programmes dealing with problems faced by tribals may be designed and desseminated through community sets.

5.4. Once in a year meet of officials of concerned departments with knowledgeable representatives of tribals and voluntary organisations will yield immense help in developing strategies. Anthropological and socio-psychological aspects need to be of prime considerations in developing strategies.

6.1. While procedures of credit disbursement from financial institutions should be simpler, schemes, which generate additional income in short period should be given priority.

6.2. For meeting increasing demand of tribal areas, LAMPS/Co-op. Societies should have enough resources. Commercial banks may adopt different areas for the purpose of disbursing credit through and to the LAMPS, etc. Till the business of LAMPS begets sufficient margin to meet overhead costs, Govt. subsidy should be available, specially on transportation from remote areas. LAMPS should be made free from direct control of Govt. officials.

7.1. Having introduced different grades of new technologies to different areas, as per needs and having ensured of increase in income of the tribals, areas of other basic needs like welling, water supply, sanitation, health, education need to be tackled. Appropriate technologies may be applied in improving the

conditions of dwellings by use of local resources, but with value additions. Likewise, in water supply, simple devices to filter water for drinking can be thought to be developed by use of appropriate technology. Improvement of sanitary is also possible with appropriate technology at no extra high cost. Technologies for increasing shelf life of fruits, vegetables by use of simple self made devices are also available. As for health family welfare and education, Govt. support to voluntary organisations are required. Improved cooking devices developed on considerations of health, hygiene, reduced fuel consumption, time, etc, also could be propularised.

7.2. For these aspects of socio-economic developments, while Govt. support is essentially needed, role of voluntary organisations is more precious, as expertise in adaptive innovations is essential.

8.1. As such, while there is vast area of applicability of new technologies in tribal development, and have potential ; the applicability differ from area to area, level of development achieved so far, and so, the transfer of these technologies will have to be in steps, as per degree assessed and then utilised.

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Integrated fish farming

M. Sahariya *

Integrated Farming is not new to the Farmers and cultivators though its benefits might not have been utilised to its fullest extent. It is so popular due to the fact that the waste products of one crop or culture can be very fruitfully recycled into costly input for the other crop with minimum expenditure. Moreover when the density of population is increasing year by year, we must utilise every space for as many crops or culture as possible. Integration of fish culture with live stock raising or paddy cultivation holds great promise and potential for augmenting production of animal protein for supplying a balanced diet to the multiple halfstarving rural people and also help in betterment of Rural economy and generation of self employment to the educated youth living in remote villages.

The modern fish culture technologies have immense potential for increasing fish production to three to four times more than its traditional production from the available water resources in the country but the technology pushup the input cost due to intensive use of fertilizers and fish feed. These fertilisers and fish feed are very costly now a days to the tune of about twelve thousand per hectare for which the poor cultivators cannot afford to procure them. This expenditure on inputs viz. fish feed and pond fertilisers which constitute nearly 60% of the total operational cost can be reduced by scientifically recycling the available animal wastes in our villages. The best way to achieve this is to adopt multi-commodity farming system involving fish culture., livestock raising and agriculture. The system maximises the production through recycling of wastes, optimum utilisation of resources and results in lucrative returns to the farmer as fish feed and fertilisers are dispensed with.

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The recent research efforts have resulted in the evolvement of integrated farming system involving fish culture with livestock or paddy cultivation. There are large numbers of house-hold ponds amongst the villagers, and the tribal farmers in particular where this farming systems can be very suitably introduced and maximum production at minimum cost can be obtained,. Care should however be taken in balanced integration of the technologies in Fish Culture and animal husbandry because our concentration in one may act to the detriment of the other.

1. Duck-cum-Fish Culture :

The idea of composite fish culture with six varities of Indian and exotic Carps is to fully utilize the food available in different water columns of a particular pond with their different feeding habits, like surface feeder, bottom feeder etc. By introducing some ducks into the tank, the surface area of the water sheet can be fruitfully utilised. The fish can directly feed upon the undigested food particles in the duck excreta and the digested wastes is very rich nutrients for the plankton growth in the tank which ultimately becomes fish food. The ducks also consume such organisms like tadpoles, Mosquito larvae, dragon fly, nymph, insects, molluses and aquatic weeds and as such, they do not compete with stocked fish for their food items. Besides the dabbling of the ducks in the martinal shallow areas of the pond in search of natural food loosens the pond bottom which helps in releasing the nutrients from the soil which help in increased production of fish.

For getting the full benifit, the duck houses should be constructed on the embankments or hanging over the pond surface in such a way that the wastes and washings of

the duck houses are directly delivered into the ponds. The ducks spill lot of feed while eating which is consumed by fish in this system.

For a water area of one hectare 250 to 300 Ducks are sufficient to fertilise the pond. Fingerlings over 10 cm. size should be stocked as the ducks may prey upon the smaller frys.

Lime @ 500 kgs. per hectare should be applied in the tank about 7 days before stocking fish seeds for increasing the alkalinity of water. No other fertiliser or supplementary food is required for the fish in the pond. Considering a total production of 2000 kgs of Fish 30,000 Nos. of eggs and 300 kgs of duckmeat at the end of the year the annual revenue will be about Rs. 68,000.00 per hectare of water area against a probable expenditure of Rs. 38,000.00 on recurring cost including price of ducklings feed, fish seeds, lime, etc. As such it is expected that a net annual profit of Rs. 68,000.00—38,000.00= Rs. 30,000.00 will be received, by which one can employ himself very comfortably.

Pig-cum-fish Culture :

The pig dung provides best nutrient to the pond as the fish consumes directly some part of it and the other part provides for its luxuriant plantonic growth which ultimately becomes fish food. Forty to forty five piglets may be reared for six months for one hectare of water area. The Pigsties measuring 14′×12′ each for eight piglets should be so constructed with pucca floor and one pucca drain so that the entire washing of the wastes falls into the pond. Care should however be taken to check the acidity of water at frequent intervals as the pigdung increases the acidity of the water very quickly. Whenever the water is found to be acidic, lime to the extent of 300 Kgs per hectare may be applied.

Annual net profit for pig cum fish culture is more than that of duck culture as two crops of piglets can be reared in one year. It has been observed that one piglet grows to

sixty kgs, in six months. After disposing that crop another batch may be purchased.

It is expected to earn an annual profit of Rs. 40,000.00 from one hectare of water area.

Paddy-cum-fish Culture :

Fish can be reared in such paddy fields where water retains for three months to eight months in the year. Paddy fields which are not affected by flood should be selected and one embankment should be constructed all around the field with the excavated earth obtained from cutting a channel inside the embankment of six meter in breadth and 0·60 mtr. in depth depending on the level of the paddy field with provision of inlets and outlets. Deep water variety of paddy like 'Jaladhi or Kati Bao' should be selected for cultivation in such fields. The land should be prepared after applying double the quantity of organic manure and fertilisers and the paddy seedling should be planted. All the six varieties of composite fish culture should be stocked @ 5000 to 10000 per hectare. Air breathing fish like murrels, 'Magur' Singhi, etc. also can be reared and a production of 100 to 150 kgs. of fish per hectare can be obtained which may be harvested along with the paddy. Some quantity can however be retained if a deeper portion is excavated to retain water to about 1.5 metre in the summer season.

In this paddy-cum-fish culture system the fish can eat various insects, larval nymphs which are injurious to the paddy and also moves the mud in such a way that the nutrients are released from the soil which are absorbed by the plants easily through its roots and thus both the crops are benefitted.

No artificial feeding is required for the fish stock. Care should however be taken as not to spray any insecticide in the field.

I hope, these technological adoptations will help the persons who are really at the helm of food production affairs and if the technology cannot help these base level growers, our networks of research works will be meaningless and the food scarcity will remain as it is.

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A sociological model for long term development of the tribal areas of Assam through application of Science and Technology: A case study of the Mishing Tribe

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A. K. Borah**

The technologies in the wider sense are the knowledge for producing various artifacts or tangible things through the application of science. The generation or technologies in the human society is not a new thing. The human races over the centuries together have evolved tools and concepts which helped them to lead their lives in a physically more enjoyeble and durable manner. With the application of scientific knowledge developed through time space continuum more and more technologies are developed day by day and this process is enriching the portfolio of technologies for their transfer to the field with the ultimate aim to march ahead in the ladder of modernization by the human races of the world.

But the main aim of this paper is to chalk out a sociological model for development of the tribal areas of Assam through input of science and technology and to make an enquiry of what type of the new technologies are to be made as input in the tribal society with particular reference to Mishings of Assam without creating disequilibrium in the serendipity of the traditional society. Because every new technology which invloves application of science creates disorganisation in the society. But the science which is ingrained in the technology has a dominant value based on *universalism and communism* (1) overweight the temporary disturbance in the society which is based on irrational values and firmly place its own values based on rationality.

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Before discussing the types of technologies to be made as input in the Mishing society from the sociological point of view we may first consider the following conceptual model while talking about the development of any area in general and a tribal area in particular through the application of science and technology. This model is as follows :

Society	Stages of input of science and technology	
Traditional society	1st Stage	Existence of cultural lag
	2nd Stage	Development of rationalistic ideas for accepting science as a part of culture in a society
	3rd Stage	Input of the simple scientific technologies which may be in the form of upgradation of the existing crude technologies that are in use in the society and their proper adoption and absorpition through exhibition and training
	4th Stage	Development of innovative personality within the social structure with ultimate aim to produce a class of entreprenuers to accept science and technology for faster economic development
Modern society		Open to the input of any advanced science and technology

As it can be seen from the paradigm, this model involves the stages of input of science and technology, so let us discuss the first stage.

In every human society culture plays a prominent role in shaping the society. It is embodied in customs, traditions, thoughts and institutions etc., of the experiences of a social group throughout the ages. But with the development of the science in the western hemisphere towards the middle of the 18th century, the culture based on scientific tradition had taken a different shape and this came to be known as material culture. Science grew exponentially in the west (2) and ultimately it extended its long arm to every sphere of human life and embraced the whole human society of the world. But, in this process, as the time passed by, the science which emerged as material culture could not retain its equilibrium with the non-material culture, customs, values and norms that exist in the society. A lag between the two material and non-material cultures was noticed. Because the exponential nature of science has helped the scientific community of the world to create a pace faster for the material culture than the non-material culture and this lag was coined as cultural lag by william F. Ogburn in 1922.

Now this cultural lag is noticed in the traditional societies may be tribal or peasant societies all over the world more specially in the Third World countries. For example, during World War II some G.I.'s bartered away their alarm clocks to natives in the south Pacific, who wore them around the neck (3). This example clearly shows that how the natives of the south Pacific were lagging behind in their material culture, as because they were not having the idea about time and did not utilize the alarm clocks for timing purpose. It may be an universal phenomenon when we try to make input of advanced/sophisticated science and technology without realising the societal level of acceptance of science in any society.

Coming to the north-east India with its enchanting hilly terrains and plains, a pocket for meeting ground for different peoples with diverse races and cultures, it is felt that the input of science and technologies (advanced) may not immediately be accepted by them, though the cost-

benefit ratio of an advanced technology may be maximum. Now a-days, the tribes in particular are accepting the modern technologies/implements under various economic developmental plans of the governments, specially in the field of agriculture like power tilliers, diesel pumpsets etc. But it is reported that these people in many cases are using the implements for other purposes. For example, the engine which is attached to the pumpset is detached from it and is using it for running huller mill for husking paddy. This happens because as Max Weber points out that in a traditional society people want immediate economic gain and hence our tribes are not exception in this case.

Now from the sociological perspective we want to put that, no doubt, economic gains are accruing from these modern implements, but can we call it a real development from the parlance of science and technology? The answer we feel would be a definite 'No' as because for proper input of science and technology for the developmental purpose, the people should be exposed to the science in a graded way and through innovation of existing rudimentary technologies. Unless the scientific spirit is inculcated there may not be the proper development in a society based on science and technology. A tribal man may use a power tiller or a pumpset in the field, but the question is, how much he had got the capability to do repairs the power tiller with his own hand without transporting it to the big towns or cities for repair. These are the vital points to note while the input is to be made in the form of advanced science and technology for development in a society. The basic point to be noted here is that uptil now specially the tribal or peasant societies of Assam are under the grip of black magic, witchcraft, polytheism, animism, traditional beliefs, values and norms and these are non-material and irrational culture which cannot cope with the material culture i.e., science and technology which we are trying to make as input in the traditional tribal society. So from the foregoing analysis it may be concluded that they are suffering from cultural lag.

Coming to the second stage of the model, let us now discuss how to remove this cultural lag from the tribal societies of Assam and to develop a rationalistic attitude among them to accept science and technology as a part of their culture. In this connection we want to pose a question i.e, do we as sociologists, scientists, technocrats visit the villages, village dormitories of the tribal societies and hold discourses based on science specially in the dormitories, which are considered as the culture bearing centres from the older to the newer generations ? The answer to this question we feel would be a definite No. In reality, without studying the actual field situation and without making any effort to grow rationalistic attitude through holding discourses on science suiting to their ecology for accepting science as a part of their culture, it may be an uphill task for the different planners to make input of science and technology in their societal structure. We feel that the scientists, technocrats alongwith sociologists, anthropologists should visit the tribal villages, stay with them, study their non-material and material cultures (taking note of existing ruduimentary technologies which are in operation in their day to day life with a specific aim to upgrade them at first through applying *little science* (4). and hold discussions with the people in the dormitories based on science. In this process, we feel that gradually a rationalistic attitude would grow in the midst of tribals for accepting science as a part of their culture.

Let us now slip into the third stage which entails the input of simple scientific tecchnologies, sometimes in the form of upgradation of the existing crude technologies that are in use in thc tribal society. In this process, first effort is to be made to identify the existing technologies which are in operation in the society by the scientists, technocrats in actual field situation. Efforts are to be made to upgrade the existing technologies through application of *little science* and then vigorous efforts should be made through exhibition in that village itself from where they

(the sociologists, scientists, technocarts) took note earlier the existing technologies of upgradation for adoption. The people would definitely accept the upgraded existing technologies which do not involve the *big science* (5). as because they are now developing rational attitude and exposed to science through various discourses made by the scientists, technocrats etc. When the people would be motivated to adopt the upgraded technologies efforts are to be made to select a few of them who are creative in nature to train them in the field/village or in the laboratory or institute where upgradation of the technologies are made, so that they would return to the village and help others for proper adoption and absorption of the technologies.

Now let us come to discuss the forth and the last stage of the model i.e. the development of innovative personality within their social structure for subsequent innovation of the upgraded technologies which are now in operation and to produce a set of entreprenuers to accept science and technology for foster development in their society. Here also the social psychologists, scientists, technocrats have a leading role to play. Because, the effort of the selected few who have already got training for headling the upgraded technologies are to judge psychologically whether they themselves are developing innovative idea for subsequent innovation of the existing upgraded technologies. We are hopeful that they would do subsequent innovation because when they were selected first for training, they were selected on the basis of their creativity. Once motivation for innovation is started in a tribal setting, then the entreprenuerial class with innovative capability would emerge. Then we feel that there would be input of any technologies by themselves in a graded way suiting to their societal and ecological conditions and the society as a whole would march ahead in the path of development.

The Mishing Tribe : A case study :

Now let us put this model of development in case of Mishing tribe which is one of the scheduled tribes of Assam.

Before going to examine the feasibility of this model in case of the Mishing tribe, it is necessary to have an idea about their socio-cultural and socio-economic background.

The population of the Mishing tribe is estimated at 259,551 (Census of India-1971). Their place of habitation covers mainly the districts of Lakhimpur, Dibrugarh, Darrang and Sibsagar. Ethnically the Mishings belong to the Tibeto-Burman group. It is worth noting that the Mishings have their close resemblance in their language and various cultural traits to those of the Adi tribe of Arunachal Pradesh. From the stand point of their physical features and socio-cultural system, the Mishing and the Adi can be easily called as one and the same ethno-cultural group.

The Mishings were originally hill tribes. Before their migration to the plains, the Mishings lived in the range of hill called Miri Hills lying in between the Subansiri and Siang districts of the present Arunachal Pradesh. Their folk literatures suggest that they migrated down to the plains of Assam in search of more peaceful and better economic life quite before the advent of the Ahoms in Assam. Thenceforth, the Mishings have been living mostly along the banks of Brahmaputra river and its tributaries for which they are called riverine people. When they lived in the hills, they adopted the shifting cultivation. After their migration to plains they of course adopted the settled cultivation.

Now-a-days the Mishings subsist on agrarian economy. They produce rice, mustard seeds, black pulse and vegetables. Rice is produced mainly for domestic consumption, whereas, mustard seeds and black pulse are used for commercial purposes. Economically, till now leaving a few exceptional cases like the inhabitants of Namoni Barpamua village (6), the Mishings are one of the weakest sections of the Assamese population. They use traditional or age old techniques of production in the field of agriculture like wooden plough, spade, dao, axe etc. The production accruing out of land is generally low. Moreover they are

always exposed to floods and erosions which damage their land, crops and other properties. Barring a few areas these people depending on the subsistence form of agriculture are in the midst of grinding poverty, disguised unemployment etc.

Survey of the existing technologies among the Mishings :

Let us now make a survey what are the existing technologies that are in use in the field of agriculture and other societal spheres. This effort has got two aims in view firstly, to identify the existing technologies and secondly to offer suggestions for upgradation. After that we would also explain the probable application of the sociological model for input of science and technology in case of Mishing society.

The Mishings, as stated earlier, practise settled cultivation. In this cultivation process for tilling and preparation of soil for wet cultivation age lod technology like wooden plough is still used. For storing the grains directly after harvesting from the field they use conventional bins which in popular Assamese parlance is known as *Gusi Dhanor Bharal*. Threshing of paddy in the Mishing society is practically done by men and women with their feet. For storing the grains after threshing they used big container made of bamboo, and for dehusking of paddy the indigenous machine called *Ural* is used. The dehusking of paddy is generally done by women everyday in the morning hours in the Mishing society. Now-a-days, in contain places the rice hullers are used but this cannot be treated as an universal phenomenon.

Apart from the agriculture, where all the above mentioned age old technologies are used in other spheres also the rudimentary technologies are in operation. For example, as a part of their culture, fish is a part of day to day diet of Mishings. However, meat like pork, chicken are also taken. Further, they are habituated in taking

dried fish and meat. For fish and meat drying they use traditional technique i.e. drying under sun, which is an inefficient technique and the dried things are exposed to germs, fungus and which ultimately spoil these from storing.

In the Mishing society weaving is a part of their women life. The women of the Mishings are weaving clothes for their domestic use and they have got a tradition as finest weaver of *Endi Chaddar* and *Mirijim*. In this area the Mishing women are known for their dexterity. Because for preparation of Mirijim they grow cotton, make thread out of them and the small cotton balls to be used in weaving of *Mirijim*. This is an unique practice in their society and which is quite conspicuous by its absence in other tribals societies of Assam.

Suggesttons for the improvement of the existing technologies among the Mishings.

Let us now explore the possibilities for the existing technologies that are in use in the Mishing society.

In the field of agriculture for tilling the land the Mishings are using the wooden plough. This is a traditional technique which is not very much efficient for tilling the land. At the same time we may be having other efficient machineries lile power tillers etc. for efficient tilling of the land without employment of draught animals. But the questions is that, considering the levelling and quality of the soil-frequently ravaged by flood-barring a few area in all the places where the Mishings are living the power tillers may not be viable for efficient utilization for agricultural purposes. So necessary upgradation can be made in the ploughing system by discarding wooden plough and replace it with iron plough not following the univer-sal desing. The Department of Agriculture, Govt. of Assam, already developed a model of iron plough to be used in tilling the land. But the response to it are not encouraging and we feel that they are suffering from cultural lag.

For storing of the grains the upgradation of technologies may be made. Firstly, instead of putting the paddy with stalks in the bins, threshing can be done first and the same may be stored in the cheap ferrocement bins, the models of which have recently been developed by RRL. Jorhat. These bins are economical, less spacious and protects the grains from rodents, insects, etc. For threshing of paddy, mechanical paddle operated thresher marketed by the Agro-Industries Development Corpn. Govt. of Assam may be popularized among them.

The *Ural* is used by the Mishing women for dehusking the paddy, an indigenous machine which reguires lot of physical force, Necessary efforts may be made to input the technology which may evolve a portable hammer (iron or heavy wood) which is mechanical and hand operated to replace the conventional wooden bar of the *Ural* and save the women from their dreadful drudgery. In this area, Central Mechanical Engineering Research Institute. Durgapur a constituent establishment of Council of Scientific and Industrial Research, may be requested to study the actual field situation and develop it. The same mechanical hammer we feel with little modification may be used in ironmonger's work for making dao, sickles, hoe and other husehold and agricultural implements in the Mishing society.

Fish or meat drying is a part of the Mishing society. For hygienically and prompt drying of fish or meat non-conventional solar energy may be utilized considering the availability of the sun hours in a year in actual field situation. This is an area which we feel can fairly be handled by the National Physical Laboratory, New Delhi and the National Environmental Engineering Research Institute, Nagpur, both are the constituent establishments of the Council of Scientific and Industrial Research as because advanced researches are going on in the field of solar energy in both the laboratories. Further the Institute of Advance Studies in Science and Technologies of the

Assam Science Society may be approached for development of solar drier.

For weaving Endi Chaddar and Mirijim already certain improved weaving techniques are in operation in the peasant societies of Assam and these may be popularized among the Mishing women and if necessary for special technique like making of balls for weaving Mirijim, the Weaving Department, Govt. of Assam, may be approached which may in turn contact appropriate institute for developing easier time saving technique for making the balls.

Lastly, for washing cloth etc. and to relieve women of the Mishing society, paddle operated portable washing machine can be used which may very well replace the conventional time consuming method of washing clothes. For this Regional Research Laboratory, Jorhat, may be requested to develop the technology.

These are the few areas where the existing technologies may be upgraded by utilizing easily understandable mechanical process by layman and popularize among the Mishings, motivate them with ultimate aim to create a base for making input of graded science and technology and the development of entrepreneurial capability.

Application of the sociological model for input of science and technology in the Mishing Society :

Now let us discuss how to motivate the Mishing tribe to accept science and technology as a part of their culture and thereby removing the cultural lag that exist among them and development of rationalistic attitude to accept science and technology in the societal sphere of Mishings with ultimate aim to develop the entrepreneurial capabilities within their society. This entails the following stages, considering the sociological model of input of science and technology discussed earlier.

1. Development of rationalistic attitude among the Mishings to accept science and remove the cultural lag.

2. Motivation of people to accept the upgradation of the existing technologies using *little science* and less mechanical device through maximum exhibition for adoption and absorbtion.
3. Judging the motivation of people from social-psychological standpoint pick up for training certain selected elite people which are prone to innovative ideas.
4. Development of innovative personality within their social structure using these selected people as catalytic agents.
5. Development of entrepreneurial capability.

To remove the cultural lag from the midst of the Mishings and to develop rationalistic attitude for acceptance of science as their part of culture, socialization process should be initiated. There should be the concerted efforts of sociologists, scientists, technocrats and other social scientists to look first their existing cultures at close quarters. This can be possible through visits by them even sometimes in disguised from to the different Mishing villages and to hold scientific discourses and identify the possible areas for making input of science and technologies. The Mishings have their own social organizations like *Bane Kabang* at national level, *Mimbiryamme* (Youth Organization) and similar other organization at village level. These organizations may be contacted and the discourses based on elementary science and technology can be held with the members of these organizations by the scientists, technocrats, sociologists, etc. This effort, we feel, would definitely help to develop retionalistic attitude in the midst of some people of the Mishing society in the first hand for accepting science as a part of their culture.

Secondly, the scientists, technocrats and others should identify areas as suggested in the suggestion para for the improvement of the existing technologies and motivate people through the above mentioned village organizations. It is worthwhile to mention that in the midst of Mishing society if the youth organization like *Mimbiryamme* accepts a new thing, nobody in a village would oppose it, rather the people would readily accept it. Because the traditional

authorities are vested in this kind of organization and they are doing all kinds of activities for the development and welfare of the village. Like *Mimbriyamme*, other social organizations like *Dolung Kebang* could also play a leading role in motivating people to accept the upgradations of technologies in their society. With the help of these organizations exhibition of the upgraded technologies should also be made in every Mishing village for acceptance.

Thirdly, when the people would accept the upgraded technologies, it is now the task of the social psychologists to judge carefully some persons who are really adopting and absorbing the upgraded technologies. It is certain that very few would definitely adopt and absorb the technologies. Now these people should be selected for further training in order to propagate the ideas in the midst of the other peoples of the Mishing society. The leaders of *Bane Kebang* or *Mimbiryamme* may be judged and taken for training. Because these leaders are somewhat elites in the Mishing society and would play subsequently important role in motivating the villagers towards accepting new technologies based on science.

Fourthly, after getting training, the few elites may emerge themselves as the group of entrepreneurs as they have already adopted and absorbed the upgraded technologies and after the training they are capable to do subsequent innovation of the existing technologies. They may also act as catalytic agent for others to develop innovativeness.

Lastly, when the people with entrepreneurial capability would emerge in the midst of Mishing society through the above mentioned processes than there is no need to request them (the entrepreneurs) for acceptance of science and technology as a path of development. The entrepreneurs would contact different organizations and accept the technologies suiting to their ecology and social structure. In this way the induction of science and technology would definitely help the Mishing society for rapid economic development.

To conclude, we feel that application of science and technology in a tribal setting should be graded in nature for proper

adoption and absorbtion. This graded input of science and technology would definitely develop a class of entrepreneurs which is most important to put the society in the path of development.

NOTES.

(1) R. K. Merton, *Social Theory and Social Structure.* Free Press, 1959, p. 553

(2) D. J. Price, "Exponential Curve of Science" in *Sociology of Science*, Bernard and Walter Hirsch (ed) : New York, The Free Press, 1963. p. 517.

(3) Harry M. Johnson, *Sociology* : New Delhi, Allied Publishers Pvt. Ltd., 1983, Eighth Indian Reprint, p. 89

(4) This is a concept evolved by D. J. Price in his article entitled Little Science and Big Science which is included in *Sociology of Science*, Bernard Barber and Walter Hirsch (ed) ; New York, The Free Press 1963.

(5) *Ibid*

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Some thoughts on the Application of Science and Technology for Tribal Development

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The application of science and technology in the tribal areas could be considered as a case of application of Science and technology in an un-developed area for upliftment of economic conditions with due consideration for the traditions and practices of that particular tribe residing there.

Statistics shows that more than 90% of the tribal population are dependent on agriculture that is the economic structure of the tribal population is dependent on agriculture. Now considering the vast areas under cultivation and the amount of hard labour put in, it was found that the productivity is very very less and thus the economic structure of tribal population could not be improved. This is basically due to the traditional methods of agricultural practices. Thus application of new scientific methods of agriculture such as application of fertilizer and pesticides and use of irrigation facilities could help in increasing productivity.

But, the disadvantage of agriculture based economy is that the agricultural season is itself not perennial but seasonal and so the economy will also fluctuate a lot when assessed for the whole year. Also this will lead to the consequence that for a considerable long period of the year (when cultivation activities are over) most of the farm labourers are left without work. To solve this problem certain agro-based industries which are itself seasonal in operation, like a sugar factory, Jute mill, etc., or some other small scale industries could be established in these belts, making use of the locally available products. Thus it can be said that agricultural tribal labourers who are so to say underemployed would have opportunities for the year round work if some industries are established based on the locally available raw materials in that particular tribal area. This will also help in reversing the migration of labourer to towns and large industrial cities and create condition for development of these areas. Again many tribals who are under the poverty line would be brought above the level by the creation of employment opportunities near sheir homes.

But the basic necessity for setting up of any industry for either a small scale Khandsari Sugar mill or a large Petrochemical Unit is power. Even for the implementation of improved methods of agriculture, energy is necessary. The availability of energy is very important for socio-economic growth of an area. In some areas of the North Eastern Region, particularly in the tribal villages, the cost of transmission of electricity is sufficiently high due to the rough terrain, forest area and the absence of good roads.

In the tribal areas energy is needed for the following purposes :

a) Domestic purpose—Cooking, lighting, water supply & heating (for cold areas).
b) Agriculture—Modern agriculture is energy intensive. Apart from use of more fertilizers and chemicals, all agricultural operations require energy in one form or the other. Energy is also required for post harvest processing, transport & storage.
c) Social Services—Street lighting, community lighting, even for hospitals.
d) Small Scale industries.

The energy demand of most of the rural and tribal areas is generally met by non-conventional sources like

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fire-wood, charcoal and cowdung, collected by their own individul efforts. But it is seen that unabated cutting down of trees for fire-wood not only leads to deforestation resulting in soil erosion, loss of fertility of soil, long-term damage of ecology, and environment but also to the extinction of the rare-species of medicinal and other valuable plants which are grown on those areas. As transmission of electrical power to the remote tribal areas has been found to be uneconomical, so stress should be laid on the use of alternate energy sources like solar, wind, geothermal, and biogas, whichever is found suitable in that region. Although the initial cost may be high but if small units are set up to meet the local demand, it would be a good attempt towards development.

One of the basic necessities of life is drinking water and this is one of the things not easily available in most of the tribal villages and if it is at all available is not in a purified from to be used for drinking purpose.

Water is generally available from flowing streams or rivulets and has to be carried far long distance. Moreover, water collected form streams or rivulets are not suitable for drinking directly. So if small and simple water treatment plants are set up near the villages and water from streams are pumped directly to these, and then distributed to the houses, problem of drinking water could be overcome.

But the most important thing is that every tribal area has its own social environment and individual needs and so a common technology could not be used for all tribal areas as whole. For techno-economic development, to suit the local-needs and utilize local raw materials 'Appropriate Technology' could prove useful. In India research work in this feld is done by the 'Appropriate Technology Development Association' suited In Lucknow. This assocation has developed many appropriate technologies for traditional village industries like handloom weaving, blacksmithy, carpentry, extraction of edible and non-edible oils, ceramics, tanning and shoe-making, cereal processing and jaggery manufacturing.

In the field of power generation the ATDA has developed the village power pool which consists of solar appliances, windmills, mini-hydel and biogas system for energy generation. So attempts should be made to make use of the specific appropriate technology which suits the local tribal coditions. If this is done, economic condition of the tribal population will improve.

The only need today is to match the needs and conditions to the modified technologies available and to make the best of the combinations. This could be the actual key to a prosperous and developed tribal area.

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Women and Technological change in Tribal societies

Alokananda Nath*

In all societies all over the world at all times there was some sort of division of labour between the sexes. In this division of lobour the physical and mental capacities of the sexes are always taken into correlation. A woman is not always capable of doing hard manual labour but she is fit for small monotonous jobs. That is why in primitive and preliterate societies the drudgery of household work always fell upon the woman, while she never allowed to face the hazards involved in works outside the home. Division of labour between the sexes has its implication in technology also. Technology involved in hard hazardous tasks was the domain of men, while technology involved in small monotonous jobs was the domain of women. In primitive societies hunting was the domain of the males so also hunting implements. But it is worth nothing that more primitive a society is more equitable is the division of labour between the sexes and so in such societies the division of the domains of the males and females in the sphere of technology is also less prominent. In horticulture very few rudimentry implements are used, and as most of the work is done jointly by both the sexes, the implements like the hoe, digging stick, scraper are used commonly by both the sexes. In such societies where pottery and weaving exist these are considered to be exclusive domains of the women.

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The division of labour between the sexes determines the bifurcation in the field of technology but the converse is also true. Adoption of a different technology may change the nature of division of labour between the sexes. Majumdar (1980) has very aptly shown how adoption of plough cultivation by some Garos in Western Garo Hills has changed the sexual division of labour between the sexes. Formerly when they practised shifting cultivation almost all the work in the field used to be shelved equally by the males and the females. But after adoption of the plough to till in permanent plots most of the work in the field have come to be assigned to males and women have been left to work at the home only cooking, fetching firewood and water and looking after domestic work.

All over north east India in the tribal societies the transformation from shifting cultivation to permanent cultivation is taking place and with it the role of women is rapidly changing. But it is not to be survival that women have been pushed back to the domestic sphere in the modern world of the tribal North East. The factors affecting the life of the tribal women in the modern times is development of women's education, urbanization and industrialization. Education and urbanization have come hand in hand. And education has facilitated the women to engage themselves in white collar occupations mainly in the urban areas which have recently developed in the heart of the territory. In most of the other parts of India urbanization and industrialization go hand in hand because advance technology of the modern world induces growth of industrial centres in urban areas or conversely development of major industries even erstwhile rural areas causes growth of township around the industrial areas. But in north east India urban centres have grown as administrative centres and as centres of communication. All the north eastern states are industrially backward. This is proved by the fact that as per N.E.C. statistics for 1974-75 out of a total of 512 major industries in north east India 466 (91·10%)

are located in Assam while the rest of 08.99% are showed in the states of Manipur, Meghalaya and Tripura. Even of the small scale industries 62.09% are located in Assam and the states Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura being 00·41%. 18.27%, 06·21%, 02·29%, 01·43% respectively (source : All India Report on census of Small Industries, Vol-I 1976). Moreover, in the Ministry of Industry's Guidelines for Industries 1978-79 (Part I, Policy and Procedure) the whole of the states of Arunachal Pradesh, Manipur, Meghalaya, Mizoram and Tripura have been considered as industrially backward states. This state of affairs shows that these states, the majority population of which belong to scheduled tribal communities, one still to receive the real impact of utilization of modern technology for industrial purpose. From the table in Annexure I we find how small is the percentage of population engaged in all the states of North East India. We also find from this table that even in the urban areas (except in Assam and Manipur), the percentage of people working in industries is very small. It is also interesting to note that the percentage of females working in industries is highest in Manipur. This is because of the fact that in Manipur, weaving, though partially mechanized still remains the domain of women.

Among the tribes the only industry which is gradually getting the touch of modern technology is the weaving industry, which traditionally was the exclusive domain of the females. The seminar on handloom industries in Assam suggested the development of this industry at three levels. "While evolving a strategy for handloom development there should be a three pronged approach towards conventional household industry, commercial handloom and highly modernized weaving complex. So it can be suggested that the new strategy for Assam's programme of development of handloom industry was to be formulated keeping this background in view. In this context of our socio-economic pattern, we

will have to continue to patronise the non-commercial self-feeding sector. The promotional activities amongst them shall have to be continued" (Das 1985). Das (1985) even advocates for stilt more emphasis in this industry. "The income and employment content of the investment programme in our rural areas can be substantially stepped up through the development of handloom weaving in perference to many other capital intensive schemes. If industry is to be resource based, the handloom should be the biggest industry of this region".

However, more mechanization of this industry will certainly throw off the women from this occupation. The only way modern technology has affected the lives of tribal women of north-east India is its adoption in the homes in the urban areas. Nowadays tribal women do not have to go to fetch water from streams far away from the home, they do not have to go to jungles to collect firewood, they do not husk paddy as they buy mill made rice from the shops, weaving has also disappeared because of the easy availability of man produced clothes even of their traditional designes. Because of their emancipation from this drudgery of domestic work many tribal women in the towns are now engaged in white collar occupations side by side with males to earn bread for the family. This is the result of adoption of modern technology. But this process of lightening the burden of household work can proceed to a certain limit only and ultimately such work will have to be performed by women. Vasudev (1978) rightly states : "In Europe it is only an infinitestimal percentage of families who can afford a servant and in spite of occasional offers of help from the men and the saving grace of modern mechanical gadgets, the burden of the same old odious tasks of washing dishes and nappies and croning and cooking continuous to rest on the women. Even in America creches are not so widespread as to enable the average wife to escape acting the baby sitter for most of the time".

As has been shown above in the states of north east India dominantly inhabited by tribes industries have not developed alarmingly. But we should not think that when in these states industrialization sufficiently develops women will be emancipated. Omvedt (1978) has rightly pointed out that industrialization will not automatically save the women from household duties and give them equal opportunity of careers. Rather, such industrial growth may bring down the tribal women from the pedestal of the equality as Mandelbaum (1972) stated about the women in the industrial areas of Africa : "The parts of Africa women's position may have declined because the new colonial economic roles mines, factories, education oriented to clerical position-opened up primarily for men, overiding traditional economic roles of market women".

Reference

1. Majumdar, D.N. (1980) : A study of culture change in Two Garo villages of Meghalaya. Guwahati University.
2. Vasudeva Uma (1978) : 'Women' in change and conflict in India Edited by Ramesh Thapar, Macmillan India.
3. Omvedt, Gail (1978) : 'Caste, class and women's liberation' in challenges of societies in Transition. Edited by Monoropma Barnabas, S.K. Hulbel, and P. S. Jacob. Macmillan and Company India.
4. Mandelbaum,David(1972): Society in India. Barkeley : University of California Press.
5. Alam. K. : Planning in North East India.

Appendix

Percentage of total population as workers and workers in Industries, etc. (1981).

	Workers			Workers in Industries. etc.		
	P	M	F	P	M	F
Arunachal Pradesh.						
Total	49·19	56·63	40·64	00·20	00·29	00·10
Rural	49·83	56·49	42·32	00·16	00·22	00·10
Urban	39·76	58·41	10·83	00·75	01·09	00 21
Assam.*						
Total	28.35	48.88	05.45	04.01	01.80	00.30
Rural	28·10	48.70	05.60	00.76	01.20	00.30
Urban	38.40	50.20	04.00	04.92	07.20	00.60
Manipur.						
Total	41.68	46.69	36.52	04.54	01.52	07.65
Rural	44.65	48.49	40.74	04.37	01.21	07.62
Urban	33.36	41.69	24.76	05.00	02.37	07.73
Meghalaya.						
Total	44.20	53.02	34·97	00.48	00.48	00.48
Rural	46.90	54.56	39.07	00.47	00.44	00.50
Urban	31.94	46.65	15.84	00.52	00.65	00.38
Mizoram.						
Total	41.21	49.13	32.73	00.52	00.56	00.50
Rural	44.10	51.39	36.42	00.32	00.45	00.19
Urban	32.60	42.62	21.41	01.14	00.88	01.44
Nagaland.						
Total	45.79	50.00	40.83	00.66	00.75	00.5›
Rural	48.02	60.66	45.11	00,25	00.39	00.20
Urban	33.68	47.37	13.43	02.35	02.46	02.19
Tripura.						
Total	29.61	49.06	09.08	00.48	00.70	00.25
Rural	29.97	49.63	09.19	04.48	00.69	00.26
Urban	26.66	44 38	08.21	00.49	00.79	00.19

Source : Basic Statistics for North East India, North Eastern Council, 1981.

* 1971 figures have been given.

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Barriers in Popularising Crossbred Dairy Farming in a Tribal Block

H. N. Kakoty*

The success of dairy development programmes for increasing milk production obviously lies in the large scale adoption of recommended dairy innovations created in the laboratories by the scientists. It is fortuntate enough, that at present, a number of dairy innovations are available for adoption by the farmers. However, now, there is an obvious gap between the recommendations of the scientists and the prevailing practices of the cattle owners. In other words the pace of transferring technology is not at par with the development of new technology.

No doubt, the situation appears to be happy in the minds of the scientists and extension workers who are, on their part, very enthusiastic with a number of ideas for recommendation. But somehow many of these recommendations are yet, to get wide scale adoption. The slow spread of a large number of available recommendations can either mean some defect attached to the technology it-self, inefficiency of the extension agency or some constraints due to supplies and services or apathy of adopters. In this context a study was conducted with the following objectives (i) To study the extent of adoption of improved dairy production innovations by the small dairy farmers. (ii) To study the reasons for non-adoption barriers of improved dairy farming practices.

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Research Methodology :

The study was conducted in the Dimoria Tribal Development Block, Assam. One village from each of the ten village level workers circles of the Block was randomly selected. Fifteen small dairy farmers were randomly selected from each of the selected village. Thus the total sample comprised of one hundred and fifty respondents. The data were collected with the help of a specially designed schedule by personally interviewing the respondents.

Findings and Discussions :

The result of the analysis of work in table-1 shows that 62·00 and 60·00 per cent of the small dairy farmers were low adopters of improved feeding and Management practices respectively. But about 53.00 and 34·00 per cent of small dairy farmers were high adopters of improved disease control and breeding practices respectively. When the individual score of all the farm practices were taken together, it was observed that 37.33, 33.33 and 29.34 per cent respondents were medium low and high adopters of improved dairy farming practices respectively. Hence, this finding suggests that there is an urgent need to assist the small dairy farmers for adoption of improved feedings and management practices. Similarly, the small dairy farmers should be encouraged to raise the level of adoption from medium to higher level.

TABLE -1

Distribution of respondents according to level of adoption.

Area of Adoption	Level	Range	Number	Percentage
Breeding	Low	0-41	41	31·33
	Medium	41.1-72	52	34·66
	High	Above 72	51	34·00
Feeding	Low	0-18	93	62·50
	Medium	81.1-42	37	24·65
	High	Above 42	20	13·33

Management	Low	0-15	90	60·00
	Medium	15.1-40	14	9·33
	High	Above 40	46	30·66
Disease control	Low	0-70	16	10·66
	Medium	70.1-87	55	36·67
	High	Above 87	79	52·67
Over all	Low	0-37	50	33·33
	Medium	37.1-59	56	37·33
	High	Above 59	44	29·34

TABLE-II

Barriers for Adoption of improved Dairy Farming Practices.

Area of Barriers	Name of Barriers	Mean Score	SD	Rank
Breeding	1. Location of A.I, Centre if far away.	1.16	0.43	V
	2. No demand for C.B. male calves.	2.72	0.33	II
	3. Crossbred calves are not disease resistant and are more susceptible to diseases.	1.98	0.36	III
	4. Low conception rate in case of A.I.	2.86	0.35	I
	5. C.B. animals are not fit for draught purposes	1.75	0.79	IV
Feeding	1. Irregular supply of concentrates.	2.21	0.63	V
	2. Concentrate feeding is expensive.	2.91	0.29	I
	3. Improved seeds for Fodder cultivation are not readily available.	2.89	0.33	II
	4. Irrigation facilities are not available.	2.47	0.71	III
	5. Non-availability of surplus highland for fodder cultivation	2.35	0.52	IV
Manage-ment	1. Facilities for examination of faeces are not available and location of dispensaries are far away.	2.77	0.43	I
	2. Anthelmintics and disinfectants are not readily available in dispensaries and hospital.	2.17	0.68	II
	3. Infected calves with their pot bellies look ugly.	1.71	0.55	IV
	4. Difficult to maintain personal hygiene and separate milking shed is not available.	1.15	0.42	V
	5. Anthelmintics and disinfectant are not readily avilable in the markets.	2·04	0·38	II
Disease control	1. Cost of midicine is high.	2·8	0·4	
	2. Increases mortality if the sick animals are treated at late	1·59	0·55	IV
	3. Decreases milk yield after vaccination.	1·49	0·59	V
	4. Essential medicines are not available in the dispensaries, hospitals and in the stockman centres.	2·77	0·45	II
	5. Location of market is			

It is worthile to mention that above listed technological barriers may be reduced both in number and intensity with the appearance of technology that has already been perfected or the other barriers like social, situational and adiministrative can be removed if concerted efforts are made by the concerned developmental agencies.

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Application of Science and Technology for Tribal Development

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Standing close to the end to the 20th century, we find that science and technology is no longer a mere subject study. It is an economic force, and a vehicle of socio-cultural transformation. It influences every part of human life.

Since the beginning of industrialization, efficiency and productivity in all fields of human endeavours have gone up considerably, primarily due to spectacular developments in and application of science and technology. Phenomenal discoveries made in this field have contributed to miraculous achievements in most areas of economic and social endeavour.

But unfortunately bulk of the fruits of these developments and achievements has not so far reached the majority of the poor. Developments have, therefore, become lop-sided. The two sectors Urban and Rural are not developing simultaneously.

In this paper, we are concerned with the development of the rural sector. Since the tribal population lives mostly in the villages, they have not been able to derive the benefits of the scientific and technological development. So, basically the tribal development is linked with rural reconstruction. The instruments of production and activities in this tribal

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rural sector are crude and near primitive as inputs given by science and technology as well as organization and management are not available to them.

India has vast natural resources, talented people, and reasonable infrastructure all of which ought to have facilitated extension of the benefits of modern science and technology to nearly more than 80% of her population living in rural areas. But this has not taken place to the required extent and whatever little progress is there it is so slow that sometimes it is felt, as if, there is no progress at all inspite of the fact, that India has highly developed sophisticated sectors comparable to advanced countries, third Largest scientific and technical manpower with prestigious research and development institutions. In India the conventional scientific and technological study has been serving only the 'urban industrial sector'. On the contrary, India's economy is mainly based on agricultural production. It has been found that U.S.A. is able to produce 400 million tons of food-grains with only 5% of the population engaged in this sector while in India with a much larger population engaged is producing only 135 million tons. The difference is agonising and painful indeed. In the last three decades the irrigation potential has increased from 53 million tons in 1950-51 to 133 million tons in 1981-82 ; irrigated area increased from 26.6 million hectares to 65.4 million hectares during the same period. Industrial production has gone up 5.5 times ; the power generation 10 times ; steel output 7 times and paper production 9 times. But we are still the poorest country in the world occupying the 123rd position out of 125. Poverty therefore remains the most pressing problem and perhaps the source of many of our evils in India.

Application of science and technology for tribal development has therefore become an imparative necessity. In fact, a dispassionate analysis of the existing condition of the rural tribal people of India will at once reveal the fact that they have become victims of the disinterestedness shown by

the planners, the politicians, administrators and technologists. It has also been found that even the trade—unionists are showing no interest in this sector rather their interests are concentrated mostly in the urban organised sector. This is indeed most unfortunate as this rural sector which does not have any vocal advocates is thus denied of the kind of technology and technological man-power needed for its development. The poor tribal people belonging to the rural sector continue to remain helpless and vulnerable and thus get exploited right, left and centre.

The vast majority of tribal people need food, shelter and clothing. Obviously, the conventional method of food production will not meet the demand and thus calls for new technology in the field of agricultural production sufficiently aided by sound organisation and management. The conventional house-building technology also needs revamping to suit the requirement of these people keeping in view the availability of raw-materials and also the weather conditions and other environmental factors. Improvement of sanitation is also very important in improving the standard of living. This will require sewerage treatment and its disposal. This will require training the tribal people. Unfortunately to-day whenever we think of technological development we find some conventional institutes are established for training people in trades like fitting, welding, carpentry etc. This is perhaps because we do not have any technological institutes working in the field of agricultural science and engineering or in the environmental science. We, therefore, need to mordernise, improve and diversify traditional crafts, make the tribal people learn the importance of organization and management and apply the same while utilising the new technology for required developments in various fields. We have to see to it that engineering institutions in the country prepare manpower not only for the organized sector but also for the tribal rural non-organized sector. In spite of nearly 40 years of evolution, we have still remained unsuccessful in

giving technical and scientific education an indigenous character.

If the Boeing aircraft is important for India, the bullock cart is also important. What we need to do is to invole ourselves in both. We have technical know-how, let us therefore use it and use it for the purpose of pulling the tribal people out of sub-human conditions they are in.

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Entrepreneurship Development in Tribal Societies - problems and prospects

A. K. Neog*

Emergence of a class of dynamic entrepreneurs is a 'sine-qua-non' to launch successful industrialisation in a developing society. Lack of entrepreneurs is often cited as one of the causes of economic backwardness. In a backward area, the planners face this problem. The problem is further aggravated if the society is a tribal one, where a class of dynamic entrepreneurs is almost non-existent due to influence of status, prestige and authority. Social milieu is not congenial to entrepreneurship.

In a tribal society characterised by limited literacy and where there is official job reservation, open unemployment may not be so critical. As a result, there is less attraction for 'private' industrialisation. On the other hand, socio-political reasons may not allow launching of industrialisation through a class of 'borrowed entrepreneurs'. Under such circumstances, government or para-statal organisation can itself act as model entrepreneur, side by side encouraging entrepreneurs from tribal communities to develop. The problem is very difficult as entrepreneurs have to be identified, coaxed, motivated, trained, escorted and nurtured till they reach 'take-off' stage and run on their own.

Tribal societies or areas, however, also offer some potential advantages for industrialisation. In view of the protection enjoyed by such societies or areas, competition is less here than elsewhere. Further, some incentive facilities

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are ear-marked exclusively for such societies. Hence the probability of success in such area is likely to be more.

It would be wrong to accept a hypothesis that tribal societies entirely lack entrepreneurship. Some such societies in Assam have shown good deal of entrepreneurship e.g. in Sericulture, Weaving Handloom/loin loom, Handicrafts, Hunting, etc., though their level of technology is very poor. The poor level of technology is also associated with their poor level of earnings. Hence, part of the solution to the problem of under development also lies on improvement of technology. The improved technology should be such that it not only increases 'value added' but also employment. Further, it should benifit both hill and plain areas, rural and urban societies. Citronella cultivation and its extraction, for instance, is one such thing which has got the above properties. In tribal area industrialisation one important thing to be noted is that by and large, a tribal economy is a 'subsistence economy'. As such, it cannot offer a viable market for industrial products. The market for its product therefore would have to be the plain and urban areas barring 'footloose' items.

It may be worthwhile to look at the characteristics of a tribal economy that may have pull and push effects on entrepreneurship development. To a great extent, tribal areas menifest the characteristics found in rural areas and something more. The characteristics are subsistence farming (including jhuming), primitive technology, illiteracy, poverty, sharing with others the individual profit making as a value, barter system, poor infrastructure and inertia, over-exploitation of natural resources, seasonal migration (in the hills), lacking in motivation, etc. These characteristics are nothing but problems in disguise, which need to be acquainted with, by any development organisation.

In fact, the more a society manifests the characteristics of a subsistence economy, the more difficult it is for entrepreneurs to succeed. The only entrepreneurial class who can

succeed in such an environ is the traders or trader-cum-lenders who generally hail from outside that society.

In a tribal society, almost all their economic activities centre around land, primary sector dominating the scene. For industrialising such societies along private entrepreneurship line land ownership, pattern of distribution and its produce play a vital role. For, land also acts as a 'surrogate' for capital in so far as it can be mortagazed/hypotheticated against financial loan. In this context, it may not look queer to examine the number and area of operational holdings among the Scheduled Tribes. Table I below presents the data for Assam available from Agricultural census 1980-81.

TABLE-I

Sizewise distribution of number of area of total operational holding belonging to scheduled tribes of Assam in 1980-81.

Size Class (Hectare)	No. of holdings ('000 Nos)	(%)	Area of holdings ('000 hect)	(%)
Below 0·5	66.69	23.07	19.35	4.48
0.5—1.0	67.29	23.28	50.93	11.79
1 — 2	84.83	29.34	120.71	27.93
2 — 3	37.57	13.00	90.44	20.93
3 — 4	15.82	5.47	54.00	12.50
4 — 5	8.24	2.85	36.09	8.35
5 —7.5	6.67	2.31	38.97	9.02
7.5—10.0	1.40	0.48	11.96	2.77
10 and above.	0.56	0.20	9.67	2.23
All sizes	289.07	100.00	32.12	100.00

N.B. Figures are rounded.
Source : Directorate of Economics and Statistics. Assam.

The table shows that about 76 per cent of the holdings operating on 44% of the area are below 2 hectares, which are supposed to be non-vaiable. Only 0·2 per cent operating on 2.23 per cent of the area belonging to large farm size of ten hectare and above. The pattern of distribution is also

less uneven, since the Gini concentration nation for holdings belonging to Scheduled Tribes is 0·44 compared to 0·56 for all. It is obvious that entrepreneurs would have to come mainly from the 'Medium farm' households in tribal societies. However, the problem remains of motivation of people from agriculture to risky self-employment in industries. Further, there is also the problem of ownership particulars of land to place it as mortgaze against bank loan. The question now emerges, how to overcome the problems. Few measures in a nutshell are suggested below :

(1) Industrial villages :

Big villages or a cluster of villages having traditional skill and artisans can be reorganised as industrial villages. They should be equipped with social infrastructure like. housing, schools, post and telecommunication, hospital, dairy, banks, market, police station, etc,. These villages should be well connected with urban markets as in the western countries. They should inculcate industrial culture and demonstrate to the rest. KVI has immense potentiality in this respect, Even some electronic activity like TV/Radio assembling can be taken up in such villages as has been done in parts of Bihar.

(2) Growth Centres :

Potential Growth Centres having infrastructural facilities and in close proximity to markets should be identified for industrialisation along modern SSI units. Industrial activities in Growth Centres should promote 'ripple effect' all around.

(3) Cooperative units :

Since common tribal entrepreneurs are poor and lack required capital also, cooperative ventures along 'community' membership line hold better promise. As group activity is an integral part of tribal culture so the same can be harnessed.

(4) **Training Demonstration Centres :**

Such centres should be set up in close promixity to the industrial villages and the growth centres. Usually, for fear of competition the master craftsmen refuse to part with skill, knowledge, technique and the secret of his art. Such centre should substitute this, besides flourishing tribal crafts and blending with modern design.

(5) **Technology :**

The low level technology products (e.g. tailoring and ready-made garments, food products, housing, servicing and repairing) and products using 'screw driver technology' have got higher prospects in tribal areas, since entrepreneurs need not have to acquire high skill for the same.

(6) **Composite Schemes :**

Modern industry is a new thing to a tribal society as it involves risk and uncertainities. To motivate the entrepreneurs risk should be reduced to minimum. Perhaps, it may be worthwhile to encourage entrepreneurs first into business and services, then into industries pure, as the chance of success is observed to take the following ordinal ranking viz.

Component	Chance of success
Business	Higher
Services	High
Industry	Low

In business and service there is no sophisticated technology involved. Hence no problem of technology transfer. Further, the IRDP and SEEUY programmes have better prospects in the tribal societies as no mortgaze is required under them and levels of business and service activities are low.

(7) **Package of Incentives :**

Because of its inherent weakness tribal area industrilisation deserves a higner package of incentives with higher

rates of subsidy, longer moratorium period etc. Product reservation for such entrepreneurs can also be thought of.

(8) **Entrepreneurial Programmes—cluster approach :**

In those areas where tribal society has integrated or mixed with the rest, it is advisable to go for 'cluster approach' in entrepreneurial campaigns and programmes, say, with 80% tribals and 20% non-tribals. Experience from tribal areas of Bihar shows that this yields a promising result. A breakthrough in tribal entrepreneurship lies in group entrepreneurship where they feel more at home and secured. Under such approach they can support each other and learn from each other. They can be financed by one particular bank who understands their problems. In tribal areas/societies the promotional organisations including bank should follow the model of 'adopted entrepreneurship'.

In the selection of entrepreneurs, more preference should be given to under matric or matric-failed candidates since they are not likely to be absorbed in 'formal sector' employment. In respect of female entrepreneurs there is greater likelihood of success if they are recruited from higher age groups having lower prospect of getting married, and from married, widows, separated or spinsters.

Training should be stipendiary and be imparted at Block/Sub-division headquarters with factory visit, bank visit, etc. For tribal entrepreneurs, period of training should be longer than for non-tribals.

(9) **Co-ordination :**

A number of promotional organisations directly or indirectly are involved in tribal area development. For Assam mention can be made of Tribal Research Institute, SISI, NISIET, NSIC, EMTC, ITDP, DRDA, DIC, KVIC, KVIB, ASEB, ASIDC, AFC, AHSIDC, Tribal Development Corporation, Sericulture & Weaving, Handloom & Textiles, Coffee Board, Rubber Board, RRL, etc. not to speak of banks and financial institutions. In view of the multiplicity of organisa-

tions need for a body to coordinate the various promotional activities seems inevitable.

Experience shows that performance of entrepreneurs in developed areas is more than these in backward areas. Similarly, the success rate of tribal entrepreneurs is far lower than the non-tribals. The real test, however, of success of entrepreneur motivation lies in transforming artisans and unemployed persons into industrial entrepreneurs looked for by the banks and financial institutions. On the other hand, people's participation in the industrilisation programme is equally indispensable for which, extension network to educate the people is essential.

References

1. P.C. Goswami, (ed) (1987) : Problems and Prospects of Industrialisation.
2. D.D. Mali & P.D. Deka, (ed) (1987) ; Industrial Development in North East India.
3. Dr. G. Bordoloi & Neog, (1986) : Economy of North Eest India.
4. Tribal Research Institute (March, 1984) Assam : National Seminar on Alienation of Tribal Land and Tribal Indebtedness.
5. Dr. Michael V.D. Bogaert, : How to work with Tribal/Rural Entrepreneurs, Xavier Institute of Social Science, Ranchi.
6. A.K. Neog (June J984) : Role of Technology in Development and Technology Transfer (Seminar paper).
7. -do- : Role of Entrepreneurs in Industrial Development (Seminar paper).
8. Govt. of Assam ! Agricultural Census, 1980-81.

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Environmental degradation in the tribal areas of Assam and application of Science and Technology

B. N. Bordoloi *

Introduction :

Environmental degradation is caused by a number of factors and the problems connected with it have drawn the attention of the scholars belonging to different disciplines in our country only in the recent years. The problems connected with environmental degradation have assumed such a dimesnion that it is very difficult for a man with a mind for human welfare to remain a silent spectator. In order to meet the constantly growing needs the resources available have been exploited in a very unplanned manner leading to degradation in the environment. In the tribal areas of Assam the environmental degradation has been taking place at a faster rate. In this paper I want to discuss how the enviornment in the tribal areas of Assam has been degrading and also to suggest ways to stop further degradation. For this purpose I propose to divide my paper in three parts. In the first part I want to give a brief introduction to the Assam Tribes and in the second part I propose to analyse the factors responsible for degradation in the tribal environment and in the third part I propose to deal with the question of applicability of science and technology to stop further degradation of the environment in the tribal areas.

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An introduction to the Assam Tribes :

Assam has two lists of Scheduled Tribes one for the Plains areas and the other for the Autonomous Hills Districts. While in the plains areas, there are 9 Scheduled Tribe communities, in the hill areas there are 14 Scheduled Tribe communities. As no Census was conducted in Assam in 1981, we shall have to rely on the data of 1971 Census only. As per 1971 Census there were altogether 16,07,035 persons belonging to tribal communities out of which 13,44,413 were in the plains and 2,62,622 were in the hills. The percentage of tribal population to the total population of the State of Assam was 10·99. While the Boro-Kacharis are the largest group among the plains tribes, the Karbis are the largest group among the hill tribal communities.

Each tribal community of Assam has a distinct ethnic identity having its own culture, religion, language, etc. They are not at the same stage of development. While some of them are quite advanced, economically as well as educationally some of them are still lagging behind.

Agriculture is the mainstay of the tribal communities of Assam. While in the hill areas shifting cultivation has been the practice, in the plains areas people do wet paddy cultivation. In the hill areas the Jhum cycle has become shorter resulting in more destruction of hill forests. Sericulture is an important cottage industry among all the tribal communities of Assam. Every tribal woman is an expart weavers Cattle and poultry are reared by them. Their avorsion towards drinking of milk is still found to be prevalent. Manufacturing of cane and bamboo articles is one of the important cottage industries.

Rice is their staple food and rice beer is their favourite drink. In all traditional Socio-religious festivals and family worships rice beer is a must.

The tribes of Assam have a corporate life where people think in terms of the whole community rather than individal entity. To help the needy and the poor is a must. Their traditional organisations like Bachelors Dormitory or Youth

Club always help the tribal families to tide over the emergent situations. Mutual help and co-operation are the basic essence of their life.

Degradation in the Environment in Tribal areas :

The Report on the "State of Environment in India" prepared by the Centre for Science and Environment, New-Delhi, has warned that if the environment was not managed properly, India would find it difficult even to feed the existing population and the African experience of famine would occur in India also (News Item, Times of India, New Delhi Edition, 25th August, 1985). This report has highlighted that the country has been losing 1·3 million bectares of forests every year resulting in famine of fuel and fodder. The report has further accused the Government for not doing anything to control the use of dangerous pesticides 70% of which is either banned or severely restricted in the western countries.

A. **Deforestation :**

There are various factors which are directly responsible for the environmental degradation in the tribal areas of Assam. Now let us analyse them one by one.

It is a well-known fact that the tribal people have a direct relationship with the forests. The forests provide them with minor forest produce and eatables and fodder for their cattle. In Assam we have 499 forest villages where 47·11% of the inhabitants are tribals. Most of the tribal villages are situated near the forests. Deforestation has been taking place in the tribal areas, both in plains and the hills at a very faster rate. The magnitude of the deforestation which has caused imbalance in the entire eco-system can be understood from the following statistics. Assam is supposed to have 39% of the geographical area under forest. This includes 22% reserved forests, and 17% Unclassed State Forests. The 17% Unclassed State Forests which include all unalloted Government land including the

grazing land is forest land in name only. It is very difficult to say how much of this category of forest now remains forest as such. There are 44 Nos. of Ply wood mills, 365 Nos. of saw mills, one match factory and 2 Nos. of match splint factories and 3 Nos. of paper mills all over Assam and to supply raw materials to them is itself is a serious problem. Of course, one paper mill at Jogighopa is closed down. Moreover these Unclassed State Forests have to meet the constantly growing demand for supply of fire-wood not only in the rural areas but to urban areas as well.

In the hill areas also, constant Jhuming due to shorter duration of Jhum cycle, has resulted in denudation of many hills. Thus unclassed state forests are now forests in name only.

The reserved forests in Assam accounts for 22% of the total geographical areas of the state. But in the reserved forests also there are large scale encroachments resulting in destruction of forests and forest wealth. Although eviction operation is undertaken occasionally, the problem is a never ending one. Illegal felling of trees by forest contractors within the reserved forests and by the tribal people without the knowledge of the forest people is a fact and not a fiction. Some poor tribal families do it with a view to get two square meals a day by selling the ilegally felled trees as fuels in the nearby markets. The privately owned trees are sold to the contractors at a throw away price by the tribal people when they are lured to do so.

Coming to the bamboo groves in the plains tribal areas, specially in lower Assam we find a very dismal picture. To feed the paper mills even the one year old bamboo shoots are not spared. In other words there has not been any scientific harvesting of the bamboos consequently after the hervest the bamboo groves die. Similarly in the Noth Cachar Hills and Karbi Anglong Districts also the contractors who have engaged labourers from out side to cut the bamboo groves, indiscriminately cut all the bamboos in a grove and as a result the bamboo groves are also dying

down. If such a state of affairs is allowed to continue, it is very doubtful whether the Jagi Road Paper mills of Hindustan Paper Corporation will be able to survive for a longer period since the raw-materials are likely to be exhausted within a very short period of time for unscientific harvesting and without any scheme for immediate regeneration.

When there is illegal felling in the reserved forests, the forest personnel are there to regenerate if not fully, partially. But so far as the unclassed state forests is concerned there is hardly any scheme for regeneration and so far as the bamboo groves are concerned one can hardly see any new plantation.

In the hill areas of Assam the Jhumming practice has also caused considerable damage to the unclassed state forests. It is estimated by the National Agricultural Commission that in the Karbi Anglong District 4.15 lakhs hectares of land are under Jhum cultivation involving 45,000 tribal families while in the North Cachar Hills 83,000 hectares of land are under Jhum cultivation involving 13,000 tribal families. All these factors lead to the deforestation of forests in Assam resulting in ecological imbalance and environmental degradation. Even the rainfalls in Assam have also become more or less irregular and uncertain. Secondly, there is depletion of fodder resource which has adversely affected the cattle population of the state. Thirdly, the destruction of forests leads to the destruction of many medicinal plants and the life of the wild animals and birds has also been disturbed to a considerable extent. As a result of the constant Jhumming the top soils are washed away by the rains to the plains below and the river beds are silted. The river beds cannot carry the same volume of water as it used to carry and this has resulted in the recurring floods causing havoc to the standing crops, cultivation, life and property of the people living in the plains. Flood is always followed by epidemics which effect human as well as animals. When the flood water is subsidised foul smell is omitted and the whole atmosphere appears to be polluted. People find it difficult to

get good drinking water as most of the ring-wells are submerged and the water becomes unfit for drinking.

B. Use of Chemicals :

The tribal people in Assam are not well-acquainted with the proper use of chemical fertilizers, insecticides and pesticides although these are provided by the Agriculture Department either at a subsidised rate or free of cost. The Extension Officers of Agriculture Department and Gram Sevaks may not always be available for demonstrating the proper use of these chemicals. When they are haphazardly used in the paddy fields and in other cultivations, the water is polluted. Such pollution is dangerous to the fish and also it affects the fodder in the paddy fields and in their neighbourhoods. Such fodder might harm the cattle when it is used as a feed.

C. Water & Air pollution :

It has already been mentioned earlier that recurring of floods in Assam causes water pollution and to get fresh drinking water in the flooded areas becomes a problem. This is, of course, natural agency. But water in the tribal areas in this state has been polluted by the human agencies also. Many industrial establishments set up in the tribal areas of Assam like Salakati Thermal Project and the Bongaigaon Refinery and Petro-Chemicals located in the Kokrajhar District, the Chandrapur Thermal Project located in Pragjyotishpur District, the Hindusthan Paper Mills at Jagi Road in the Nagaon District, the Namrup Fertilizers Plant located in the Dibrugarh District have caused water pollution at an alarming rate.

Similarly air pollution has also been caused by a number of industrial establishments located in the tribal areas. As for example, we can point out to the Bokajon Cement Factory located at Karbi Anglong District. This Cement Factory has polluted the atmosphere covering a radius of about 2 kms. from the Factory so much so that one can see

about half an inch of thick white dust covering the roofs of the house, trees and the plants. The atmosphere near the Cement Factory always remains foggy.

D. Application of Science and Technology :

Most of the tribal communities of Assam have hearths inside their houses which remain burnning 24 hours. As there are no specific outlets for letting the smokes out, the smokes fill the houses causing air pollution. The tribal people being habituated to this type of living since time immemorial, of course, donot mind this at all.

Over and above these, the question of unhygienic sanitation in the tribal areas has also to be taken into account. The people generally go to the nearby jungles or fields to ease themselves. They practically donot have either sanitary or pit latrines. Those tribal communities which have bamboo platform type houses, use to keep the pigs below the platform. As a result foul smells vitiate the whole atmosphere. Cow dungs and other refuges are thrown away and scarcaly they are dumped in the comost pits. All these factors mentioned above are responsible for environmental degradation in the tribal areas of Assam.

The already degraded environment will, further degrade and the situation will further deteriorate unless timely actions are taken for planned and scientific management of environment in the tribal areas of Assam. The planning should have short-term as well as long term perspectives. The short-term planning should ensure that the environment does not degrade further and for this purpose effective steps should be chalked out for their immediate implementation. The long term perspective should aim at the improvement of the environment to the greatest extent possible. A piecemeal approach to the environmental problems will not serve any purpose. What we need is actually an integrated approach from all the disciplines which can contribute something for the improvement of the tribal environment. The officials of those disciplines should have the fair knowledge of the socio-cultural

factors that govern each tribal society. They should try to have a grasp of their (tribals') problems with sympathy and understanding, Each society has a set of predetermined customary rules. For an outsider some of the customs or customary rules may not sound logical and good. But for the society itself they are quite good since they meaning tribal people judge things according to their own cultural values and ethics. In plannig for environmetal improvement the planners must take these things into account if they want to have the desired results.

In order to stop further degradation in the environment and to improve the environment management in the tribal areas of Assam science and technology must come as a saviour for human survival. From our earlier discussion it is seen that degradation in the environment is mainly caused by the depletion of existing resources in a region. The depletion of resources takes place because of their excessive exploitation when the people try to meet their basic needs which are increasing by leaps and bounds in the present days changing context. The application of science and technology takes into account the basic human needs and the scientific use/exploitation of available rosources without degrading the environment. Thus environmentally sound technologies suitable to the tribal people shall have to be developed with the help of the scientific knowledge.

A. Afforestation :

In order to stop further deterioration of environment in the tribal areas and to restore ecological balance, afforestation has to be given first priority. Afforestation means the plantation taken up in areas devoid of trees and plants with a view to bringing under green coverage. It may either be done by Production Forestry or by Social Forestry or by both. Plantation by individual families may also help the afforestation to a considerable extent. So far plantation by Social Forestry is concerned trees and plants for which the tribals have a special liking and trees which can be

harvested for fuels are to be planted by the Social Forestry Department.

B. Checking of Deforestation :

In order to stop further degradation in the environment of the tribal areas, immediate checking in the deforestation is highly essential. In order to do this, education and motivation of the people through the medium of publicity to protect and preserve the forests for their own interest should be given first preference. The Forest Department Officials must be vigilant so that there might not be illegal felling, removal of trees and encroachment in the reserved forests.

C. Introduction of Bio-Gas :

Introduction of Bio-Gas in the tribal areas of Assam is highly essential since it will save many trees which are at present used as fuel but at the same time it will provide fuel for cooking and generate power for lighting houses. Unfortunately in Assam the rural people donot use cowdung as a fuel. Hence there is no dearth of raw materials. However, the tribal people of Assam have hardly seen bio-gas plants. Hence the Khadi and Village Industries Board which has done a pioneering job in introducing the Gobar Gas Plants in Assam should motivate the people in the interior areas through practical demonstration.

D. Use of Solar Energy :

Solar energy which has been used very profitably for cooking, boiling of water and irrigation purposes in the other parts of the country is yet to become popular in our state. If solar energy can be used for cooking purpose, a certain percentage of fire wood would be saved. But this depends on two important aspects namely, the availability of suitable pressure cookers according to the size of the family and secondly, their prices. In this connection we

shall have to take into account the uncertainty of weather conditions during summer in our state. Therefore, for Assam solar cookers have to be manufactured with modified designs keeping the weather conditions of our state in view.

E. Prevention of air & water pollution :

In has been stated earlier that the tribal people in Assam are in the habit of keeping their hearths burning 24 hours a day. The same hearth is used for cooking food, preparing tea, etc. During winter season the family members sit around the hearth to ward off cold. Even the guests are also entertained near the hearth. Just above a metre of the hearth a Machang (a strongly built platform made of split bamboo) is kept hanging. In this Machang, vegetable and other seeds for next cultivation, newly manufactured cane and bamboo baskets, meat, etc, are kept to save them from insects. The smokes from the burning hearth fill the whole house as there is no specific outlet and thus the air is polluted. Smoke affects the eye sights and the cloths kept inside the house are darkened.

Introduction of smokeless Sullah might save the situation. But whether smokeless Sullahs will be accepted by the tribal people is doubtful as smoke is very much essential and the neccessity of smoke is shown in para above. The only way out is to develop a Sullah which emits lesser quantity of smoke. The Department of Science, Technology and Environment, may play the pioneer's role in this respect. Such type of Sullahs can be introduced in the tribal areas by motivating the advanced section of the people first.

So far as the air pollution caused by the industrial establishments is concerned we may refer to the Assam Air (Prevention and Control of Pollution) Act, 1981. The State Board for Prevention and Control of Water Pollution, Assam, established under Assam Water (Prevention and Control of Pollution) Act, 1974 has also been empowered to prevent and control air pollution. So far this Board has not been able to do any concrete works for the prevention

and control of air pollution in the tribal areas because of paucity of fund. But the Board has proposed to establish an Air Monitoring Station at Bangaigaon Thermal Project, Salakati, which falls within the Tribal Sub-plan area at an estimated cost of Rs. 1.5 lakhs. The Board has also taken steps to identify the industries which cause air pollution.

Water pollution in the tribal areas caused by the industrial establishments is also another problem. Due to constant efforts of the Board the Industrial establishments which cause water pollution have now established treatment plants for polluted water and only after such treatment water used in the industry is discharged. According to the provisions of the rules framed under Assam Water (Prevention and Control of Pollution) Act, 1974, whenever a new industry, having potentiality of using water, is proposed to be set up the project report has to be okeyed by the Assam State Board for Prevention and Control of Air and Water Pollution first. The Board Officials examine the project report to ascertain that there is provision for treatment of discharged water. Project reports lacking in this respect are not approved by the Board and without the Board's approval the proposed industries connot be set up. Such steps will surely minimize water pollution in tribal areas due to establishment of industries. Fortunately in the tribal areas of Assam we donot have chemical plants. The Bhopal Tragedy caused by the leakage from Union Carbide plant is still fresh in the mind of the people.

In order to avoid drinking water pollution of the ring wells, the Public Health Engineering Department may install hand tube wells in the ring wells to draw water from the wells. Potas, lime and other disinfectants should be used from to time to purify the water of the ring wells.

Pollution of water in the paddy field due to the use of heavy dose of chemical fertilizers, insecticides and pesticides can be controlled by the Agriculture Department by giving proper training to the tribal farmers through frequent demonstrations. Unless the tribal farmers realize fully

that these chemicals are actually poisons and their use in heavy doses might bring disaster to fish and fodder in the paddy fields, pollution of water in the paddy fields is likely to continue whenever such chemicals are used. The Agriculture Department should devise means for controlling such type of pollution.

Unhygienic sanitation is another problem in the tribal areas of Assam. The Panchayat and Community Development Department now proposes to construct pit latrine but the people should be motivated first to use such latrines. If the plates are provided free people are likely to accept this scheme.

The Agriculture Department should initiate a special drive for compost pits in the tribal areas. Cowdung and other refuges dumped in the compost pit may be used as fertilizers and such fertilizers are sure to be preferred by the tribal people.

Conclusion :

Degradation in environment in the tribal areas of Assam has been taking place at a rapid rate. In this paper only a few aspects of the problem are discussed. To stop further degradation and also to improve the already degraded enviornment, Science and Technology must come forward. Due consideration has also to be given to investigate renewable energy from different available sources. Construction of houses with very cheap building materials invented at the Regional Research Laboratory, Jorhat, soil conservation measures, improvement of traditional technologies of the tribal people are some of the other aspects to which science and technology should pay proper attention.

I conclude my paper here by sharing with the participants a few experiences that I gained while paying a visit to Ziro, in Arunachal Pradesh, the land of the Apatanis. These people are really expert in environmental management. An Apatani is allowed to cut a matured tree provided he plants one before he fells the tree. Failure to do this means a

fine of Rs. 500/- and he can never escape from it. Formerly the punishment was in terms of Mithuns. Bamboo groves are kept so nicely with fencing as of they were flower gardens. Pigs are not reared because they destroy vegetation and make the atmosphere nesty, of course, each family keeps a pig which might be needed for a Puja. But it is also kept in an enclosure. Cows and Mithuns are kept in the jungles so that they may not destroy crops and vegetables in the villages. I feel that we, the so called advanced people, have to learn many things in regard to the environmental management from tribal people living in such furflung interior places. Our conserted efforts should be to make people conscious of the environment where they live, move and have their beings to make the plans and programmes successful.

Lastly I would like to suggest that some organisations in collaboration with the Forest Department should undertake a study on the Annual Fuel Requirement of each Tribal Family so that alternatives arrangement proposed to be implemented on fuel requirements could be made in a very scientific basis.

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