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THE IMPACT OF TECHNOLOGY ON POVERTY ALLEVIATION: THE
CASE OF ARTISANAL MINING IN TANZANIA

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A STUDY OF ARTISANAL MINING IN TANZANIA**

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

1.1 Small-Scale/Artisanal Mining Activities

Small-scale and/or artisanal mining in Tanzania can be traced back to the colonial period and has gone through different transformations over time. It has involved many of the minerals the country is abundantly endowed with, but mostly gold and gemstones, salt, kaolin, building and construction materials. In post independence Tanzania, however, its formal recognition is recent following the realization of its significant contribution to the National economy and as a significant source of livelihood for the rural population.

This sector has been a significant employer especially in the rural areas. Being largely a labour intensive operation, it has a greater impact on employment than the large scale mines. The most recent study conducted by TANDISCOVERY Ltd. (1996) contends that more than 555,000 people are directly involved in mining activities around the country. In addition, a number of people are involved in the delivery of social services, e.g., food supply, health, personal services like recreation and entertainment. Artisanal mining has also been discussed in relation to the significant incomes it generates to certain population groups. Although it may not be realistic to establish a fixed amount of income for such activities, estimates on incomes indicate that some participants earn incomes that are more than the current government minimum salary.

The sector is however plagued by various factors which limit its operational and productive capacity to become a reliable source of livelihood for the entire population concerned, despite its attractive potential. Gross inequalities in having access to mining rights, distribution of income, coupled with poor technical know-how, inadequate technology and thus low productivity and other constraints have trapped most of its population in poverty.

1.2 Research Objective

This study set out to explore the following broad objectives:

- Identification of technological problems facing artisanal mining;
- Exploration of socio-economic aspects related to artisanal mining and their inter-relationship with technological issues.

1.3 The Choice of Artisanal Mining

In identifying the research problem in relation to poverty alleviation, the choice to focus on artisanal mining activities within the Mining Industry was based on several considerations regarded as essential in understanding poverty. These reasons include among others, the following:

- There is usually a misconception amongst many people, that those involved in mining activities make a lot of money despite the risks involved. This belief is among many reasons that attract a large number of people to such activities;
- Artisanal mining activities involve small-scale production processes which attract/absorb labour that is otherwise disadvantaged, unemployed, vulnerable, etc. In other words, these activities generate employment mainly to the rural majority;
- The activities are wide spread in the country and thus offer areas where production capacity can be expanded to improve the well being of the participants if technological application is improved;
- Artisanal mining offers the conditions to study how the organization of labour can determine access to benefits of production even with improved technological application and hence inequality and poverty.

1.4 The Study Area

This study was conducted in the following mining areas, Mgusu (gold) in Geita, Rwamagaza (go in Geita, Mabuki (diamonds) in Misungwi, Merelani (tanzanite) in Arusha and Matombo -Ng'ong'olo (ruby) in Morogoro. The criteria for the selection of these areas included; (i) Representative samples in terms of the minerals in which most artisanal miners are involved. Available documented statistics state that most artisanal/small scale miners in Tanzania are engaged in gold and precious stone production. (ii) Mineral variety was also a factor in selection, hence the choice of gold, diamonds, ruby and Tanzanite. (iii) Accessibility: During the time of this study, certain areas were inaccessible because of government restrictions, e.g., Bulyanhulu and Tunduru. (iv) Budget restrictions also influenced the nature of selection.

2.0 RESEARCH FINDINGS

2.1 The Population

Various factors question the accuracy of drawing figures for the populations involved in artisanal or small scale mining activities in Tanzania. These include the miners periodic shifting nature to other areas, the inability in many cases to distinguish between who is involved in direct production who offers support services especially due to the nature and location of the 'mining settlements' in question. As such, only estimates relating to the period the study was conducted can be drawn.

At the time of this study (Feb. 1996), the total population in Mgusu was estimated at 8 - 10,000 people with about 1500 - 2000 people engaged in direct production. The estimates of people involved in direct mineral production is based on the number of operating pits which were nearly 200 at the time of the visit with 120 having been abandoned. Estimates at Rwamagaza puts the

population between 3 - 5,000 with most being permanent members of nearby villages. A number of those directly involved in mining was estimated as 1000.

In Mabuki there were 27 registered mining groups of about 6-10 people each which put the number of those directly involved in mining at around 142 - 270. Based on the number of registered claims in Merelani it was estimated that the total population is 16, 710 people with 13410 engaged in direct production and 3300 offering support services. In Matombo (Ng'ongolo), it was estimated that on average, there are 240 -320 miners engaged in alluvial mining and 72 in hard rock gemstone mining, giving us a total of 312 - 392 people directly involved in mining.

2.2 Work Organization and Division of Labour

There are different labour divisions within the artisanal mining sub-sector most of which are neither known nor recognized by the Government. The labour divisions have evolved as a result of several processes that under normal circumstances would make economic operations impossible. Without any starting capital most claim holders and other operators have resorted to these divisions the rewards of which are based on productivity. The divisions include the claim holders who are the owners of mineral rights, pit owners or those who rent part of the concession from claim holders, mine workers who do the manual labour , and, specialized working groups who carry out work on contracts. Other divisions include those who reprocess tailings to recover minerals (mainly women and children) and those who provide social services like food and drinks vending, trading, supply of water, etc.

2.3 Groups Interrelationships

Most miners enter the trade with very little or virtually no working capital and resources at all. Hence many of them become sponsored either by claim holders, mineral traders and businessmen/women under agreed terms. The relationships between mineral traders (Mineral Dealers and Brokers) and the production groups named above, range from minerals trading to provision of financial or material support (sponsorship) for production activities. Mineral dealers and Brokers usually provide such support on agreements for a guarantee to purchase all minerals produced from which their investments is also recovered. Some claimholders and pit owners also operate as mineral dealers and brokers would usually obtain their share after production, and if they have provided material support to miners, the recovered minerals would be sold to them. The main characteristic of the relationship between claim holders, pit owners and mine workers is the sharing of the production proceeds. In most cases the production proceeds (usually the ore) are distributed at a pre-determined rate e.g., 60% or 70% for the pit owner and his workers, and 40% or 30% for the claim holder. Sometimes the pit owners and mine workers are paid in the form of working in a shift of their own for 1 - 3 days.

2.4 Productivity

It was observed that in Mgusu, 4 people would usually produce one bucket of ore per shift. Estimates put this to about 0.034 tons per shift or 0.068 tons per day. Gold production estimates put it at 4-6 gm per day. With these figures, and assuming a recovery rate of 70%, the average grade of ore mined varies from 84 gm/t to 126 gm/t. Estimates for Rwamagaza was put at 12 gms of gold per day and the average grade at 131 grams per ton. Estimates for gemstone mining were difficult to establish

due to the complex nature of their geology. This is typical to all artisanal gemstone mining. The production figures for Matombo are based on estimates since during the visit, there was an acute shortage of water and hence no recovery was possible. When there is enough water for washing the gravel it was estimated that only an average of 3.5 tonnes can be washed per day with the screening method available.

2.5 Incomes

At Mgusu, the office claimed that production levels had dropped significantly to 4-6 grams a day. This was due to the transient nature of their activities, e.g., they periodically shift to Bulyanhulu, and of late to Tunduru. At the current price offered by NBC (February 1996) of Tshs 4,250/= per gramme of processed gold to TShs. 4500/= per gramme of native gold, this averages to TShs. 17,000/= - 25,500/= and 18,000/= - 27,000/= per day respectively. However, the parallel market prices vary from TShs. 6,000/= - 7,000/= or 24,000/= - 42,000/= per day.

In Merelani, due to high secrecy of miners regarding their productivity it was rather difficult to establish actual production figures from these operations. However judging from the material accumulation and levels of expenditure of pit owners, their earnings are quite substantial. Average income per month per pit in Matombo was estimated to be TShs. 200,000/= per month. This amount when divided by an average of 6 people per pit was TShs. 30 - 40,000/=. But this is an unreliable estimate since occasionally, the miners scoop stones worth TShs. 1-3 million, or they may not get any worthy stone for a very long time. Hence it is erratic to establish a fixed amount of income for such activity.

2.6 Technological considerations

In all mining sites visited, except in Merelani, it was observed that the equipment and tools were very rudimentary and the techniques very basic and wasteful. Mining equipment in most sites included, picks, shovels, hoes, hammers, sharpened drill steels or chisels, sisal ropes and sacks, and, buckets. In Merelani, there was a large number of equipment like compressors, diesel engines, wire ropes and drilling machines and all their accessories. This resulted in substantial production figures compared to other sites. However, it was also observed that despite having mechanical equipment there was little know-how on their efficient usage. Compressors were underutilized and most used jackhammers without water lines in underground environment and thus risking inhalation of large amounts of dust and fast wear of drill bits. There was a wide use of explosives including cable explosives (Cordtex) and electric detonators. Miners in Matombo also used explosives in hard rock gemstone mining or in dislodging large boulders in alluvial mining. Specialized groups were be hired in most mining sites to carry out blastings. The area of Mabuki, Matombo and Rwamagaza had severe flooding problems due to high water tables in the area and lack of pumping facilities. Movement of ore from underground was being carried out manually with the help of self made wooden pulleys.

Minerals beneficiation was no exceptional in that both crushing and grinding were being carried out manually mainly by using hardwood mortar and half axle pestle. Other processing equipment include hand hammers, steel pans sacked strakes and buckets. In Mugusu, a hand made ventilation fan was being used to ventilate working areas in deep pits.

2.7 Institutional and Organizational Aspects

The organizational structure of the Mineral Resources Division (MRD) of the Ministry of Energy and Minerals (MEM) which is responsible for the mineral sector was found inadequate to cope with the fast growing artisanal/small-scale mining activities. The division was found to have inherent problems of shortage of staff in relation to the mining area and population to be served, the lack of working facilities, a small budget for monitoring and inspection of mining areas, and shortage of technical expertise. Most of the areas visited had problems with ownership of mineral rights, e.g., Mabuki, Rwamagaza and Merelani. Despite the fact that zonal/district offices were aware of these problems, they were incapable of solving them due to lack of work facilities like transport and even stationery.

Miners complained on the lack of effectiveness of their associations. It was noticed that most miners associations were being used as occasional forums for mobilization and representation in mining disputes. As a result, most miners had started forming alternative associations, e.g., "Umoja wa Wachimbaji Mabuki", (UWAMA) instead of MWAREMA and MINASCO in Merelani instead of AREMA. There were similar complaints in Morogoro against MOREMA where miners thought their interests were not being represented. In addition, local government leaderships in the mining areas complained of not being involved in the management of the sector.

2.7 Marketing, Finance and Credit

Most gold miners claimed to have been selling their gold through the Bank of Tanzania and hence were disappointed by the bank's withdrawal. However, at the time of the study, the NBC, Geita branch was still buying gold from small-scale miners. It was also noticed that the price offered by the banks were too low a factor which encouraged illegal gold trading. While there was hardly any market for the green rubbies in Matombo, the diamond miners in Mabuki and Tanzanite miners in Merelani were overwhelmed by dealers.

While most of the financial institutions consulted indicated their willingness to provide financial support to artisanal miners, the conditions attached to such support proved to difficult to meet. For one, the mineral rights tenure period of one year without any guarantee for renewal, can hardly be acceptable by these institutions.

2.8 Healthy and Safety

Although the study did not find enough reliable data on health and safety, it was established that the rate of mining accidents in the pits is low compared to the health hazards and illnesses occurring in the settlements. Most settlements were overcrowded in poorly ventilated makeshift huts. There was a clear lack of adequate sanitation facilities; the source of water for domestic use was the same as that for mineral processing; crushing and grinding (e.g., Mugusu) were being carried out within living quarters and thus releasing enormous amounts of dust to the compounds, and other visible health hazards. However, despite the low level of accidents, the lack of protective gear in both mineral extraction and beneficiation, make their working environment more dangerous. Poisonous chemicals like mercury were being handled without following any safety procedures and there was little awareness of their dangers.

2.9 Women Participation

Women entry into direct production is often determined by taboo, socio-cultural factors, financial and economic capacity, technology and organizational aspects. Within these, the study established that women are mostly concentrated in mineral processing activities. Fewer women are involved in pit mining, for example, in reef gold mining probably because of its strenuous nature and too much risk involved in such activities. Other women's participation was conditioned by marital obligations, e.g., those involved as wives working with husbands (Mabuki and Matombo). Sometimes wives follow husbands and work in the pits owned by them. It was not however very clear how the relationship in income distribution was since in some areas the women declined to expose the modality of sharing profits claiming their husbands were the spokes-persons.

A few women were directly involved as claim title owners, investors and dealers (Matombo and Merelani), with the initial capital having been acquired from other businesses like bars, hotels or food catering to the miners and later invested in mining. The rudimentary and often risky underground mining technology used was noticed to inhibit most women from direct participation. Not much evidence could be shown on women group formation in mining. They were witnessed frequently employed as casual labourers in gold processing (Mgusu and Rwamagaza), and in Ruby screening (Matombo).

3.0 ANALYSIS OF FINDINGS

3.1 Social Organization and Division of Labour

A fundamental issue that needs to be addressed in the question of artisanal mining and poverty, is identifying to whom the question of poverty alleviation is focused. This is essential because under the current set-up, there are obvious differential dispositions and benefits accruing to the various population groups within direct or related mining activities. Because of the informal labour divisions that have cropped up in artisanal mining areas the following problems arise:

- (i) The claim area is turned into a series of haphazardly located pits that are detrimental to the miners' safety and the environment.
- (ii) The system is exploitative in that apart from paying for the license, most claim holders invest nothing in the area but reap the highest benefits.
- (iii) The division of earnings between the claim holder/pit owner and the miners is usually determined after deducting the operating costs. There are usually no records of these costs other than a word of mouth from the sponsor.
- (iv) The welfare of miners is in their own hands as they are not regarded as employees but as people with a non-binding contract with the pit owner.

3.2 Income

It was very difficult to establish a monthly rate of income for this sector because it all depends on successful production of minerals and also because the miners never keep records on production (i.e., they neither have data nor provide returns on production), or submit under stated production figures. Nevertheless, it was established that the incomes from successful activities are quite significant although they vary according to area, type of mineral and the number of people involved. In most

cases, incomes are unequally distributed among the mining population (i.e. those engaged in production and the claim holders). In this respect, a majority of the mining population are still deprived economically and become trapped within the production system in expectation of breaking even in future.

3.3 Vulnerability

Vulnerability is an important dimension of poverty in artisanal mining basing on the 'delicate' social and political environment the miners operate within. Conflicting property (land) ownership policies render small miners vulnerable to dis-ownership when bigger or state interests overrule in the guise of compensation which is hardly worth the property (ref. the mineral rights overriding all surface rights), or the discrimination in offering prospecting rights to otherwise publicly owned land. Even under the current liberalized system where miners have to enter into negotiations with bigger companies interested in their areas, the idea of a fair game, is still far fetched. While big companies have the capacity to engage lawyers, engineers, economists and other professionals in negotiations, most artisanal miners do not have that capacity and can hardly understand, interpret or sometimes even read the negotiated contracts.

3.4 Institutional Aspects

It was established that the Government institutions, including the MRD of the MEM have failed to cope with the rapidly expanding artisanal mining activities in the country in terms of the provision of technical, regulatory and financial assistance. The coordination of functions and responsibilities between the zonal and resident/district offices often lags behind the need for mining rights and technical expertise. These deficiencies have impeded the creation of a suitable environment for the development of artisanal mining. In addition, the Government has not yet devised an equitable transfer system of revenue accrued from the mineral economic rent between the central and local Government.

3.5 Property Ownership Rights

There are a number of constraints stemming from related legislation or inefficiency in the implementation of existing law or policy directives. Protection of land ownership is the foremost significant aspect reflecting a concrete desire for development of artisanal mining. However, there are a number of conflicts in artisanal mining areas most of which arise from the traditional v/s modern interpretation of land rights to which compensation is warranted, and the fact of mining rights overriding other land ownership rights. Other factors giving rise to these conflicts could be summarized as misconceptions on the part of the miners on legal ownership or mining rights versus the existing land policy, and, the lack of will to compromise between the two sides.

3.6 Policy Issues

It is the policy of the Government that artisanal mining areas be limited to indigenous Tanzanians only. As such, foreign investors are not allowed to operate in these areas unless there is a transfer of mineral rights. At the same time, it is also the Government's policy to encourage access to appropriate technology and finance by artisanal miners in a bid to transform their activities to more organized operations. It is the view of this study, that these policies are contradictory and thus self defeating despite the good intentions. Mining (small or large) is a capital intensive undertaking and

thus beyond the capability of most indigenous Tanzanians. The criteria upon which special areas for artisanal mining can be set-up is technically questionable. In addition, setting up such areas denies artisanal miners the chance to access both finance and technology through joint venture partnership.

3.7 Tenure Period

Mineral Rights for artisanal miners are issued for a period of one year. This period was gathered as limiting especially when miners try to obtain loans or go into joint venture partnership.

3.8 Marketing

There are currently many deficiencies in the marketing system which have a direct implication to the artisanal miners. Firstly, there are limited opportunities for marketing within the production areas. The sudden withdrawal by the BoT from purchasing gold and the inability to quickly replace it with another marketing arrangement have resulted in the expansion of illegal gold trading. Secondly, the prices offered by the BoT were too low compared to world market prices a situation which encouraged miners to resort to informal marketing channels. These are aggravated by the lack of marketing information to miners.

3.9 Cooperatives and Associations

The failure of most Regional Miners Associations, REMAs, to act as a coordinating organ between the Government and miners was attributed, among others, to lack of operating funds, poor management skills by the leaderships and the pursuing personal interests rather than those of their members. Other major factors include, the mode of establishment of REMAs which was through a top-down approach after being initiated by the Government, the nature of their memberships and the lack of determination by miners to collaborate.

3.10 Technological Issues

The problems associated with technology being applied were noticed at all visited sites. The lack of appropriate working tools, lack of capacity to fabricate even the simple tools, lack of supply channels even to those who can afford them and the lack of information and technical know-how on all technical mining issues, were noted at every level of artisanal mining. In some cases miners refuse to use new safer techniques and tools due to lack of know-how, e.g., the refusal to use amalgamation retorts which were offered to them free. Some mining sites are abandoned prematurely due to lack of knowledge on the geology of the area or sometimes due inability to contain water inflows. As a result of application of poor technology, productivity is very low and hence the incomes. The low incomes coupled with the lack of financial and credit facilities and lack of technical information mean that miners cannot invest in better technology. This results in a negative circle which has trapped most miners in poverty. In addition, the application of poor technology means that miners pay little attention to environmental problems resulting from their activities. The health and safety of most miners and neighbouring communities are put at risk due to the consequences of the application of poor technology. These problems are aggravated by the lack of technical advice on sensitive issues and the lack of training facilities.

4.0 EMERGING POLICY CONCLUSIONS

4.1 Legal Ownership

Most of the problems within the artisanal mining sub-sector emanates from the unregulatory and informal nature of the sector itself. Furthermore, in this context, the sub-sector deprives the government of the revenue it deserves. Hence, it is recommended that:

(i) The Government should streamline processes of licensing to facilitate the acquisition of prospecting rights and claim titles in order to ensure identity and the responsibility to invest in production.

(ii) The size of the claims issued to artisanal miners should be pegged to "ability to develop". The current system have resulted into landlords who lease licensed areas and rip the highest benefits without making any investment.

4.2 Capacity Building

The weaknesses in REMAs could be mostly attributed to their lack of representation of the miners' interests. There is thus a need to enhance the capacity of REMAs to enable them to support their members effectively. In addition, efforts should be made to promote formation of miners' associations based on shared interests. It is recommended therefore that the Government should formally encourage and facilitate the establishment of miners' groups based on voluntary collaboration, sharing of common interests and common goals. These groups or associations should be free to collaborate with any local, national, Governmental, non-Governmental or private organizations in promotion of their interests.

4.3 Financial Support and Credit

Promote access to loans and equipment leasing programmes through the establishment of special credit institutions, while ensuring that they offer interest rates which are affordable and reasonable to artisanal miners.

4.4 Marketing

It is recommended that the government should make deliberate efforts to reduce the amount of paper-work dealers have to endure, facilitate availability of marketing information, improve miners' marketing knowledge through training schemes/extension services, facilitate and encourage financial institutions to provide credit schemes. Extension services in marketing should also cover areas like educating miners on minerals' valuation and grading, promotion of mineral auctions in collaboration with miners' associations and other NGOs. Whilst strengthening the monitoring and record keeping systems that would enhance control over parallel markets, efforts should be made to encourage mineral dealers to acquire licences. For this to succeed, licensing procedures should be made less bureaucratic.

4.5 Monitoring and Coordination

Since it can be gathered that the financial constraints of the MEM are not likely to be improved soon given the current economic capacity of the central Government, and also given the fact that the lower administrative structures may be the most appropriate managers of local resources, there is a need to decentralize certain functions of the MEM to the Zones and regional administrative offices to

facilitate the overseeing and monitoring of artisanal mining activities. We therefore recommend that the Government should re-categorize the control of mining activities and revenue from a centrally based approach to include more decentralized interpretations.

4.6 Training

Without enhancing the miners' abilities to deal with problems associated with their operating environment, it might prove difficult to provide tailor-made solutions to them. It is therefore recommended that training programs should be arranged in order to provide miners with mineral extraction and beneficiation, marketing, mining regulations, health and safety, environmental, financial and other techniques best suited to their site's geological conditions, education levels and investment capabilities.

4.7 Environment

For adequate management of all natural resources, it is recommended that:

- (a) There should be an established integration between the various relevant institutions which are in one way or another related to natural resources. This can be in the form of coordinating training, awareness, monitoring and regulating programmes.
- (b) Efforts should be made to put in place an integrated environmental mining policy that would provide guidelines on:
 - (i) Discharges of mining waste to the ground and water bodies;
 - (ii) Air pollution control;
 - (iii) Importation and use of toxic chemicals;
 - (iv) Health and safety, etc.
- (c) Environmental indicators should be put in place so that the set standards and regulations can be easily enforced through monitoring and inspection.
- (d) Regular monitoring programmes should be organized through existing zonal and district/resident mines offices. For this to succeed, adequate resources in terms of trained manpower and working facilities should be made available.
- (e) Over time, as miners' awareness over environmental issues is raised, plans should be made to peg certain standards to the renewal of mineral rights. Past records provided through the monitoring programme over individual licenses should be used in this exercise.

4.8 Availability of Technical Information

Availability of mining related information would enhance miners' efforts in running their day-to-day activities. It is therefore recommended that the government should develop special program aimed at providing information to miners. For example, designing simple drawings and leaflets in Kiswahili, visual aid facilities like cartoons and films to the miners. The radio is one of the communication media that miners have access to. Therefore, special programmes on specific issues can be disseminated to a wider audience so as to create mining interest to the non-mining community.

4.9 Equipment and Working Tools

In order to improve the miners access to appropriate equipment and working tools, the following are recommend:

- (i) To encourage local engineering institutions, entrepreneurs and workshops to adopt, design and develop appropriate tools taking into considerations the local working environment.
- (ii) To strengthen and provide support to fabrication units that exist within the mining areas.
- (iii) Promotion of hire/purchase schemes on mining and processing equipment.
- (iv) To encourage the provision of centralized services, especially mineral processing facilities.
- (v) Where necessary, to provide clear importation channels for mining and processing equipment.

4.10 Use of Explosives and Other Hazardous Chemicals

Because of the current indiscriminate use of explosives and other chemicals, it is recommended that:

- (i) The Government should ensure, through zonal and district mining offices (using trained mine inspectors), that the current regulations regarding the handling, storage and use of explosives, are being observed by miners.
- (ii) The distribution of explosives should strictly be through authorized agents who should in turn ensure that they are sold to license holders only.
- (iii) Explosives storage facilities for small users should be made available through mines offices. In addition, designs of these boxes should be made available and mine inspectors should inspect and approve privately built storages.
- (iv) In order to encourage miners to acquire blasting licenses, special training programmes on explosives handling should be conducted in mining areas.
- (v) It is also recommended that the Government should regulate the importation, distribution and use of dangerous chemicals like mercury.

4.11 Energy Sources

Lack of adequate sources of energy is one of the problems that still makes artisanal mining so dependent on labour intensive techniques. In addition, the available sources are either too expensive for the miners to afford (e.g., electric generators and internal combustion engines) or are too far from the mining areas, e.g., the electric grid system. With this in mind, it is recommended that efforts should be made to encourage research in affordable sources of energy by taking into consideration the remoteness of most mining areas. Such sources include, solar energy, small hydro-based plants, wind energy, water wheels, etc. Research institutions should be encouraged to direct their efforts to search for cheap energy sources the outcome of which might have far reaching benefits.