ISSUES ON

Natural Resource Management

With Special Reference to North-East India

Editors

Utpal Kumar De • Francis Kulirani

Depletion, degradation and thus management of natural resources have become an important issue worldwide for sustaining human civilization and its progress. Several factors like population growth, incidence of poverty, unplanned economic activities, ownership rights and faulty system of management as well as government policies are identified to be the major reasons for this. The both- way linkages between the availability and quality of resources and economic and human development have been established in several writings theoretically and empirically that provide useful insights for the policy formulation and judicious management of resources. Attempts have been made at different national and international fora to raise awareness among the people and formulate ways for the sustainable management and utilisation of resources. In spite of having huge potential resources, North-East India failed to tap and judiciously use those for the development of the regional economy. However, the region has also been observing degradation of such natural resources.

The present volume is a collection of good articles highlighting the issues and problems of management of natural resources in connection with the development of economy. Also the linkage between human resources and management of natural resources is analysed along with the analysis of role of society, education of the people and traditional knowledge especially in the North-East India for the management of resources both renewable and non-renewable. A part of the volume is also devoted for the management of tourism and related resources along with the description of resource management under natural disaster, which assumed much importance after the observation of tsunami in recent past and huge loss of property and human life.

Thus, the book is expected to be a great help to the researchers and students of social sciences especially those who are interested in North-East India and also to the general readers interested in the aspects of resource management. It will be a good acquisition by the concerned academicians.

Rs. 750

US$ 50

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Issues on
NATURAL RESOURCE MANAGEMENT

With Special Reference to North-East India

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Preface

Resource management problem has become a big issue for the survival and progress of human civilisation. With the growth of population and standard of living, development of the economies through improved agricultural practices i.e., intensive and extensive use of land and other resources, industrial progress, urbanisation etc. supported by development in the field of science and technology, use of natural resources viz., land, water, forest and mineral etc. increased. The activities and competition in different areas for the development and selfishness in acquiring better access to various resources ultimately led to the decline in availability of natural resources to the people. Over-exploitation and mismanagement of natural resources is a common phenomenon, which is primarily due to the problem of ownership, non-cooperation by the users and strive for becoming reach within a very short period. Incidence of poverty and faulty system of management and government policies are also responsible in many cases.

In most cases the poorer earn their livelihood directly from the environment (e.g., common forest, fishery, grazing field, water-bodies etc.). Moreover due to limited access to education and awareness, tendency of population growth is higher among them, which put more pressure on environment and accelerate the process of environemental resource degradation, which in trun affect their livelihood. However studies show that the poorer are always not responsible for the degradation of resources. In many cases due to their better accessibility (because of ownership or political power), profit motive and government policy the richer cause much damage to the environment. In some cases however the poorer are found to judiciously manage due to their indigenous knowledge and invest in such resources for the maintenance

of their livelihood. But they are the more vulnerable to the degraded and polluted environment.

In the world around 900 million poor people are living in rural areas and depend mostly on natural products for their livelihood. More than 500 million live on marginal land and the number is expected to rise to 800 million by 2020. Almost 35 per cent of developing world's population is living in dry lands, mostly in Asia and Sub-Saharan Africa.

Survey shows that soil degradation alone each year affects nearly 2 billion hectares, damaging the livelihood of around one billion people living on dry lands. Around 70 per cent of commericial fisheries in the world are fully or over-exploited. One-third of the developing world's population are facing safe drinking water crisis and the same will go on increasing unless steps are taken to revive the situation.

There is a two-way relationship between human development and the management of natural resources and environmental quality. The level of human resource development especially of the poor masses is highly influenced by the environmental resource condition and degradation. Also degradation of forest is found to be very high in the countries that acquired very high level of human development (e.g., Japan, Finland, Korea) and the same is comparatively higher in the countries those achieve low level of human development (e.g., Jamaica, Lebanon, Paraguay). Therefore withering poverty, inequality and sustainable managment of environmental resources are among the major UN Millennium development goals declared in 2000.

If we look at North-East India, per capita availability of land has been reduced from 1.16 sq km in 1971 to 0.71 sq km in 1991. The availability in 1991 ranges from 0.35 sq km in Assam to 6.36 sq km in Arunachal Pradesh. Though the figures are comparatively higher than all India average, considering the productivity and dependence of people on land and rare industrial progress in the region pressure on other natural resources like forest, mineral have been on the rise. Many sections of population are directly dependent on these natural resources for their sustenance. However much of these resources have already been damaged. Forest is one important natural resource of the region has been subject to over-exploitation and deforestation is a common scenario. That is why legislation has been made to protect the forest biodiversity.

Along with poverty, property right/ownership pattern and faulty management are responsible in many cases for the destruction of such resources. Participatory management may be an alternative option in such case. Gender is also important issue in this case as the women in this region are mainly responsible for collection of fuel wood and water and also involved in the cultivation practices. Unless sustainalbe harvesting and management system is developed the people of the region will be left with limited choices and opportunities. Therefore there was a need to address such issues relating to management of natural resouces in the region.

The book is a small effort to highlight the different aspects of resource management problem in connection with the socio-economic perspectives of Eastern and North-Eastern India. The papers address the problem of resource management from different angles and there are six sections in all.

The first section addresses the problem of human resource development and its linkage with the management of natural resources. Paper by U.K. De shows how different components of human development are interlinked with the management and degradation of natural resources. The interlinkage among different components of human resource, poverty and natural resource degradation has been explained in the context of North-East India. He concluded that checking population growth, removal of poverty along with overall human development is the ultimate solution to the problem of management of natural resources. Agarwala and Das also explained how the development of human resources could help better innovation and planning design for the overall progress of West Garo Hills region of Meghalaya. Aravamudhan also gave a structural description of how human resource development help better comprehension and idea about resource management.

The second section confined to some resource management especially management of some renewable resources. The paper by Prof. S.K. Datta and R. Kundu extensively disscussed the problems and prospects of financial management with respect to some cooperative fisheries in West Bengal. The study also provided some important solutions to the financial and management problem of fisheries especially for poor fisheries. Prof. Arunoday Saha offered an alternative model for the solution to water

distribution problem in the urban municipal areas. Rezina Ahmed in her paper has discussed the effects of deforestation on the people living in and around border areas of Meghalaya. Dr. M. Sinha in his paper has discussed the importance of bamboo culture in the economy of Nagaland and also suggested ways for the proper management of bamboo culture. Joshi also addressed on the different aspects of biological resources in Meghalaya and focused on the participatory management of such resources.

Section three addressed to the issues on society, resource management and economic development. De, Rout and Das in their paper discussed the nature of extraction of coal in Meghalaya and also the possibilty of exhaustion of coal in the state. They also discussed the possible impacts of extraction on the socio-economic situation of the state. Dr. P.K. Kuri in his empirical study analysed the dependence of societies on common forest resources in Arunachal Pradesh. He discussed how the nature of such dependence is influenced by a variety of factors like education, land holding, family size etc. Das and Agarwala again discussed how socio-economic development of poorer in rural area is affected by the resource degradation. They empasized on model formulation with a holistic approach for the overall development of rural West Garo Hills of Meghalaya. A. Banerjee in his paper stressed on the poverty reduction and participatory management for the socio-economic development especially of the tribal societies in North-East India.

Analysis on population, education, and indigenous knowledge is incorporated in section four. Here Jasmin and Chakraborty have discussed the effect of population growth on the degradation of natural resources in and around Guwahati city. Sarmah *et al.*, has provided an interesting observation of how the indigenous knowledge of Lisus in Arunachal Pradesh help them to better manage natural resources for their sustenance. Sengupta and Paul also offered some discussion on the role of education on the preservation of forest resources in Meghalaya.

The next section is confined to tourist resource management. Sashikumar and Gowlog described the potential of eco-cultural tourism in Meghalaya. They also highlighted how sustainable maintenance of tourist resources help socio-economic progress along with environmental balance. P. Bhattacharya in his paper

discussed about different approaches to tourist resource management in North-East india's context.

The last section focused on the issues related to flood and disaster management. B.P. Sahu in his paper analyses how interlinking of river can help better management of water potential to reduce flood problem and enhance economic prosperity in Assam. He also discussed the strategies and constrained of flood management in Assam. Anup Saikia in his paper also discussed the issues of disaster management for flood control and preparing for other disasters to save life, property and natural resources in the context of North-East India.

I hope the book will receive much attention of the readers including researchers and students of social sciences especially those who are interested in North-East India.

U.K. De

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Background

At the beginning of Christian era i.e. A.D. 1 world population was around 2.5 crore and growing at around 0.04 per cent per year. Now the world's population passed 6 billion and growing at an annual rate of around 1.5 per cent. In spite of several measures undertaken by different nations, population of several countries have been growing (though at different rates) and if the current trend is maintained, it would take only another 50 years to double the present population. But for the survival and to meet the rising need of growing population it is necessary to have a reasonable size of natural resources. But already we observe depletion or degradation of natural resources like forest, mineral, water etc. at different levels across the world. Hence there is a doubt about the sustainability of the growth processes and also about the ecosystem services of the environment. Already the Southern American, African and some Asian countries have observed large-scale destruction of primary forest tracts, water resources of many countries have been depleted and by 2025 many countries especially from Asia and Africa are expected to face severe drinking water problem. The India and North-East India is not exceptions. In spite of having huge natural resources the North-Eastern part of the country is underdeveloped. The resources are being exploited but not utilised properly for the socio-economic development of the region. The region has been recording higher population growth during last few decades compared to the national average. Also industrial progress is very slow and whatever is there primarily based on local natural resources. Here resources are being extracted primarily for the survival and for further capital formation and also the biodiversity of the region for which is known as one of eighteen hotspots, is under severe threat. Therefore, we need

to develop a constructive mechanism for the sustainable development and management of our natural resources for better quality life and livelihood of the people. The World Environment Day is observed on 5th June every year to draw attention of the people to the basic issues relating to proper environment for sustainable growth of the society and the people.

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Human Resource Development and the Management of Natural Material Resources of Meghalaya

S. Aravamudhan

Introduction

It is by the day-to-day natural living that the inhabitants of a region or a locality learn about the materials around them. It is this experience, which makes them recognize the naturally occurring utilizable resource materials (Aravamudhan, 2004). Recognizing the natural material resources this way need not be sufficient-enough experience to manage the resource materials. This means, it would not be appropriate to reckon them as accomplished resource persons capable of managing the resources efficiently. When the region is developing (Husain, 1994), a comprehensive outlook on the development must include the Human Resource Development; this would be so, even if the strategy were to mainly manage the material resources.

For obvious reasons, it is the usual tendency to begin by modeling the region under consideration to be a closed system — without any external inputs into the system and, also letting no outputs from the system to the surroundings external to it. The exceptions would be when for realistic situation, the priorities demand that, the local (inside) resources have to be made available for consumption outside the region (resource availability is 'abundant'). However, certain materials required critically for consumption within the region may not be available as part of

the internal natural resources for the purposes of management. Then, dependence on inputs from outside has to be counted as a factor (resource availability is 'inadequate'/'scarce'). How the activities, related to resource management, can become a transaction across regional borders should be appreciated from the sequences of the processes depicted in Figure-1. In this context one may refer to the internal resources of Meghalaya; but, the situation of human resources would necessarily bring a sea change in the North-Eastern region.

From the above point of view, the requirement of developing human resources while seeking the efficient management of material resources is itself posing a complicated entanglement. It is so because the very same people, who would be the consumers, should be improving themselves with the techniques of securing the resources for the people, adequately in quantity and quality for as much length of time that the people do not have to be concerned about having to reduce the consumption after getting used to it.

The interdependence of the factors would complicate the process of evolving a strategy specific to the region (Husain and Barik, 2004). The strategic utilisation could be either by a small-scale individualized venture or by a viable large-turn-over industrial venture. This type of utilisation is a value addition stage before the original resource material reaches the ultimate consumer. By this it is meant that the consumption of natural resources through such ventures produces out of the original material something more price-worthy than the raw material. Even, better would be that these activities provide such experiences to turn out people who are much better qualified to regulate such activities.

The modern technique, for envisaging a regulatory pathway to disentangle dependences to promote and favour only the reinforcing interdependences (Singh, 1995), is to draw out a scheme of flow chart to include comprehensively the input-output correlations, indicating clearly where and how the envisaged output would have to become part of the input itself (Leigh, 1996). This aspect is the most crucial interdependence for the value addition process. The advanced stage of such interdependence of inputs on outputs can be envisaged from the flow-chart of Figure-1. The enterprises, which thrive from the internal

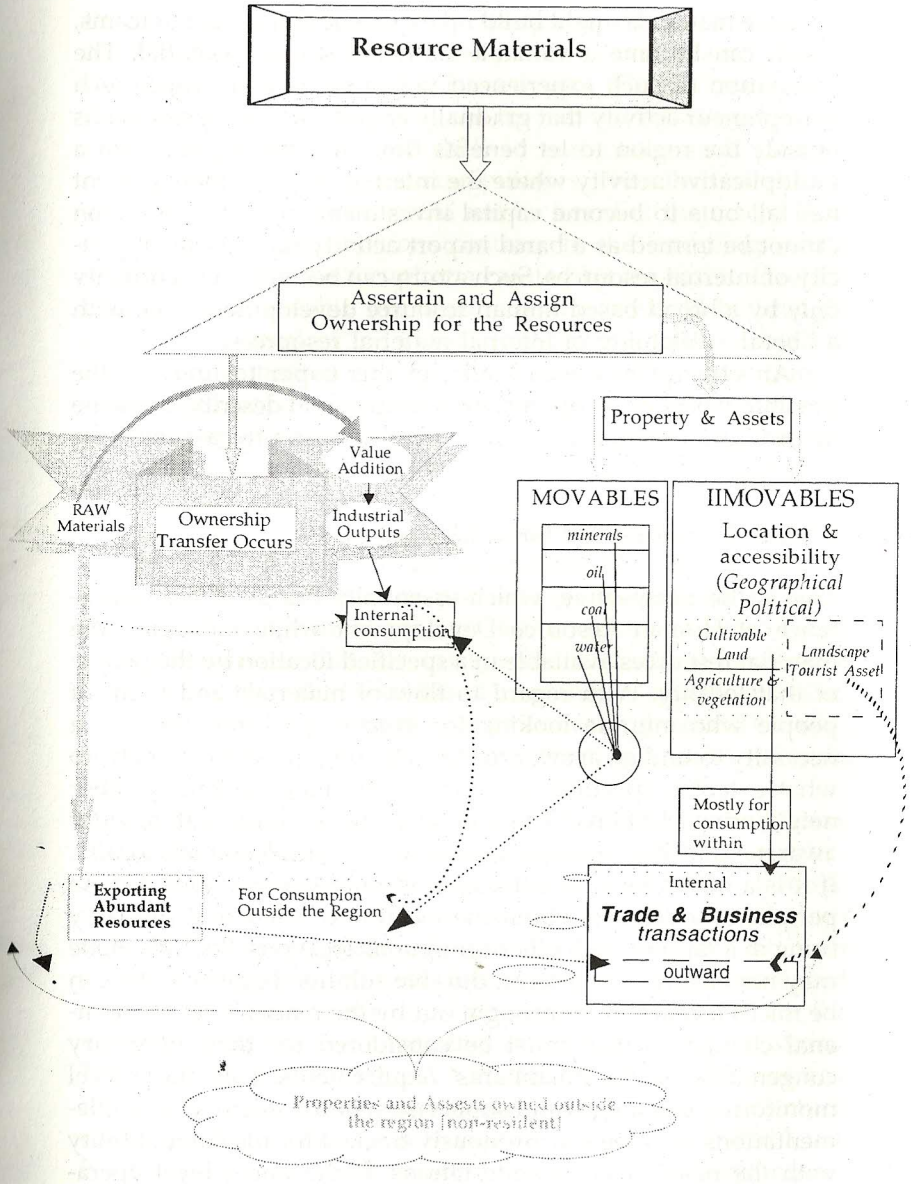

Figure 1. A Flow-Chart for the way the resource materials reach out to consumers from where they are naturally available. This sketchy flow indicates the directions for activities and how the management of resources can be comprehended from the source to outlets

resource materials might build up experienced managerial teams, which can become a valuable human resource potential. The occupation of such experienced personnel would propel such entrepreneur activity that gradually engulfs material possessions outside the region to let benefits flow into the region. Such a multiplicative activity where the internal resource management has fall outs to become capital investments outside the region cannot be termed as a banal import activity for reasons of paucity of internal resources. Such a turn can become an eventuality only by a broad based human resource development even with a liberal availability of internal material resources.

An attempt has been made, in this paper to find out the possibility of such an optimization process and describe a scheme to provide a comparison with what is currently a prevailing strategy.

Global Awareness for Local Management

This is the perspective, which essentially brings in the importance of Human Resource Development while managing the material resources available in a specified location by the people of that locality. With regard to flow of materials and flight of people who migrate looking for greener pastures, there is a necessity to find an answer to the following question: namely, to what extent a specified location can be independent of other neighboring locations? This can be answered only with a wider awareness of the consequences of what is implemented locally. If it is a macro level monitoring and management, then a mere peripheral awareness about the location of site could probably bring in a rapport with other contiguous locations. But, this alone may not ensure a long-term, durable solution because there can be micro level changes brought out by the macro level phenomenal changes, which must be considered for their necessary congeniality for the inhabitants' requirements. This micro level monitoring of changes and supervision of the micro level implementations must be synchronously tracked for the compatibility with the macro level manifestations. If the micro level operations require strict controls and regulations, then it is quite possible that this results in an engulfment of the micro from the macro. It would be as if a closed hard-shell form around the on

the spot movements, since all the people would be attentive and focus on to the micro spot. People do not turn outwards and the movements freeze soon after leaving spot. Thus micro motivations would remain concealed, and the micro level changes would not permeate through the shell to surface out and become conspicuous to macro level manipulators. Then the voices from on the spot supervisors would not be heard at the macro level dispensations. The situations contrary to the foregoing would be that there may be a euphoria created by the macro level indicators, but in reality not much advantage would be brought about at the level of individual well-being. In either case the total management would be elusively a failure resulting in disgruntled population. The nature of data gathered and how the time dependent developments are related to the factual data requires a development of skillful management techniques. This is the Human Resource Development which calls for much broader potential than, what apparently seems to be only modest requirements in certain curtailed contexts of management of local natural resources. The practical managers must be well-aware of the scope of the modern technologies on a broad based comprehension so that, for any specific task arising locally at a specific site, from the broad based awareness a specific direction becomes discernible, which pointedly leads to activities with certainty without much of trial and error approaches (Husain and Barik, 2004).

Thus an understanding of the micro level processes synchronized with the macro level homogeneous development requires a smooth transition from the micro level practical system, through middle level operation to the macro level realities, if the outcome is to be a comprehensive growth and development. Such a comprehensive integrated development must be envisaged at every location and this must be further synchronized for the regional processes encompassing all the constituent locations. This is essentially to suggest a fractal design in which at any constituent level the management schemes are patterned as much similar to the pattern which is apparent for the integrated level. For the people involved to act cohesively in the development process, the management should be endowed with a skillful Human Resource, which becomes available by conscientious initiatives of naturally talented people.

Hence, if it is a question of efficient management of resources of Meghalaya, it is imperative that it calls for a conscientious effort towards Human Resources Development in the North-East.

Pre-requisites for Evolving a Strategy for Human Resource Development

In accordance with the reasons put-forward in the previous section, it seems imperative that the people who are the on-the-spot managers for the local natural resources, must be all the time viewing the operations from a wider perspective including the fallouts into the neighbouring locations in the region and the refills from the neighbourhood into the specified management location in the region. This is necessary in order to ensure that micro level regulatory exercises at no stage becomes a confrontation at macro level because of the inattentive disposition of the people on the spot, to certain slow and inconspicuous changes at micro level. Such negligence, if it persists over the continued operation, which could be over a considerable length of time, then there can be cumulatively built-up manifestations. Perceiving such subtle changes at any given time and, devising precautionary steps for the cumulative consequences is the skill that is aspired for while human interventions and initiatives are called for. The required skill can be acquired only by the experience gained under instructions and, by the practice of the precepts innovatively for on the spot solutions. In the following sections, an effort is made to elaborate on the documented materials of Meghalaya in particular and North-East as a whole for the available natural resources and what messages it carries for inferring about the management of resources. Also a simple simulated data would be enough to caution against the possible erroneous projections when such data are subjected to statistical treatments as can be seen from Table-1. In this Table-1 a case of income/revenue data on constituent states in a region are used to calculate the corresponding gross regional level index, which results in ambiguities in calculated numerical figures. If the treatment of data is not sensible then, the whole effort might result in such sets of numbers, which sustains inconclusiveness and desperation while using this information.

Table-1: The columns for Revenue and the Populations have been arbitrarily distributed only to keep the corresponding regional Index constant. However, this simulated set of Data corresponds to a situation where the Regional Sums could have arisen from any of the combination of distribution in the columns for the states. The basic change that is brought out is in the Per Capita value which is calculated on the basis of the DATA for revenue and populations. Given the possibility that such varied revenue and population distributions can occur, what remained was a mere calculation by a machine from these figures the corresponding ratios and this row indicates a variation which may not be surprising. What could be surprising is that in spite of all arbitrariness and the varied ratios tabulated over the cells in the above table, the per capita value calculated at the regional level is the same even though the corresponding cells in that row varies from one set of distribution to another. Thus, if one concludes from the data for the regional value one may conclude there had been no change at all but looking into the details of the source data for the states there can be drastic changes reflected. How does one reconcile with such stunning contradictions and this if not properly appreciated can lead to a total demoralisation because the source data gathered cannot yield anything conclusive. Thus, for example, such drastic variation at the independent state level source data is for a lapse of five years, then the variation at the state level from one year to another does not reflect at all at the regional level over that length of time.

	State-1 [S1]	State-2 [S2]	Ratio S1 : S2	Sum S1 + S2 Region
Revenue R	100	5000	1 : 50	5100
Population P	20	200	1 : 10	220
Per capita R/P	5	25	1 : 5	22.3
Revenue R	2100	3000	1.05: 1.5	5100
Population P	20	200	1 : 10	220
Per capita R/P	105	15	7 : 1	22.3
Revenue R	1100	4000	1.1 : 4	5100
Population P	110	110	1 : 1	220
Per capita R/P	10	36.3	1 :3.63	22.3
Revenue R	2400	2700	1.2 :1.35	5100
Population P	110	110	1 : 1	220
Per capita R/P	21.8	24.5	1.09:1.225	22.3
Revenue R	2550	2550	1 : 1	5100
Population P	20	200	1 : 10	220
Per capita R/P	127.5	12.75	10 : 1	22.3

Data and Documentation on Natural Resources of Meghalaya

When an effort is made to keep abreast with the management of natural resources, a beginning can be made by trying to pursue the data and documentation available on this matter. The

convenient present day tool for documentation is the web sites published on the internet. Accessing this source of information is the popular way and the simplest now-a-days. This requires a well updated database as maintained by the web masters by periodically posting the changes in data and new initiatives in the web pages. An attempt is made in this section to provide an appreciation of such data available for the resources of Meghalaya.

Two Web sites can be cited for retrieving information on the resources of Meghalaya:

1. North-East India Regional Databank of the North-Eastern Development Finance Corporation Limited. [NER Data Bank]
   URL: http://databank.nedfi.com
2. Government of Meghalaya Official State Portal
   URL: http://meghalaya.nic.in

There are data documented in both the URL's for the natural resources of Meghalaya. A cursory look through them seems to apparently differ marginally. But the numerical figures are reasonably comparable to a large extent. The resources covered in the documentation are: Land, Water, Forest, Limestone, Coal, Kaolin, Clay and Minerals, Handlooms, Handicrafts, Fisheries and Live stock.

The Land, Water and Forest resources have been found to be well detailed. A mineral map of Meghalaya documented in the web pages comprehensively indicates the availability of mineral resources. The mineral resources of Meghalaya include Kaolin, Iron, Copper, Glass sand, Granite, Bauxite, Phosphoric rock, Limestone, Gold, Uranium ore, Fire clay, Quartz, Gypsum etc.

The statements made on the growth and development indices as reported in the website are seemingly irreconcilable when the situation for Meghalaya as reported is fitted to the information given for Meghalaya as a constituent state of the North Eastern Region. For the sake of making the readers aware of the "factual state of affairs" when documenting and reporting "factual data", the following passages from the web page documents are quoted: at the NER Data Bank [Web site no. 1 cited above] on Economy of Meghalaya the following statement was found: "In case of per capita income, *Meghalaya continues to lag behind from the national average*". Again in the NER Data Bank on

Economy of North-East, the following could be read out — "Growth in per capita income is almost stagnated in Assam since 90's, was better than the national average, in Meghalaya ....". What is stated later in the context of Meghalaya (in the context of North-East region) seems to be contradicting with the earlier statement while commenting of Meghalaya exclusively? This probably can be resolved if one critically reads and find that there could be such apparent contradictions if proper distinction is not made between *value of per capita* income and the *growth in per capita income*. But this is the source of contradiction and how it comes about is a matter that not many would be obviously aware. This warrants illustrating [as in Table-1] on such possibilities of conflicting interpretation of a given set of data even by the way simply the average values are calculated. As per documentations, detailed macro economic data for all seven states of the region are available from the year 1980–81 only. Through the entire period since then the per capita income in the region remained below India's per capita income. In the post 1991 years the gap has widened further.

The comment on the situation of Human Resources i.e., 'manpower availability' in Meghalaya is modest as quoted here: "Meghalaya has a fairly large pool of skilled, semi-skilled and unskilled labour". This statement as found in the Government of Meghalaya Official State Portal (Web site no. 2 cited above) is further studded with comments that there are a fair number of secretarial staff and a fair number of management and technical personnel with qualifications from recognized professional institutions. These are qualitative, and specifically do not point out the actual intensive efforts required in manpower training.

While perusing the web page contents for the situation on minerals, the following data could be found documented: For the period 1997–98, the total coal 'reserve' was 640×10^6 tonnes and the 'production' during 1997–98 was 3.234×10^6 tonnes. This probably would indicate production rate capability in Meghalaya for such a huge coal reserve. But an onlooker would start evaluating this data as to whether the production capability can be increased, at the given rate of production the coal reserves would seem to last as long as 200 more years. Then where exactly is the need and the necessity for this coal (seemingly large compared to the annual rates of production) reserve and what is the policy

that comprehensively projects the use of this reserve and where the readers can get hold of such information is not at this point in the web site. This means the tendency would be to note this data and keep on quoting without much inference. Hence to kindle the curiosity, beyond the availability of facts, the documentation should include links on the texts where it becomes "clickable" to open the relevant pages, where the further discussions and details are found readily documented. Similar look through the situation on Limestone in Meghalaya accentuates the importance of the comments made before on the coal data. Limestone during 1997–98 total reserve was 5000×10^6 tonnes while the annual production of Limestone during this period was 0.395×10^6 tonnes. While perusing the NER Data Bank web page on "Sectors having Investment Potential in Meghalaya" the quality of Limestone was specified with the CaO content of 53%, but the quality was not compared with any standards. Its utility could be in steel, fertiliser and chemical industries. But no mention was made on the actual places where this resource would be used; whether in Meghalaya itself this potential can find an outlet or is it necessary to involve outside locations — outside the state or even outside the North-Eastern Region. Thus the documentation of resource data must comprehensively cover all aspects of the resource management as envisaged in the Figure-1. Such documentation is possible with internet publications and this is the most convenient and compact way to document the data, inference and perspectives such that all are available at the same point only just a "click" away!

On the Scheme for Canalizing Human Resource Optimally for Material Resource Management

Either for one's awareness about one's own capability or to be leading others effectively (Leigh, 1996), there may be an *evaluation of the disposition* of the individual for the particular task and an *assessment of the aptitude* for the task.

The disposition of an individual can be favourable for undertaking a task because of the awareness that individual possesses by the tendencies of getting interested in such problems and tasks by the exposure from media and people. Thus, to systematically evaluate a person's disposition, it would require

collection of factual data provided by the respective individuals on their educational career and experiences. These could be mostly objective data gathered by appropriate questionnaire, which may be studded with a few subjective questions to know about their abilities to express the relevant facts with an inference on the purpose and content of the questionnaire. Probably, no photo identity cards would be required to evaluate on this aspect much less a personal interview. The evaluation should be objectively carried out only on the basis of the comparison of facts documented in the papers by the tabulators as was gathered from the questionnaires. The dispositions should be appropriately categorised and an index be assigned for inclusion in the final assessment with appropriate weighings for the disposition aspects.

The second, the assessment of aptitude requires setting a subjective questionnaire, which makes the candidates introspect about their own fitness for the purposes of career in the management of resources. The answers must be in one word or phrase or at the most one sentence long to reveal their version of the view points.

Having gone through an assessment and evaluation in the beginning, a mechanism must be instilled to update the impressions as and when the candidates gain experiences. Being in an organisation it is necessary to know how much of a global perspectives gets built-in while the persons solve and circumvent hurdles in the local on site situation. Thus, as much as it is required to keep an updated data base on material resources, it is necessary to maintain data bases on the human resource capabilities with updates and upgrading properly weighted. It is precisely this aspect, which becomes elusive; that is, how to handle the Human Resource data bases as much, as if they are on par with material resource management.

Comprehending the totality of the situation with a good grasp of the specific problem that has to be solved is the first and foremost criterion for effective management. Such a comprehension also enables the interpretation of the data by sensible statistical methods for realistic inferences. For example, the following kind of categorical understanding of words to use for describing the contexts with respect to materials management is a pre-requisite. When we refer to consumption which does not

seem to have harmful effects, but helpful for the present and produces good result, then it can be described as a "use" of material. When such a use has been accounted for properly from the economic point of view and sustainable growth and development, then such a conscientious consumption may be termed "utilisation". When the available material is put to use just for the sake of spending time because one does not have any other event to engage oneself with, it would be described as exploitation. In fact, when we have a material available in abundance but it is not known for consumption of any purposes, then trying to spend time to find out whether such an abundantly available material can anyway be useful, is an effort to exploit the material.

Unused and wasted materials should be exploited. But, it would be a crime trying to "exploit" in this sense materials whose value and worth are known and is also known to deplete because of demand for it. On such material if one tries to find some other use just for spending the time with it would be atrocious. Such materials should be put to careful utilisation and should not be left for wasteful uses. Such categorical description with conventional meanings (even if it is not established definitions) would help people become better aware of the value of the resources. This is all coming within the realms of Human Resources Development, basically improving the educational standards and literacy levels. This has to be much more broad based than the effort to focus only on on-the-spot requirements.

Thus, from the point of view of what has been described till now in this paper and viewing down the schematic in Figure-1, one can list out the kind of training the personnel should have, category wise:

1. Collection of Data, inventory making, and generation of data bases on the Resource Materials.
2. How to assign ownerships and how to allocate the natural material resources?
3. How to take cognizance of the ownership transfers?
4. Commercial aspects for the necessary business and trade related to the natural resource materials.
5. For items 3 and 4 one must know how to recognize the resource materials transformed as Commercial goods.

6. The policy matters related to the accountability of the available resource materials, where and how to put them to use: only to the local requirements or should the material be made available for global uses?
7. How to be aware of the technological possibilities and trends for effective utilisation of the resources. A very broad based technological awareness to be able to recognize the right technology that is required on the spot?
8. Can all these training be imparted at the very place where the materials are available in abundance and where they have to be processed?
9. With all the data available, there must be manpower appropriately skilled in the statistical techniques to subject the data to analysis for inferences. As pointed out in Table-2, there can be traps at elementary levels while seeking a statistical analysis. It requires much more talent to be discretionary about, which technique to adapt, over and above the skills at the techniques acquired assiduously. The criticalities of handling such data in the context of North-East region and the state of Meghalaya are vindicated in the papers of Subhendu Chakrabarti and Mousmi Majumdar entitled, "The Coal Reserves of North East India" (Husain and Barik, 2004) and K. Sarma, S.K. Barik and R.K. Rai entitled, "Impact of Coal Mining on the Nokrek Biosphere Reserve of Meghalaya" (Husain and Barik, 2004). In this context (particularly while pointing out the ambiguities of inferences as observed from Table-1), there is revealing example (Singh, 2004) of how the statistical and mathematical technique can reduce the data into compact forms of equations making the pages of source-tabular forms unnecessary, after such analysis. Which means the inferences can be stored and transported with much ease and more effectively. This is discussed below. The contribution was about the nutrient consumption pattern in North Eastern states of India. In the discussion below only the data for Meghalaya is copied and the consequences explained. The relevant data for the study consisted of data collected for the period from 1970–71 to 1993–94. The categories were the different kind of food items namely pulses, cereals, milk etc. For each of this category (1) the per capita consumption

value Y was gathered. And in the same locality the population X_1 in thousand persons, production of the food items X_2 (in ten thousand tones) and per capita State Domestic product X_3 are also obtained. Then these are fitted into a form of an equation $Y = b_0 + b_1 \cdot X_1 + b_2 \cdot X_2 + b_3 \cdot X_3$. This is a procedure called regression analysis and the values of the b's in the equation obtained by this analysis are tabulated.

Table-2

Food item	Constant	Population	Production	Income	R^2
Cereals	332.25	–0.2222	1.7378	0.0079	0.99
Pulses	2.15	–0.0012	1.7948	0.0001	0.67
Egg	0.04	0.00002	0.0002	0.0000	0.99

From the table, the b_1 value is negative. This indicates that consumption decreases when population increases which is a consequence that is understandable. Similarly, as income increases the consumption would increase because of the corresponding positive b value. If the 'b' value were positive for population column this must be interpreted as that the production increases much more rapidly than the increase in population. A comparison of the numerical positive value would further substantiate these trends.

Finally in developing region, with a multitude of race, religion, traditions, customs, and languages bringing a unity of approach would be upset since the Human Development will have to be ensured for Human Resource Development. For example a community participation in the forest growth and maintenance like the "Sacred Groves" is a more sensitive and subjective matter and all consideration of economics and education would be relegated to very low priorities in favour of maintaining the sanctity of sacred groves. The ownership, access to visitors all becomes much less a subject, which can be rationalised on the basis of humanitarian considerations but only the divine dispositions would be upheld. Then these kinds of activities and assets should be given an unquestionable exclusive status and trying to evolve logically continuative flow diagrams may not be possible covering these aspects. This is an aspect, which is more on the part of human development than

the Human Resource Development. Complications of these "Human Development" aspects are more than any kind of simplifications which people can aspire for on the basis of managerial techniques for the economic welfare. That people may have to reserve away a fertile land to be only for maintaining a few scared groves, while the production of staple food items may be under severe shortage. Here it would be difficult to alter the conventional and traditional priorities even pointing out the incentives of more food for per capita consumption.

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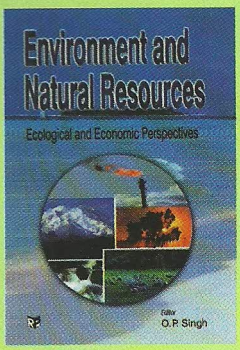

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