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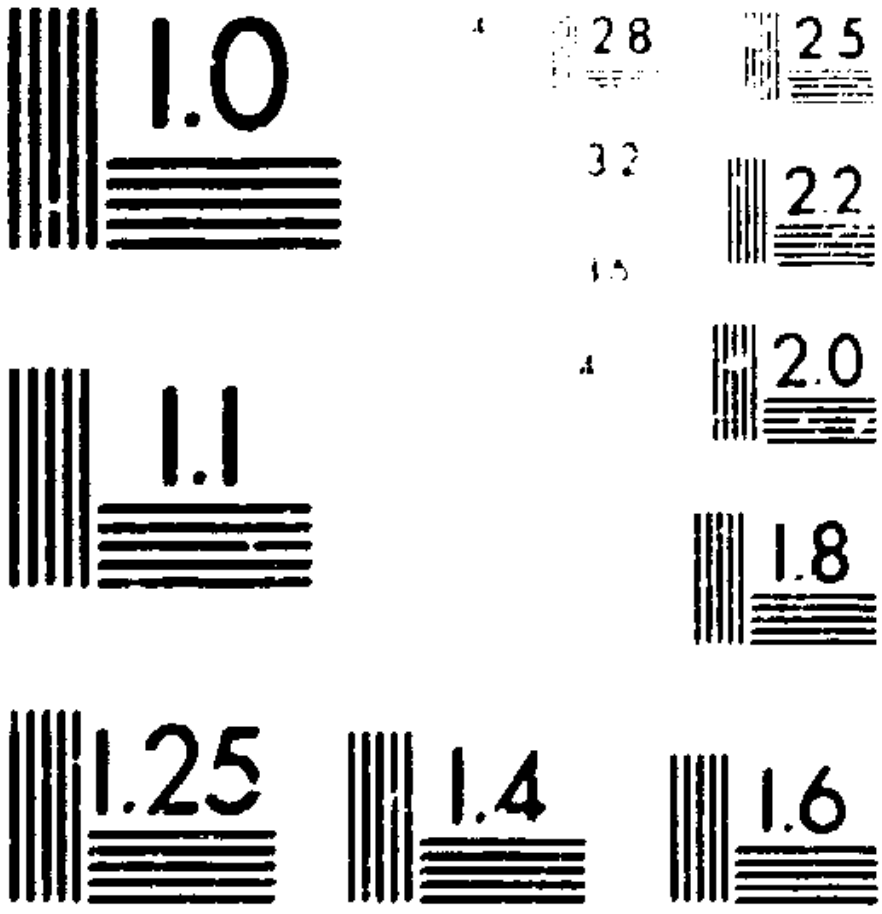

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COMMERCIALIZATION OF RESEARCH RESULTS*

by

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The topic of discussion is very clear in the sense that it should cover research activities together with commercialization attempts of such results. But it should not be taken literally as clear as it sounds, since both of these concepts are products of a sophisticated society and their synthesis have often been definitely time consuming and loaded with uncertainties not only in the least developed countries like Nepal but also in the advanced countries from where these concepts have emanated. Talking honestly, I feel a sense of loss at the very outset to say that our collective experience in this regard is fragmentary and prone to give rise to misunderstanding and misgivings.

In order to smoothen the international flow of research results and transfer of technology and simultaneously develop local capability, it seems that understanding of technical details do not guarantee the desired outcome, unless some broder issues relating to environment are properly addressed. When most of the developing countries in this region are trying to grapple with the concrete issues they are facing, we, in Nepal, are still searching a viable framework so that it would be effective to solve specific problems arising out of its peculiar geographical position and difficult terrain. I sincerely apologize for any detour from the context, if any, and hope for the sympathetic consideration of this crucial factor by all concerned.

State of Arts of Commercialization of Research Results at National Level

Institutional Arrangements:

Till very recently, there was no central agency responsible for the promotion and development of science and technology as such in Nepal, although there were a member of institutes/agencies engaged in research and experiment of mechanical processes, application thereof and in a very limited way commercialization. Since the history of such effort is of recent origin, it is still uncoordinated and inadequate. Therefore, in order to identify the priority areas, itensify the efforts where needed, eliminate the duplications, coordinate the actions and create and

subsequently nurture the atmosphere conducive to the development of science and technology, the Royal Nepal Academy of Science and Technology (RONAST) was constituted in December 5, 1982 in Nepal.

This event has been emphasized here because of the correctness of approach and tone it has set during this short period of its operation. Although its objectives and policies are broad and all encompassing with regard to development and promotion of science and technology in the country, it is pertinent to note a few areas in which we are presently interested viz. "encouragement to the promotion and application of science and technology in the private sector", and "supervision of application of technology in the industry and other sectors as well as transfer of appropriate technology."[1/] It should be noted that research results need not be purely indigeneous in their content in order to be successfully applied; if their appropriateness with regard to physical environment and human considerations are established. Needless to say that foreign research results are cost effective and yield quick return, if the transfer of technology embodying such research results are adapted to the local needs.

The following table* illustrates the types of adaptive research works undertaken by Nepalese institutes and agencies. Many of them, however, deal with promotion and dissemination of known technologies with little modifications.

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1. Royal Nepal Academy of Science and Technology - Brief Introduction.

* Condensed from a disucssion paper on "Scientific Research, Technology Development, Transfer and Dissemination": Some Guiding Concepts" prepared by RONAST, May 1983.

Sector	No. of Identified Priority Areas	No.of Research works undertaken (including promotion and dissemination of known technologies)	Institution Involved
1. Agriculture	13	3	Dept.of Agriculture, Livestock and Horticulture
2. Irrigation	8	3	Dept. of Irrigation, UMN, BYS, Nepal Hydro
3. Dottage & Small Scale Industries	14	4	BYS, SATA, UMN
4. Industry	20	1	RECAST
5. Transport & Communication	16	4	Dept. of Road, BYS, UMN
6. Energy	26	14	BYS, UMN, RECAST, Nepal Hydro RCUP, Institute of Forestry, Dept. of Agriculture
7. Housing & Construction	20	6	Himal Cement, RECAST, NCCN, HBTF, TMB Shotcrete
8. Education	15	3	BYS, Dept. of Cottage Industry and Private Institutions
9. Health and Nutrition	15	10	Royal Drug Ltd., BYS, UMN, Dept. of Agriculture, East Consults.

The above table reveals the urgency of research works in every area particularly so in the case of industry and cottage and small scale industries although agriculture also lags behind the need together with other sectors in a appreciable way. However tentatively the facts in the

table are assembled and presented, it shows that we have hope in the area of health and nutrition as well as energy sectors. Both the sectors being prime movers for the development of human as well as physical factors, we can be satisfied with ourselves that the direction of effort is not misplaced. Until some breakthrough is attained in these sectors, no progress is possible on other fronts, in spite of mutual interdependence of all the sectors of the economy. But satisfaction would not be worthwhile unless promise is turned into prospect and prospect into practice.

Application of Results and Linking Mechanism

When we talk of linking mechanism, we should distinguish between indigeneous and foreign research results as well as mechanisms because the former is ruled by patent and trade mark laws and regulations while the latter is governed by technology transfer laws and regulations. Sometimes there appears to be no clearcut frontiers between the type of research results and their application mechanisms, but still we maintain this distinction in order to facilitate the analysis.

Indigeneous research efforts, though limited in coverage, have been presently directed towards multipurpose water wheels, small turbines for electricity generation, equipments or devices to use solar energy for the purpose of cooking and water heating and dehydration of vegetables and fruits, adaptation of equipment and mechanism to use bio-gas and bio-mass for producing energy. Alongside, there have been some efforts towards appropriate loor making and appropriate modification in the traditional paper making technology. We will dwell on these in the following pages.

a. Vegetable Dyeing Process:

Here I would like to mention a relatively unpublicized case of vegetable dyeing of woolen carpets for export. Woolen carpets has begun to be exported from Nepal since a decade back as a non-traditional export item. It has seen many ups and downs during this formative period. But from the application of technology point of

view, it suited the ethos and historical consciousness of the Nepalese society. Initiated by a few exporters based on import of raw wool from Tibet, dyes and other stuffs from India and other countries it generated substantial employment of Nepalese labour. With decentralized operation of activities and combined by imaginative local artists and Tibetan refugees craftsmen, this activity gained a momentum of unexpected proportion during later stage. But this scheme had a lacuna in that the imaginative faculty of the local artisens was restricted to the availability of foreign materials due to heavy import content of material components. Therefore, it had to face the fate of decline caused by deterioration in quality, despite the edge of low labour cost. After intense research on the selection of materials coupled with application of new-found dyeing methods developed indigeneously, the export level has been restored after three to four years of uncessant effort. Instead of depending on cut-and-dried dyeing methods and materials, research was carried on along the line to find a suitable combination of locally available materials and processes, by which the aesthetic quality of end products could be enhanced and could be made more appealing to the foreign importers. Still there seems to be enough room for improvement. It has yet to satisfy the equity consideration in that those who are involved at the lowest rung of operation have not benefited proportionally. Thanks that it has attracted the attention of experts and process simplification work is underway. Hopefully the solution will be found out soon.

Elsewhere I have stated that it suited the ingenuity of local populace. Why so ? Firstly, the operations were decentralized and many of which were carried out at home. Secondly, pecuniary risk was undertaken by someone who was well placed to do so. Thirdly, the technology of dyeing has now been based on local resources.

b. Small Water Turbines, and Multiple Use Water Wheel

Nepal abounds with water resources quite disproportionate to her land area.[2] Composed of numerous river valley systems, Nepal's hydro-electric potentiality has been estimated at 83 million KW and per capita avialability at 48,000 KWH. Against this potentiality, the present production capabilities is around 29 KWH per capita. One wonders why such a big gap exists. The answer is quite simple that development of hydro-power requires more in terms of fixed capital formation although operating cost is minimal. Not only that, systematic observation and study over long periods of time is required to assure that the installation might not be washed away. Distribution problems and costs are enourmous again. Therefore, till such time these hurdles are cleared and large scale projects are taken up, appropriate technology in terms of low capacity and low cost turbines have been considered necessary if any improvement in the plight of rural Nepal is to occur. As energy is a pre-requisite to any meaningful economic activities, it was and is still appropriate to advise plans to generate, combine and popularize the cost effective and suitable technology in this regard.

Water has been traditionally a source of power in Nepal. One recent estimate suggests that between 25,000 and 40,000 horizontal water wheels are operating in Nepal.[3] Their operating efficiency was found to be as low as 20% in average. Efforts were undertaken with an aim to replace these inefficient devices by efficient ones. During 1973/74 Balaju Yantra Shala (BYS) Kathmandu developed cross flow turbines and installed a number of them. Since then Butwal Engineering Workshop (BEW) and a few other workshops began manufacturing

2/ Hydro-electric potential of Nepal's river courses is estimated at 83 million KW. Compared to 0.11% of world area, this potential, turns out to be 1.5% of the world potentiality of hydro-power generation (theoretical). Dr. H.M. Shrestha - "Hydro-electricity Development in Nepal - An Overview" printed in Nepal Industrial Digest 1983.

3/ A Bachman and A.M. Nakarmi - Himalayan Waterwheels (RNAM Newsletter, ESCAP April 1984).

such turbines. Upto now approximately one hundred and fifty of these turbines are functioning all over the country. Of these about seventy are manufactured and installed by BYS, majority of the remainder by BEW and a few by others. In what follows hereafter, the features of BYS equipments and their application is discussed.

BYS equipments have two variants known and T-7 and T-6. T-7 variant is a low capacity (5-20 KW) dismantable and portable machine. Its aim is to replace traditional water wheels and to enable to operate a number of machines simultaneously on account of its higher efficiency levels (more than 2.5-3 times) e.g. rice hulling, wheat and maize grinding, rice flattening, saw milling etc.

Inspite of room for marginal improvement in quality and efficiency, basic consideration in manufacturing this type of cross flow turbine is that its cost be kept minimum in order to suit the financial means of rural people and that it be manufactured in pieces so that it could be carried otherwise even in the absence of modern means of transport and communication.

Another variant i.e. T-6 is aimed to generate electricity. It has relatively higher capacity (upto 50 KW now and possibility of upto 150 KW) than the previous one has. It is a compact model and therefore considerations of reliability and efficiency are taken into account. More than a dozen of outfits are operating now with this type of equipment. A few are exported abroad also. Judging in the context, this piece of equipment is reasonably efficient, its turbine efficiency being within the range of 70 - 75%. Despite being so, only about a dozen machines with 350 KW of cumulative electricity generation capacity have been installed (worth Rs. 2.8 - 3.0 million*) during the course of half a decade's time span.

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* US$ 1 = Rs. 17.40

Bottlenecks: It seems that there is not a single bottleneck but a series of bottlenecks in the process of commercialization of research results. Both internal and external factors (not only to concerned institution) have their proper share of blame. The list would be long and it would inevitably reflect underdevelopment syndrome. Resistance to change due to inability to adjust oneself to a new situation has been one of the critical constraints. "Major negative impact of these water turbines are seen on the traditional water wheels. Large turbines in the locality have killed most of the nearby water wheels. From a large number of these traditional devices only a few is still surviving - some only for the sake of prestige, other just for private purposes and the rest only because they had nothing else to do. Thus investment made for these devices - labour, capital and skills have gone in vain. Many operators who used to work in these water wheels have been compelled to go in search of new jobs."[4/] One of the goals of introduction of improved technology is to release the work force and other resources for other productive purposes. If this transition is not smooth and planned, social problems might prove to be counter productive. It is a concern of the society for whom thewhole process is meant to benefit. 'Another dimension of the same problem is that 'people think that mostly the people of upper level" are benefitted[5/] from such schemes. Therefore, it is not enough to solve a problem from technological point of view only; rather it demands synchronization of activities with specific need of the area. Here it is not necessary to mention other peripheral problems. But the most disgusting part of it is that 'international organizations who profess formally for the enhancement of local technological capabilities seem to act in a manner detrimental to their professed ' objective. It is my personal opinion that there is still a long way to go for reduction of undue influence of pressure groups and vested interest (both of the country as well as outside the country).

4/ Chandra Bahadur Joshi - Sample Survey of Traditional Waterwheels and Small Water Turbines in Nepal, Research Centre for Applied Science and Technology, Tribhuvan University, Kathmandu, Nepal.

5/ Op. Cit.

c. Case of Low Cost Cementious Materials:

Research Centre of Applied Science & Technology, Tribhuvan University, Kirtipur, had conducted research on cementious materials as an alternative to portland cement available in the market during 1977. The rationale was not only to make "low cost alternate cement available for cheap construction, but also at the spot where it is needed."[6/] Moreover, the use of high strength portland cement even for ordinary masonery and plastering work was in fact considered as misuse. Besides high cost, and acute transport problem in remote area, formulation of a cheap cementious materials was considered as appropriate for use in rural Nepal.

In the development of cementious materials, the main raw materials were rice husk (agricultural by products) any lime sludge (wastages of sugar factory). The rice husk cement based on these raw materials had the physical properties as follows:

Comparative Studies of Physical Properties of Rice Husk Cement and Portland Cement[6/]

Properties	Portland Cement	Rice Husk Cement	Indian Standard as 1966/67 masonary Cement
Fines			
Specific Surface cm^2/gm	2500 - 3000	5000	minimum 5000
Soundness			
Lechatcher Expansion		3 mm	maximum 10 mm
Autoclave Expansion		1 mm	maximum 1 mm
Setting Tune			
Initial Setting	45 minutes	45 minutes	minimum 90 minutes
Autoclave Setting	12 hours	150 minutes	maximum 24 hours
Compressive Strength			
in 7 days (Kg/cm^2)	minimum 280	90	minimum 25
in 28 days (kg/cm^2)	normally 350-400 33-40%	maximum 200 average 178 50%	minimum 25

6/ RECAST Annual Report 1977/78.

On the comparative study of the properties it was concluded that though somewhat inferior in quality to ordinary portland cement, the rick husk cement can be used in masonary, plastering, light foundation even to meet the recent ISI specification for masonary cement. Besides, this cement can be used for the production of cementicus pipes and corrugated roofing sheets.

Since by all means the technology was ripe for commercialization practical problems began to crop up. Now the time did really come for testing the efficiency of the mechanism concerning transfer of technology from laboratory stage to commercial production stage. RECAST applied for the patent of the process, which was duly granted by the Department of Industry HMG/Nepal as per patent Design and Trade Mark Act, 2022 (1966). Then RECAST decided to grant license for manufacturing rice husk cement to any licensees for Rs. 5000 per district.7/ One licensee got the license from RECAST but started manufacturing operation in another district.

In the Act we find that there is one provision which states that nobody should imitate or make known or use by other's name any patent registered under the Act without obtaining written consent from the patent holder during the period mentioned in Article 8. Article 8 states that the patent-holders' right on patent remains valid for 15 years and it is renewable for another 15 years, if the concerned Department is satisfied that improvements have been done by the patent-holder. Moreover, another Article provides that if anybody is found non-compliant or encourages someone to voilate the provisions of this Act, he would be li ble to pay fine of Rs. 500 by the Department's rulling and all the materials pertaining to such violation shall be confiscated. In this case, RECAST being a public institution devoted to th cause of donducting research on technology specially useful for rural areas and promotion thereof, it was a non issue. But supposing a private inventor applies his resources and

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7/ Nepal has 75 administrative districts.

ingenuity and discovers something useful for the public and seeks legal protection to recover the whole or part of his expenses, how the legal framework operates to safeguard his interest? obviously the legal framework is deficient in substantive issues as well as on enforecement aspects. Neither was it aimed that way at the time of commencement. But "the patent system should strike a fair balance between the need for economic and social development and the rights granted by industrial property."[8/] Of course, there is another side of the coin also. There seems to be no basis by which one can judge patentability of the technology or process in question, how long it is actually necessary to grant patent for. Moreover, it is not clear why should any patent which is registered in at least three countries is automatically patentable in Nepal. In sum, the prevalent Patent Design and Trade Mark Act needs thorough review in order to enable it to be an effective instrument of public policy.

d. Other cases

There are a few other case of indigeneous applied research and commercialization.

a) New type of stoves in order to save fuel wood consumption have been successfully designed by RECAST and in now being popularised by encouraging local clay-workers to manufacture and place them in the market. These improved varieties of stoves will save upto 30 - 35% fuel wood.

b) There have been some works at RECAST, BYS and other workshops to design equipments for utilizing solar power in order to dry fruits, vegetables etc. and to warm water for domestic consumption. In addition, efforts are also geared towards manufacturing low cost solar stoves in order to cook meals.

8/ "Review of recent trends in patents in developing countries", Report by the UNCTAD Secretariate.

c) Some works with regard to bio-gass utilization are underway. Because of diversity of climate, availability of materils, variation in topography etc. not a single version or model is going to be effective throughout the country. These diversities have not only limited the scope of application of these technologies but also posed the problem of availability of construction materials in remote parts of the country where such technologies are badly in need of. Therefore, there is a long way to go until such technologies are made less costly and suited to the requirement of rural people. For example, a model of bio-gas production outfit requires dung from at least four buffaloes and investment of Rs 7000 - 8000 (i.e. approximately US$ 500).

d) One definite qualitative improvement that was obtained was in the field of cloth weaving through efforts of the Department of Cottage and Small Scale Industries, HMG/N. There was some initial spur towards commercialization of this loom, which was to be operated by footead by hands. It was successful to generate efficiency of upto 3 times as compared to traditional handloom. Commercialization of the technology could not proceed further not because of the unsuitability of the technology as such but because of the lack of organisational factors such as lack of materials, markets etc. and organisation of production units.

e) There has also been effort to develop a low cost fruit preservation unit, which can be used in cold fruit growing areas having no ready accessibility of market. For example, with this device about 50 MT of apples and equally same quantity of potato thereafter can be stored in a specially constructed godown in which temperature would be controlled by opening or closing the number of holes of natural air circulation system and cooling of air can be done by sprinkling water through gravity near the holes. This apparently introduced device has been judged as successful. Its application, although bound to be limited in selective areas could be beneficial to the high-land agrarian economy.

Bottlenecks in the Process of Commercialization of Research Results

As highlighted above, one can get a clear hint that neither adequate research results nor the process of general commercialization in a wide scale is existent in Nepal. However, there have been some efforts, oriented towards finding solution of the rural problems (fittingly so for a country where nine-tenth of the population resides in the villages); such efforts only are far meagre for the purpose. One need not repeat how widespread the canvass of rural poverty hangs over there in the background and how rare the oases of rural affluent people are. In communities where majority of people consider the use of match sticks luxury, how can one induce them to use those appliances and equipments intended to ease their daily lives as a prelude to make them more productive? There is no easy answer. We can only hope that improved technology would be introduced by the rural well-to-dos. In such a case there is every likelihood of monopolising the additional benefit accruing out of it by those rural 'elites'. Even if such benefits are allowed to be spiltover to the rural masses, these will only be marginal improvement in their economic condition. Therefore, in order to bring about changes in the conditions of rural people by popularising new found technology within the existing socio-economic structure would be almost futile. Even the number of rural elite who venture to apply the new technologies would be gradually declined, since there would be no further inducement to them in the absence of opportunities to employ the extra surplus generated in course of time and the process would close up their migration to more populous urban area. This looks like a bleak picture of the future but we have to accept the reality and try to form a package of programme to alleviate this situation.

Issue of Transfer of Technology from Abroad:

Upto now we focussed our attention entirely on the problem of transfer of technology from research and production centres to the people in general within the country. Another area where we are turning now is the arrangement of transfer of technology from abroad. We are not in a position to ignore this vital aspect since socio-economic realities as they are at present would be gradually evolved to comprehend the needed

technologies if spill over effects are channelised to traditional sector from the modern sector. With this perspective in view, we are going to scrutinize the mechanism of transfer of technology from abroad.

In the above analysis we have emphasized implicitly or explicitly the limits of absorbptive capacity of particular community or communities with regard to transfer of technology. The same holds true in the case of international transfer mechanism as well. With this note of caution let me be more specific to country situation.

Nepal has been predominantly an agricultural country with traditionally stagnant agriculture. Since 1951 there have been efforts towards securing foreign aid for the development of infrastructure. Nepal launched her first Plan (1954 - 1961) during mid-fifties with foreign resources more than three-fourth of the total financial expenditure. This orientation towards securing foreign assistancehad increased during the Second Plan. Even while we are approaching the terminal year of the Sixth Plan period, foreign assistance is estimated to hover around three fifth of the total financial expenditure. It is not intended here to mean that foreign assistance should be curtailed as such, but only that domestic efforts should be geared up to an appropriate level so that total development outlays are substantially increased. Predominance of foreign assistance programmes in wrapped up packages have limited the local inquisitiveness and sensibilities and at the same time accentuated dependency even in simple matters. There is enough scope for changing the direction and content of foreign assistance programmes if sufficient alertness is shown at national level towards developing indigeneous technological capability.

There seems to be little awareness existing on the part of the policy planners even as late as 1981 that a proposal of foreign private investment should be assessed thoroughly in order to make it compatible with the brodor national development objective. It was not thought necessary and still not practised in sufficient depth to scrutinise the relevance,

effectiveness and mode of implementation of a foreign assistance programme not to mention foreign aid which is a grant by any friendly government to the country. Anyway Nepal's Sixth Plan has underlined a need to shift her strategy from development of basic infrastructures to utilisation of those already created infrastructures for productive purposes. With this shift in strategy it was naturally aporopriate to give way to private initiative by creating a climate conducive to productive enterprises. Against this backdrop, HMG has promulgated a revised Industrial Enterprises Act together with a new Foregin Investment and Technology Act in 1981. The latter is therefore, a legal framework for the first time in Nepal to effect the transfer of foreign technology in a systematic way.

Nevertheless, there have been a few cases of transfer of technology as a result of contract between the parties and approval of the same by the HMG, as outflow of foreign exchange is subject to HMG's prior approval. Under this new Act, while approving foreign investment (it is assumed that foreign technology would be necessarily coupled with foreign investment) in Nepal, consideration would be given to -

1. Whether the proposed investment project is appropriate for or beneficial to Nepal;

2. Whether theinvestment is related to import substitution process or the development of exports;

3. Whether the investment project is to utilize local materials; and

4. Whether the investment project is to provide employment and financing opportunities to Nepalese nationals.

Among others, there are two other provisions in the Act which are important from the point of view of national technology policy. Article 14 of the Act stipulates that HMG is empowered to give guidance to enterprises in the following subjects (and it is obligatory on the part of such enterprises to abide by them):

1. Quality of production and services of such enterprises, price and distribution system;

2. Management of such enterprises;

3. Issues relating to maintain cordial relations between labour and management;

4. Issues relating to environmental pollution;

5. Issues relating to protection of public interest.

Article 18 of the Act empowers the HMG to frame rules to carry out the provisions of the Act specifically in the following areas (without prejudicing the power to frame rules in other areas):

1. To determine the nature of industries open for foreign investment and operation thereof;

2. To determine terms and conditions of foreign investment

3. To evaluate the tangible assets made available under foreign investment or foreign assistance;

4. Concerning payment of interest and repayment of foreign loans;

5. Concerning guarantee and security of foreign loans.

Despite these provisions, rules are to be framed as yet. In the absence of specific criteria, evaluation of foreign investment proposal would be subject to judgement and conscience of those participating in the decision making process. It is actually not conducive to favourable investment climate, since no party knows with a fair degree of certainty at the time of negotiation which proposal and provisions of the agreement is likely to get the approval of the government.

Suggestions on New Linking Mechanism

National Context:

We have noted at the outset while enumerating the area of RONAST's activities that as a national institute for promotion and development research activities as well as transfer of technology, RONAST should be fitted in these schemes so that appropriate linkage between research institutes and executing agencies be established. Unless research institutes are aware of the area of business needs and executive agencies like Ministry of Industry (MOI) and Department of Industries(DOI) and committees resporsible for evaluating the proposals are aware of the technology options available in the country eitner through collection and processing of information and research efforts, no meaningful and cost effective transfer of technology can take place in the country. There appears to be a need to reinforce this perception at the policy formation level and therefore a strong coordinated action in furtherance of this objective should be the immediate concern of the government.

Another arrangement which would be helpful in the commercialization of research results is by promoting pilot projects (which have scope for wider application) by government agencies or other agencies with close supervision of research institutes. In the initial stage of applications of research results, there are numerous risks associated with it and capability (financial as well as technical) of the private sector only will be too limited to cope with them. In this context either joint venture of the government and private sector should be arranged, or some sort of subsidy to private investor for a certain period of tire should be arranged.

Linking of National and International knowledge base

Despite numerous problems on research as well as commercialization fronts, one cannot set aside the urgency of their fruitful application in the least developed countries like Nepal. It is a known dictum that one need not reinvent the wheel in the name of research. Similarly commercialization does not take place in an alien land like grafting. Therefore, if there is a need to have an inventory of research results which can be applied in a similar situation, there is also an equally pressing need to dovetail the various elements of such research results prior to their application. In this context we should not undermine the role of a central national body which keeps itself abreast of new research results in a foreign country and monitors and guides the national efforts in a systematic way. Various international agencies and institutes which are engaged in the dissemination of research results and are providing advisory services in the case to case basis should not shrink their activity. They should rather broaden and deepen then involvement in this regard. It would be meaningful to channelize the information through a responsible medium, so that necessary local modification on these devices and substitution of materials could be introduced at an appropriate stage.

Although commercialization of research results is a time consuming and slow process, it is still theonly better way left at present to accelerate the pace of industrial development.

Conclusion

In sum, the problem of commercialization of research results as well as technology transfer cannot be solved unless a comprehensive national development framework is formulated and unless a strong will to implement it is manifested in action. International organizations involved in these area can only help by informing the scientists and technologists, engineers and economists, bureaucrats and entrepreneurs by arranging training programmes to enable to carry out the task, by availing research and

laboratory facilities within the country, so that indigeneous capability to identify and exploit the opportunity is developed. The countries concerened in most cases have their own social milieu and special problems which they are only in a position to solve.