PROCEEDINGS

of

WORKSHOP

on

Indigenous Technological Capabilities at Industry Level

19-21 April 1993
(7-9 Baisakh 2050)

Organised by :

Royal Nepal Academy of Science and Technology
Kathmandu, Nepal

in Collaboration with :

Developing Countries Research Unit
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INAUGURAL SESSION

Chief Guest, Dr, Prithvi Raj Legal
Hon'ble Member of National Planning Commission

Prof. Kedar Lal Shrestha
Vice-Chancellor, RONAST

WORKSHOP IN PROGRESS

PARTICIPANTS AT WORK

CLOSING SESSION

Recommendations Presented by a Participant

Certificate Distribution

CLOSING SESSION

Chief Guest, Dr. Binayak Bhadra
Hon'ble Member of National Planning Commission

Distinguished Guest and Participants

Foreword

The Workshop on "Indigenous Technological Capabilities at Industry Level", held on April 19-21, 1993 can be said to be an important activity in the area of technological development of a country striding towards industrialization.

The Workshop together with the field visits created a platform for beneficial exchange of ideas between the participants and the experts from Developing Countries Research Unit, University of Strathclyde, UK.

I am happy that the events of the Workshop is being put to record in the form of proceedings.

The publication consists of papers presented by the experts, local resource persons, RONAST staff, report of the field visits and recommendations. I hope this publication will be helpful to all concerned.

I take this opportunity to thank our experts from UK, who have contributed toward the success of this Workshop by sharing their valuable experiences and knowledge in this area.

I would also like t o thank the various institutes that have participated to make t his Workshop a success.

I extend my special thanks to British Council. Kathmandu, who has supported financially towards the Workshop.

Last but not the least my grateful thanks goes to the staff of RONAST who have worked tirelessly not only to make the Workshop a success but also towards putting the events to record in the form of this proceeding.

April 1993
Kathmandu

Prof. Kedar Lal Shrestha
Vice-Chancellor

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WELCOME ADDRESS

Hon'ble chief guest Dr Prithivi Raj Legal
Hon'ble Vice Chancellor, Chairman
Distinguished participants
Ladies and gentlemen
Sirs and pals

It is indeed my great pleasure to welcome you all to this, very practical seminar on "Indigenous Technological Capability at Industry Level" which I believe contributes a lot to the development. In my opinion, civilization in the end everywhere rests on and is fully supported by technologies. The continuous great civilization in this part of the world has contributed to many types of good technologies which are very indigenous, very practical and are conventionally used in villages and everywhere in this country. But, because of the geo-physic nature of this country and also because of commercialization of many technologies which have emerged from Northern Hemisphere has come through many ways to this country. They are practically being used in villages, many districts and remote places.

Among those technologies we have a great opportunities having something
which can contribute in a large way indigenously and independently to our development. This august gathering of experts, knowledgeable persons and people who are involved with the development, I hope this seminar on indigenous technological capabilities will emerge with some thing of great impetus to technologies. Obviously the technologies are encompassing the rural areas of the country especially but whether they are at manufacturing level or not, they are in the cottage industries level indeed. Brick making technologies, brewing technologies, shoe making technologies, carpenteries, all these technologies are available here but at what level and what contribution they can make is obviously is the theme of this workshop. With this I welcome all the delegates and guests and chief guest for this seminar.

Thank you very much.

INTRODUCTION TO THE WORKSHOP

Good morning Ladies and Gentlemen
Mr Chairman Vice Chancellor Prof Kedar Lal Shrestha
Distinguish chief guest Hon'ble member of NPC Dr Prithivi Raj Legal
Dr Keshav Chandra Sharma
Mr David Pottinger
All other respected guests, participants of the workshop
Ladies and Gentlemen

It gives me great pleasure to say a few words this morning in the form of an introduction to the workshop. As many of you are aware that this is the second workshop under the RONAST Strathclyde Technology Link Programme. We from the University of Strathclyde are indeed very glad for having the link with RONAST. We sincerely believe that through this link programme both RONAST and Strathclyde working together we should be able to contribute towards the development of an effective technology awareness as has already been raised in this part of the world.

Technological change as you know provides the basis of productivity growth and competitive strength of any economy and needs no saying that such a change is of utmost importance to an economy like Nepal. I am sure this applies to other economies including my country of origin Bangladesh. We are indeed very hopeful that both RONAST and Strathclyde, working together, will succeed in influencing one important policy variable that is the effective transfer technology which I understand has been strongly emphasised by the Government of Nepal.

Jim Love, our Director of the Developing Countries Research Unit and I still remember the enjoyable time we had in Nepal 3 years ago when we came here for organising the first workshop which many of you know was intended to be a preliminary one. As the link programme remains suspended for about two and a half years due to circumstances beyond the control of the link institutions there was obviously a feeling of uncertainty on both sides. Now that the link has been survived, thanks to the interest shown in the project in particular by the British Council, we would link to proceed in full gear. In the present workshop following our original schedule we would have liked to go a bit deeper dealing with some of the fundamental issues of technology transfer as reflected in the title of the present workshop.

However, it has become necessary for all of us to realize some of the practical difficulties. As with many other institutes, the Technology Evaluation Policy Unit of RONAST is in the process of taking a final shape. From the initial discussions we have had of the last two days with Prof Shrestha, Vice Chancellor of RONAST and Mr Rishi Shah, the Secretary, we are encouraged in the sense, that the technology unit is going to be strengthened. The unit will now have a number of staff members who will be fully

engaged for carrying out relevant studies with practical importance satisfying the needs of the industrialists, policy makers and other institutions and individuals in Nepal. Let us hope that this workshop forms the starting point for achieving the newly set objective.

Let the discussions conducted over the three day period of this workshop make us, including the staff members of the technology unit of RONAST, aware of a number of basic relevant issues on Indigenous Technological Capability at Industry Level. As I mentioned earlier, in this workshop we have deliberately set our goals at a low level.

But this in no way should imply that we are stopping at this point, far from contribution towards shaping the things to come.

In this workshop, we think, indeed the discussions which will take place during this workshop will definitely make a positive are aiming to have a frank and positive discussion.

Let us make it a true learning workshop while we will gain by exchanging views with others. I for myself, I am indeed looking forward to that learning experience

Thanking you Ladies and Gentlemen.

ADDRESS

Mr. Chairman, Hon'ble Member of the N.P.C.
Academicians of RONAST
Distinguish Guests and Participants

It is said that brevity is the soul of wit. I wont lay any claim to any great displace of wit but I will be brief I promise. First of all I am delighted to see such a distinguished gathering of participants for this workshop and I wish you all very fruitful discussions over the next two or three days. Dr. Huq has already reminded us that this workshop is taking place within the context of the link between Developing Countries Research Unit of Strathclyde University represented here by Dr. Huq himself and Prof. Love and RONAST.

This Link supported with some funding from the British Council for the exchange of persons and it is already with this link in mind that one very desirable outcome of this workshop for me would be the policy makers and leading members of the business community present here, to developing an awareness of the role which RONAST and in particularly the technology policy and evaluation unit or a role which RONAST can play in advising, conducting research, providing alternatives in the field of applied technology policy and I think really it is for you, the participants to indicate over the next three days to RONAST how they might most effectively play this role and fulfill a useful function for you.

Thank you very much.

OPENING ADDRESS

Vice-Chancellor of RONAST and Chairman of this General Session
Dr. Huq, Mr. Pottinger, Dr. Sharma
Distinguish Participants
Ladies and Gentleman

It gives me a great pleasure to come this morning to inaugurate this very special and very important workshop which is truly designed for indigenous technology in the Nepalese case or specially in developing countries case. I would like to thank the organizers for giving me this opportunity. If you recall that in a sense the present government as I see in my office for last two years it has adapted a policy which by any means can be considered as an open and competitive industrial policy. We know, we had almost 3 years or 3 decades experiences of a closed door economic policy, and we very well know that the achievement that we had is thus far met final with the kind of economic policy that we have implemented in the last 3 decades or so. Now since the last 2 years government has made an almost 180 degree turn in its economy policy as well as in its economy policy management. In that direction in opening up the economy and to make the economy much more competitive, you are very much aware of the fact that government has introduced a number of policy measurers beginning from the foreign exchanges policy down to industrial policy, trade policy, agriculture policy and even hydro resource development policy.

Several policies have already been implemented and still more are coming. In the mean time government has also taken several measures in strengthening the areas related with industrial sector, trade sector and foreign exchange sector. In the last 2 years we have travelled a long way I think and that we still have to travel a long way further. Since last one year we have adopted a partial convertibility in the foreign exchange policy and this year within 11 months time period or so we could make our currency freely convertible in the current account. Still we need to freely float or fully make it a convertible capital account because the capital account is still closed and still controlled.

But I think and I hope that within the next couple of years we will be able to achieve in making current and capital account both freely convertible in our currency designed with the making of the convertible currency in the current account. Initially there were several doubts regarding the depletion of reserves regarding its different side effects that may have in the economy. But, we have seen in the last 12 or 13 months period that it has helped a lot in filling some of the controlled measures that government was practicing since last 3 decades and there-by helping economy in putting it in the right track. If you look at current reserve right now in Rastra Bank, it has increased a lot even in dollar terms almost 5 hundred to 6 hundred. It reached

almost 6 hundred million or so increased by almost 100 million US dollar equivalent in the last 11 months or so. Also if we look at market rate of exchange it has more or less stabilized the rates to some what less then 50 rupees per dollar for so. So the positive side of it is that it helped a lot to the government by freeing industrial sector in really creating an environment we can consider conducive to make much more competition. Right now I am seeing a lot of industrialist here. They will tell more about it as they discuss in the workshop. But I can see that with the help of freeing of the currency now government could free export license, government could free the industrial license. In most of other things there is no control at all. Now anybody, any entrepreneurs can come forward and establish industries and produce right away. There is no need for any kind of license except for certain selected industries which are considered to be either health hazardous or related to environmental pollution. Except for these industries, there is no need for taking any licenses either for imported raw material or machineries or for establishing the industries itself, it can right a way establish and produce. Even for technology, government has no control or it is not controlling the type of technology which the industrialists want. Its giving free hand to the industrialist. One thing I must say is that with the size of the country and its geo-physical location it is surrounded by much advanced as well as larger country's. I think, we must go for technology if we want to be competitive with the size or the scale benefits that India or any other neighboring country is enjoying. We can't go for size, we can't establish large size industry where-by we could get some sort of return scale or some sort of scale benefit.

But I think we must concentrate upon the technology and through technology adoption of these new technology we can reduce loss and compete with the larger neighboring industries in the global market.

So technology and its adaptation is very essential for us not only for the industrial sectors but for all sectors of the economy in particular the dynamic sectors such as trade, industries tourism etc.

I really appreciate this kind of program link between the University of Strathclyde and RONAST. I think that this type of linkage programme will definitely help not only in transferring technology, not only in exposing technology but also in indigenising these technology to the local needs or the local circumstances. As I said earlier there are still a lot to do and still a long way to go. Even in industrial sector there are still more to come. As I read the program I could see some of the industries particularly textile and carpet industries, may be the programme is focusing on those two areas extensively. I do not know whether that is the objective or just the initiation. With the kind of discussion that you will have on these two sectors I believe the sectors will immensely benefit. So with these few words I thank RONAST and the organizers for inviting me and giving me this opportunity to inaugurate this seminar. I here by inaugurate the seminar.

Thank you.

REMARKS

Distinguished Guests
Fellow participants
Ladies and Gentleman

First of all we are very happy to organize this workshop in collaboration with the University of Strathclyde and the help that we have been receiving from our colleagues from the University and also from British Council deserves our special thanks and appreciation. As we all know in a developing country like ours the importance of industrialization and for the development of the country on the whole can hardly be disputed. We have just heard that the economic strength and competitiveness depends upon the technological capabilities and so the world over people are now focussing on developing capabilities in the field of S&T. In our own place as we all know, the rate at which the population is growing and it is said in another 30 years perhaps, our own population is going to double again, we have to think about our future development strategies, development programmes. Obviously agriculture alone may not be able to sustain our economy and fulfill the aspiration of the people in general. It is an irony that in this part of the developing countries including our own on one hand the population is increasing fast, the education rate is also enhancing, increasing and also access to information or knowledge is expanding while the economic progress has not kept pace with this increasing access to the information as a result there has been a growing frustration I would say. So to over-come that it becomes very essential that measures are taken to increase the rate of economic growth to create employment opportunities and so on.
So in this context, I think, enhancement of the technological capabilities is the only solution.

I believe, that would enable us to bridge this gap. When we are talking about indigenous technological capabilities at Industry level, at the moment what I would say is, in any sort of technological vicious circle normally what happens is the entrepreneurs or the investor do not seem to give so much attention or so much consideration to the technological issues. They generally tend to leave the technological consideration to the foreign partners, as a result the initial import of capital goods and the technical services leads to the control of decision making in the further capital goods import and technical services in the hands of those who's interest lies in perpetuating this import of capital goods and technical services. It is natural whenever a private firm or an industry comes up with some technical problems, the tendency is to look out side for solving those solutions. Expert come from the mother institutions to solve those problems. Perhaps to some extend this is justifiable in the sense that this might be cheaper in terms of time as well as money to solve the problem that way rather than to fall on to the local researcher who do not seem to have capability to solve their problem. So somehow I think this vicious circle will

have to be broken and in this context, we all have to sit together and think how to go about. Now we feel the development of National technological capabilities is a long term effort and this effort will have to be based on very practical programmes that are linked with the real world of the entrepreneurs and the business community. So it is this what we have in mind, for this workshop.

The local industries could also benefit from the development of this local capabilities, we are very happy in this context, to be associated with University of Strathclyde and we are very hopeful that their experience and their expertise will help us considerably in our endeavor. Particularly our scientist, technologist and egineers for instance will also have to build up their capabilities on imported technologies, I think there is no question of re-discovering the wheel, the capabilities will have to be developed based on experiences accumulated in this process. So they have to be very creative I think and very flexible and come-up with solutions that would help the industries such that the vicious circle that I was referring to earlier would be broken and a circle would be established within the country such that the research and development organization would provide solutions to the problems that industries are facing and the industries in turn would invest more on such research and development. We are very happy to note that the recent policies of the government regarding the open market economy and also new industrial policy has placed considerable thrust on the development of local capabilities and as much as ten percent of net income I think can now be invested on R&D activities of the concerned industries for the development or for the diversification of its product. I think this is a very good opportunity so that the industrialist and the industries in turn could come closer with researchers and research organizations so that one would be helping the other, I hope a conducive environment would evolve very slowly and gradually and in this context RONAST will be more than happy to play the catalytic role.

We shall be more than happy to help anyway we can from the point of science and technology to our entrepreneurs and industrialist in this context.

I do hope that during the workshop there will be very free and frank exchange of ideas and opinion on as I said earlier and also exchange of information and knowledge. And if the workshop would come up with some tangible recommendations we on our part, will be more than delighted to do whatever we can to implement those recommendation if they fall on the S&T demand and even if there are other such recommendations we could take those to the concerned authorities, try to convince them and try to persuade them. So that there could be a better link established between S&T and the industries in general.

So with these few words, ladies and gentleman, of course, officially, our secretary will be proposing a vote of the thanks, never-the -less I would like to take this opportunity to thank you all for your receive present and for making this morning session a success.

Thank you once again.

VOTE OF THANKS

Mr. Chairman Prof. Shrestha, Vice Chancellor of RONAST
Hon'ble Dr. Legal our Chief Guest for today
Dr. Huq, David Pottinger, Dr. Sharma
Distinguished Guests, and Participants and Colleagues and
My fellow Academicians
Ladies and Gentleman

It is my honour and privilege to express our gratitude on behalf of RONAST to all of you who have come here despite your very busy schedule to participate in this opening ceremony and workshop. We feel that it articulates your interest and support for this workshop in one of the most important fields of the development which is very essential for our country. We are very much concerned about building up our indigenous technological capabilities at industry level so that they could contribute to the economic development of our country in a much bigger way.

We are confident that this workshop will help and guide us to formulate polices and plans to developed our indiginious technological capabilities so that even RONAST could bring to the notice of our decision makers and planners, accordingly. In this regard we would like to thank very much Dr. Huq and Prof. Love who have come all the way from Strathclyde, UK to share with us their valuable experience with all of us here.

My sincere thanks goes to Mr. David Pottinger of British Council for supporting us in this programme. Which will not be first and last, will go on for many years to come and also to the participants. What would this workshop be without participants of course from different institutions for coming here all the way, and I hope they will also make this workshop very successful. Let me also thank our Chief Guest Hon'ble Mr. Legal for giving your moral support to all of us here with your presence and I also add your encouraging words when you gave us your opening address. And last but not least let me thank my colleagues and staff of RONAST and specially the organising committee. They have indeed been working energetically and efficiently to make this workshop, which you also see now. I thank them for the work they have done to make this workshop a successful one and let me thank all of you once again and thank you very much.

Thanking you once again.

INDUSTRIALISATION AND THINKING ON TECHNOLOGY

Dr. Jim Love
Director,DCRU
University of Strathclyde
UK

Industralisation is an issue that has loomed large in thinking about development issues, at both academic and governmental levels, over the past four decades. This period has seen differences in views over the 'appropriate' policy regime. The dominant view until the early 1970s was that of import-substituting-industrialisation (ISI). This was then challenged by the advocates of export-promotion (EP). The last ten years have witnessed a substantial amount of debate over the relative merits of these approaches and their policy implications. One theme that has permeated the debate about industrialisation is the concern with technology and technology policy.

In helping to set the scene for discussions during the next three days, I would like in this session to focus on several matters:

1. The importance of industrialisation in the development process;

2. The debate on ISI and EP;
3. The role of technology and technology policy.

Importance of Industrialisation in the Development Process

The customary starting point in the case for industrialisation is a series of observations:

1. That many developing countries have over a long period of time been heavily dependent for income and employment on the agricultural sector;

2. that the historical process of growth in the now developed economies has involved, with few exceptions, a relative contraction in the role of the agricultural sector and a relative expansion in the role of the industrial sector;

3. that in many economies the pattern of agricultural production and export reflects not simply the operation of comparative advantage but also the influence of the colonial experience; and

4. that the prospects for achieving more rapid and sustainable rates of growth through development of the agricultural sector are limited.

This last observation has its roots in the 'export pessimism' generated by Nurkse. Writing in the 1950s, Nurkse felt that the prospects for increased agricultural exports were constrained by:

1. Low income elasticities of demand for primary products;

2. Low price elasticities of demand for primary products;

3. Low population growth rates in developed country markets;

4. Development of synthetics to replace 'natural' products; and

5. Protection in developed country markets.

This "export pessimism" was reinforced by the Prebisch/Singer thesis on deteriorating terms of primary products as against manufactured goods. The conclusion drawn from the Nurkse and Prebisch/Singer thesis was that developing countries should shift their productive structures towards the industrial sector.
This greater emphasis on industrialisation was accompanied by analysis of the inter-relationships between the industrial and agricultural sectors by Lewis and Chenery.

In the Lewis model we find the now standard characterisation of developing countries with two sectors;

1 A traditional rural sector with zero marginal productivity of labour which leads Lewis to develop a model based on 'surplus' labour; and

2 A modern urban industrial sector with high marginal productivity.

This model stresses the transfer of labour from agriculture to industry and the growth of output and employment in the industrial sector. The absorption of labour from agriculture continues until the surplus labour is employed in industry. The process of industrial expansion is fuelled by the surplus generated for industrialists as a result of rising productivity but constant real wages (resulting from the availability of labour supplies). This surplus is reinvested to expand the capital stock.

The Chenery-type 'stages' model is predicated more directly on the structural transformation which was evident in the growth of today's developed countries. This approach identifies saving and investment as critical but goes beyond the Lewis-type model to specify both domestic and international constraints on growth and development. Domestic considerations include the resource endowment, population size and government policies. At the international level, the constraints include the limited markets for exports, the availability of required imports, access to foreign capital and access to foreign technology.

Certain features are common to both models, including:

1. Structural transformation - increasing the share of the industrial sector in both total income and employment;

2. Increasing employment levels and higher average labour productivity; and

3. Higher levels of investment.

The 1950s-1970s saw a very heavy reliance on import-substitution as the means to achieving structural transformation, and the most frequent policy approach was that of tariff protection, often combined with over-valued exchange rate regimes.

ISI and EP

The ISI framework is based very heavily on the 'Infant Industry' case for protection, i.e. that by enjoying tariff protection domestic industries can mature to become able to compete with foreign suppliers. In

achieving this maturity two factors are of great importance:

1. That by excluding foreign supplies from the domestic market, the conditions are created under which domestic firms can achieve economies of scale and associated cost reductions; and

2. That through experience of producing new products and using new technologies, management and workers can become more productive, i.e. there is 'learning by doing' - this again involves cost reductions per unit of output.

In essence, the infant industry argument suggests that trade patterns and comparative advantage can be altered. ISI begins with the substitution of previously imported simple consumer goods and then progresses to domestic production of more sophisticated manufactures.
In the long-run, protection is expected to encourage the process of structural transformation and to allow the export of goods previously imported. There is, therefore, a dynamic time element to the infant industry argument. To a great extent, the trade position enjoyed by certain economies in international trade is seen as a consequence of their earlier entry into the market rather than any inherent advantage.

ISI is taken to be an inward-looking approach with restrictions on imports, the promotion of domestic industry and controls on multinationals.

In contrast, advocates of the outward-looking EP strategy stress:

1. The efficiency and competitive benefits of being closely integrated with the international economy;

2. The "distortions" created by protective measures within the domestic cost and price structures;

3. The bureaucratic costs associated with organising import controls and controls over multinationals; and

4. The advantages of trading on very large international markets rather than seeking to cater for much smaller domestic markets.

Much of the impetus for and resurgence in interest in EP strategy that took place during the 1980s reflected a shift in policy in many economies towards more'market-orientated' measures. Indeed, much of the shift during the 1980s towards EP with regard to developing countries originated in the World Bank's advocacy of the merits of markets. Throughout the 1980s the Bank's series of Structural Adjustment Programmes almost invariably made financial resources available only if certain policies were adopted. These policies included abandoning or reducing government subsidies to different activities, reducing the scale of the civil service, privatisation, and reform of tax and pricing policies, including the "correction" of overvalued exchange rates.

The line taken by the Bank was reinforced by a substantial number of academic studies which seemed to provide clear weight of evidence in support of the view that countries with more EP-orientated strategies experienced faster rates of growth. A number of important objections can be raised with respect to the validity of these studies (Sheehey (1990) and Singer (1987)).

Moreover, there is, of course, no simple ready answer to which approach is the more attractive. The advocates of EP strategies point to the success achieved by Korea, Taiwan, Hong Kong and Singapore. These are by no means, however, 'free market' economies. Rather they have practised strategic intervention in different sectors. One important consequence of their success, however, is that the prospects of others being able to follow in their footsteps are reduced by the increasing protectionism of the developed countries against manufactured exports from developing countries.

What does seem likely is that as policy-makers and institutions start to recognise the limitations of export promotion as a solution for more than a handful of developing countries, the pendulum of fashion will swing once more back towards the infant-industry case for protection.

The Role of Technology and Technology Policy

Where do questions of technology fit into this discussion of industrialisation and policy approaches ?

In the 1950s and 1960s the concern was with increasing the rate of investment. This was seen as critical to the prospects for success. Nurkse, for example, in his related writing on 'vicious circles' argued that the increased investment might come from either domestic or foreign sources. This suggests an absence of great concern about the nature of the investment.

By the late 1960s, however, it was clear that the investment which was taking place was proving to have no great impact in many economies and was certainly not producing results along the lines suggested by Lewis and Chenery. Problems of unemployment were not disappearing in the rural areas and urban unemployment was rising. In addition, there were upward pressures in the urban areas on wages for those involved in industry and the civil service.

One response to this was to identify a problem in terms of human capital - that domestic skill formation was not sufficient to prevent constraints in key areas. This response resulted in foreign aid programmes shifting from the provision of financial aid to a greater provision of technical assistance. Such a response, in effect, took the existing technology forms as given and sought to equip the labour force to work with those technologies.

A second response was to consider the 'appropriateness' of technologies and products. A basic feature of the Lewis and Chenery models is recognition of the labour abundance and capital shortage in developing countries. The failure to resolve problems of unemployment was seen in terms of a dependence on imported technologies which were developed in and for economies with quite different resource endowments. Much attention was directed, therefore, to considering alternative and intermediate technologies which might be adopted to match more closely the abundance and skills of local labour forces.

Along with this came analysis of products and the technologies involved at different stages of production. Processes were broken down into their various stages to investigate the extent to which labour could substitute for capital. Where a part of a production process involves, for example,

the generation of a high temperature, that part of the process may offer little scope for factor substitution. Nevertheless, there is the scope for reconsidering the range of technology options which exist either for part of a process or for the entire process.

Out of this debate emerged an important consideration: namely, the extent to which countries receiving aid or capital inflows from multinational companies have, in practice, any room for manouevre in their choice of options.

The discussion of 'appropriateness' also highlighted the issue of adaptation and innovation of technologies. This issue had already emerged in a particular form in the product cycle theory which assumed that:

1. Innovation in products and processes takes place in developed economies with an innovating economy enjoying an initial advantage in trade in that product;

2. Information on the product and its production processes is then diffused to other developed economies which become net exporters of the product; and

3. The technologies are then diffused to developing countries where lower wage costs will enable these countries to replace the developed economies as exporters of the product.

The emphasis in this approach, as in much else, is on cost-reductions as a means to achieving competitiveness in the developing countries. The source of the new technology remains in the developed world. It has long been recognised that technological innovation is a powerful source of competitive advantage. This is an idea that has been written about by economists over the past two hundred years. In recent decades the presumption has been that innovations are the almost exclusive province of the developed economies and that the 'best' most developing countries can hope to achieve is some form of adaptation of technologies developed elsewhere.

In large part, the argument that innovation is the province of the developed world revolves around the view that higher income levels will generate demands for 'new' products and that low income economies are still attempting to cater for demands for 'old' products. In 'new' industries, such as electronics and pharmaceuticals, there is a very high degree of technological dynamism. In 'older' industries, such as textiles, there is less innovation.

During the period of ISI domination, a great deal of attention focussed on the monopoly power which control over technology bestowed on protected firms. Where these firms were multinationals, there were great fears about the extent to which practices such as transfer pricing and repatriation of profits allowed multinationals to extract economic surplus from developing countries and about the perpetuation of technological (and more general economic) dependence. With the shift to EP, the ability to survive in highly competitive international markets came to the fore. The pressure to be competitive was regarded as placing a high priority on technological dynamism as a source of competitive strength. For those economies without a technologically dynamic industrial sector the alternative option was that of accepting a continuing dependence on the standard prescription of real wage reductions as the

means of achieving competitive standing.

This debate has highlighted the need to consider carefully the development of indigenous technological capability. Again, however, it would be misleading to believe that an argument raised in the context of the market philosophy of EP necessarily has a solution that lies solely in the market mechanism.

Where then do we stand with technology issues ?

Several issues emerge:

1. Technology transfer is considerably more complex than simply importing a technology from abroad. Account has to be taken of its appropriateness in the light of factor endowments and demand patterns.

2. Technology has to be suitable to the skills and knowledge base of the economy.

3. Much work is yet to be done on the development of indigenous technological capability and there has to be greater effort directed towards understanding how this capability can be promoted.

In addressing issues such as these, attention should be paid to:

1. Evaluating a country's previous experience with respect to technology transfer and adaptation;

2. Examining the terms and conditions under whichtechnologies are made available by multi- nationals and through aid programmes;

3. Setting out a country's industrial objectives in terms of what is desirable and what is feasible in the light of available and projected skills;

4. Evaluating the spectrum of technologies for particular activities; and

5. Seeking to promote the growth of indigenous technological capability.

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PROMOTING TECHNOLOGICAL CAPABILITY IN DEVELOPING COUNTRIES

Dr M. M. Huq
Associate Director, DCRU
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Introduction

Until the late 1970's development literature and research concentrated their attention on the choice of technology, and the terms of transfer from the North to the South. A major weakness of this work was that to a great extent it ignored the questions of how the technologies could best be introduced to the economies of the developing countries. The important issues of how to best adopt the imported technologies and how the knowledge arising from imports and exports could best be diffused through the economy were not addressed. Also later studies concentrating on trade and industrial policies, joining the debate on import-substituting versus export-oriented strategies, focused their attention on incentives, rather then on the structural factors such as the labour and capital markets, education systems, management systems and skills, innovation, research land development (R&D). However, in studies of developed countries these structural factors were recognized as significant constraints in the building up of industrial competitiveness. Recently, research based on the industrial experiences of the NICs have also taken these aspects into consideration, and have contributed to the development of a new framework for understanding the industrial performance of developing countries.[1]

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1. See for example Dahlman et al. (1987), Lall (1987), Enos & Park (1989)

Definition of Technological Capability

Following the UN (CTC, 1987), the process of acquiring technological capacity from abroad can be construed to consist of three stages:

1. The transfer of existing technologies to product specific goods and services

2. The assimilation and diffusion of those technologies in the host economy

3. The development of indigenous capacities for innovation.

However, it is obvious that much of what is currently regarded as technology transfer transactions is lacking precisely in some of these characteristics, particularly those associated with the latter two stages, and this is responsible for a great deal of the international debate on the subject.

Technological capability may possible be accurately defined, as Lall (1992) suggests, as the ability to internalise a basic core of functions which are needed to acquire, assimilate, use, adapt, change or create a technology. Dahlman, Ross-Larson and Westphal (1987) divide technological capability into three broad categories:

1. Production capability is the capability needed to operate facilities;

2. Investment capabilities, which are needed to establish and expand existing facilities; and

3. Innovation capabilities, which are needed to create new technology or develop new products and services.

To this list, Lall (1992) adds "linkage capabilities" which are defined as the skills enabling information, skills and technology to be received, at firm-level, from outside agents including input suppliers and technology institutions, and to be transmitted to other firms, which will then permit the diffusion of this technology throughout the economy, thereby providing the potential for the expansion of the industrial base.

Technological capability is clearly more than just the know-how necessary to operate equipment and produce output. There have of course been instances where the process of technology transfer, through foreign direct investment for instance, where the host country has received little more than the ability to apply a given foreign production technique in an unadapted form, often inappropriate to local conditions and factor endowments. Such instances cannot be deemed to be beneficial to the host economies and illustrates the need for the development of technological capability.

Lall (1987) provides a fuller breakdown of the composition of technological capability, the development of which would lead to more appropriate and beneficial investment being undertaken. At an initial level, it implies a certain capability and competence in making pre-investment choices. This involves a through search for available technologies including an appropriate package, equipment, and technique of production (based on its appropriateness to factor endowments and other local conditions).

A certain capability should also exist at project execution stage, including capabilities in basic engineering, equipment specification, mechanical construction and work-force training. Since foreign technologies must usually be adopted to suit local conditions, the failure to develop adequate capability at this stage may lead to increased costs as the transferor may be called on to undertake this adaptive work with substantial charges (Lall notes the estimate made by Teece (1976) that in such cases, more than 50% of the total cost of the project may arise from the costs of the technology transfer itself).

Basic capability must also exist in plant operation including normal day-to-day running and capability to adapt and improve the technology within the original design parameters, including introducing alterations to the raw materials mix, product mix and other measures to increase efficiency and reduce costs.

Higher levels of technological capability include the ability to improve upon the technology itself by introducing a new production or process (Dahlman, Ross-Larson and Westphal's "innovation capability"), and the technology transfer (or linkage) capability, where the firm or country has absorbed the technology well enough to pass this on to other firms or countries.

The benefits of developing indigenous

technological capability at firm and national level extend to more than the prevention of the transfer of inappropriate technology. More positively, Lall (1987) suggests that technological progress is one of the prime movers of the economy. The World Bank concurs with this and suggest that productivity growth, which they take as a proxy for technological change, has accounted for up to 30% of GDP growth in East Asian Countries.$_2$ At a national level, Lall continues, technological growth will determine industrial and export growth and diversification, while at firm level it will reduce the costs of acquiring technology as well as reducing overall costs and providing new products, thereby increasing the firm's competitiveness. Without developing a certain level of technological capability, infant industries will never mature and the economy, as a whole, will be left with a far more shallow, uncompetitive industrial base.

Having established that the development of technological
capability is desirable, it must be stressed that there are costs involved in this process. As Lall notes, the costs of investing in the human capital necessary in the process can be substantial and tend to rise as firms undertake more complex tasks. After the basic core of "know-how" technology has been internalised, it is not always necessary to invest further in-house technological development and the choice must be faced as to whether to buy or develop new technologies.

Dahlman et al (1987) suggest that only the capabilities or technologies which can be sued cost-effectively all or most of the time should be developed in-house (or domestically). The other capabilities may be required from external sources.

Acquiring Technological Capabilities

Turning now to examine how the process of technology transfer can be sued to acquire technological capability, Dahlman et al suggest that the potential acquisition of this capability should form the basis for the choice of technology. Choice of technology should not rest on static costs and benefits criteria but on dynamic gains.

In assessing technologies to be transferred it is therefore advisable to examine local conditions and needs, with a view to how the chosen technology can be adapted to fit these. The field of technological choices should then be broadened as far as possible before each is evaluated on its present production merits and on its dynamic potential for modification and improvement. It is not necessary-nor may it be advisable to choose the latest technology. If this is chosen without a full understanding of how and why it works, it will be impossible to develop and improve on this technology later, leading to continued reliance on foreign assistance as the technology frontier shifts out further.

Developing countries typically develop technological capability through a sequence of production, investment and innovation; a reversal of the typical developed country sequence. It is therefore at the production stage of the transfer process where much of the learning takes place. This stage of learning can take several years and often may be unon foreigners.

There are no rigid divisions between what type of assistance is and is not available. Different packages from different suppliers may be offered including training and experience in design, construction and

operation of plant and equipment, assistance with adaptation and modifications of the technology and access to future improvements in the technology. For this reason, the purchasers of the technology should be aware of the options available and should negotiate a package which will provide as much information and understanding during the transfer as is needed. As Dahlman et al (1987) state : "The critical thing is to know what is needed and to seek it at the most reasonable price under terms that do most for the acquisition of technological capability".

Lall (1992) and Enos and Park (1988) concur in their view that no adequate theory has been formalized to describe the process of technological development. Diagram 1, however, is helpful illustrating the process of incorporating foreign technology.

Measuring Technological Capability

Most studies, published on technological change in the Third World, have until this day been carried out by detailed case studies of LDC industries, with the collection of descriptive material and data, which the researchers have analyzed and drawn conclusions from. With respect to the development of technological capabilities, and the adoption and diffusion of technology, there seems to be a growing agreement between researchers as to the factors involved in the process. However, this approach is limited in that it is not able to determine the relative importance of each of the factors identified, and it leaves open to question the true pattern of causation.

A more scientific approach to the analysis of Third World science and technology indicators is that of multiple regression analysis. An example of this can be found in Huq et al (forthcoming)", where the following regression model is used to determine the explanatory factors of variations in technology, absorption across individual machinery manufacturing firms, in Bangladesh.

It is apparent that the coefficient of Government Commitment (GCM) emerges as the significant explanatory variable. Indeed, as found by Huq, et al, the absence of a systematic government policy to exploit the potential of the machinery manufacturing sector has not helped the promotion of technological capability in Bangladesh. Government involvement is reflected in various ways-tariff policy, technology transfer negotiations, aid negotiations, management of public sector projects, credit policy towards private sector, export policy, R&D support, etc. and in many of these areas government commitment is lacking. The failure of the government to demonstrate its commitment to public sector engineering plants is apparent from the continued import of machinery and equipment which can be locally produced, using the huge installed capacity existing in the country. Intentionally or unintentionally the government have failed to negotiate aid contracts properly. The self reliance objective repeatedly put forward in the various Plan and other policy documents appears hollow as the local capability has been ignored by suppression the local demand for the various engineering products.[3]

Concluding Remarks

The above finding by Huq, et. al. is in line with the suggestion, strongly advocated by Lall, that the government must play an

active interventionist role in developing technological capability. This ranges from investing in human capital through training and education, and provision of social and technological infrastructure, to the provision of incentives through subsidized credit at favorable interest rates as well as selective (but not excessive) protection of industries, or the encouragement of domestic and international competition as an inducement for firms to increase product quality and/or lower costs.

It is stressed that the government plays a critical part in ensuring the successful absorption of technology throughout the transfer process. A key role is negotiating terms for the transfer and ensuring that the suppliers of the technology do not abuse their monopoly power.

For example the government may intervene to impose limits on royalty payments to the supplier or may prohibit terms which restrict export production. In order to foster the development of local capabilities, requirements may be placed on technology importers to document that the desired technology is not locally available.

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3. For example, in the Fourth Five Year Plan of Bangladesh (1990-95) there is, e.g. a categorical statement for utilizing the machinery manufacturing sector, that "efforts will be made to manufacture as much capital goods within the country as possible. Imports of capital goods will be limited to specific items for which domestic capacity does not exist." (p.IV-9) In the face of such statements one wonders whether the government is aware of the extensive installed capacity that exists in the country.

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POLICY AND PROGRAM OF HMG IN CARPET INDUSTRY OF NEPAL

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Introduction

Traditional carpet weaving has been practiced in the Himalayan Regions of Nepal for hundreds of years. It is not possible to exactly date the beginning of this type of carpet making in Nepal. The fact that carpets have been in use in Tibet, the bordering area of China, for at least the past nine hundred years gives us a fairly good idea about the long tradition of carpet weaving practice in the adjoining area of Nepal, specially the northern districts like Solokhumbu, Taplejung, Manang, Mustang, Humla, Jumla, Dolpa etc. However the carpet making was not for commercial purpose. Marketing of the products was almost non-existent. Carpets would adorn only the houses of rich and noble people.

Because of prevailing sheep farming in those areas people utilized the wool for making various useful commodities. Most commonly, the general people would make the cheaper version of the carpet or flooring material - RADI, covering material - the PAKHI, and clothing material - the LUKUNI.

The carpet industry as of today is only a few decades old. Around 1949 (B.S.2006), for the first time a training programme in carpet weaving (Persian and Tibetan) was conducted by the Department of Village & Small Scale, then Cottage Skill Training Bureau(Gharelu Elam Talim Kendra), mostly for the military jawans. This training programme was discontinued the next year because of the lack of wool and financial support till 1956 (B.S.2013) when carpet-weaving skill was imparted to both male and female workers. In 1959, many Tibetan refugees entered Nepal bringing with them their carpet making skill. This carpet weaving technique was exploited by the International Red Cross and SATA (Swiss Association of Technical Assistance Program), by establishing the Jawalakhel Handicraft Centre in 1960. This organization, which initially started as a carpet weaving centre for Tibetan Refugees, mostly women, laid the foundation for the carpet industry of Nepal.

Carpet weaving became a commercially viable industry with the financial and marketing support of the Swiss Red Cross. The carpet weaving workshops established in many other areas of Nepal (Chailsa, Pokhara, Dhorpatan etc.) guaranteed the economic existence of the Tibetan refugees to a certain extent. The first meagre export of Nepalese Carpet was made in 1962 to Switzerland, and since then the Western market for Nepalese carpet has grown at a steady rate.

In 1963 (B.S.2020) the Department of Cottage and Village Industries established a pilot project named Nepalese Carpet

Industry Limited in Patan Industrial District to promote and develop the growing carpet industry. This project, although not successful by itself, did make a big contribution for the development of carpet industry in Nepal. Carpet weaving units were gradually set up by private entrepreneurs and this pilot project was also sold off to a private industrialist. During 1972 and 1973 private sector carpet production began in full swing and many retail shops began to emerge in the Kathmandu Valley to cater to the tourist trade. By 1976 the number of carpet factories reached 11 and major European importers established contacts with the manufacturers and the number of importing countries also began to grow. After this the carpet industry grew even at a faster pace and the number of carpet related industries has grown to more than 3000 units and is still growing. In fact it gives the impression that carpet industry is the most significant (competitive) industry for Nepal.

Current Status of the Industry

Commercial production of carpets was started only in 1960, but the carpet industry has emerged as a major industry of Nepal in just three decades. One of the reasons for the fast growth of this industry is that almost the entire product (more than 95 percent) is exported. The share of earnings from carpet export in the total foreign currency earnings of Nepal has also grown steadily to around 60 percent at present. During the last decade the quantity of carpet export grew at one average rate of about 35 -percent per annum. Value-wise (in NRs) this average growth rate per annum is even more than 50 percent.

1 Carpet Export

The carpet industry is fully export-oriented industry. The carpet export figures for the last two decades is given in Table 2.1.

2 Export Earnings from Carpets

The phenomenal growth of carpet export in the last two decades can be understood by studying Table 2.2, which shows the export earnings from carpets as compared to the total export of Nepal. The percentage share of carpet export was less than 2 percent in 1972/73, whereas it exceeded 65 percent in 1990/91. Last year it was about 58.5 percent.

Table 2.1 clearly indicates that the carpet industry has greatly contributed to the national economy. In fact, now the economy seems to depend heavily on the carpet industry.

2.3 Capital Investment in Carpet Industry

The registration of industrial units related to the carpet industry is shown in Table 2.3 and the fixed as well as working capital investment in the carpet industry during the last five years is shown in Table 2.4. The investment figures have been provided by the entrepreneurs while registering their units. Hence the real investment figures may differ. However the figures provide very close estimates and the trend and growth of the industry.

4 Impact of Carpet Industry

The growth of the carpet industry has also made other positive impacts. First of all, it has provided direct or indirect employment to more than 250,000 workers, thus

supporting the livelihood of more than a million people. The carpet industry employs more people than all other industries put together, and it is the biggest employer barring agriculture. In fact, it employs more people that HMG (civil servants). Also the carpet industry has been able to absorb uneducated and poor section of the population, and mostly women, thus providing social justice to some extent.

Secondly, it has provided linkage effect to many other industries like loom and spinning wheel production industry, construction industry, water supply industry (deep well boring} transport industry (for large movement of goods and people), and other service industries.

It is thought that not all the registered units go into production. Also many units which start production close down because of various reasons. Unfortunately such statistics are unavailable in the Department of Industry and Department of Cottage and Small Industries. During the last few years many carpet manufacturing firms came into being and many are known to have closed down because of tough competition and inexperience in the business. But assuming that 50 percent of those industries registered go into production there seem to be more than 3000 units in operation.

The specific feature of the growth of the Nepalese carpet industry is that it did not enter the Western market as a competitor to other carpets, but rather as a product of new class, which created its own market. This exclusive method of introduction of the carpets to the foreign markets was made possible by the remarkable creativity and flexibility shown by the carpet industry.

The Carpet Making Process

In the carpet making process, wool is the primarily raw material which undergoes several processing steps. The age-old tradition has been maintained, but improvements have been gradually made as the marker desires. The main processes can be outlined as follows:

a) Scouring of raw wool

b) Combing/Carding, Blending and Spinning

c) Dyeing woollen yarn

d) Weaving

e) Carpet Washing and Finishing

1 Scouring of Raw Wool

Scouring of raw wool is done to remove natural and other impurities. The Tibetan wool usually comes in a very raw form, that is, with dirt, grease, vegetable matter, urine, perspiration etc. Scouring or Washing is done in streams or with the help of alkalis and detergent chemicals in factories. After washing, the coloured wool is sorted out and only white wool is used. The Newzealand wool is imported after the scouring and sorting out stage and hence does not need this process.

2 Combing or Carding, Blending and Spinning

Combing of dried pads of wool fibre is done manually by metallic brush to remove any unwanted material and to make the fibers align themselves in straight and parallel position. Till some years ago only hand

combing was prevalent. But now, mostly mechanized combing or carding is used. Blending of Tibetan and Newzealand wool is also done simultaneously during the combing or carding process. In an effective carding, no fibre is intermingled and any dirt, vegetable matter or short fibers are removed. Also blending is better achieved and the wool appears shiny. Wool combing by hand is a tedious and time consuming job. The introduction of carding machine has made this job easy, more economical and productive. Carding process is very important for easy and effective spinning to obtain smooth and even yarns. Spinning is a traditional skill of the Nepali people. The spinning process draws and twists the wool fibers making yarns of desired thickness. Spinning is done in traditional sliver or spinning wheels, imported from India.

The wool with the fibre of 4" to 6" are best suited for spinning with 5 to 7 twists per inch which are best yarn for carpet weaving.

3 Dyeing Woolen Yarns

Dyeing of woolen yarns can be done either by chemical or vegetable dyes. Until the discovery of chemical dyes, vegetable dyes were used, mostly from the dye-bearing plants of Nepal like, madder, walnut, pipal, catechu, myrobalam etc. But vegetable dyes are not so fast to sunlight and chemical washing. Also the same shades of colour cannot be achieved in every batch of dyeing. So now a days mostly chemical dyes are used. There are three types of chemical dyes such as acid type, metal complex dye and chrome dye. The metal complex dye is popular for its fastness property - tenable to sunlight, chemical washing and rubbing, which is important for carpet wool.

Dyeing used to be done traditionally in large open copper vessels or couldrons, by boiling upto 20 kilograms of yarn at a time, heated by wood-fueled stoves. These small dye lots made it difficult to match colours exactly between lots. This traditional dyeing method in the past few years has given way to fully enclosed furnace - like stoves which can dye upto fifty kilograms at a time. But now a days more fuel-efficient dyeing machines are used. These machines can dye many more hanks in one lot, but basically the dyeing process is the same. Still improved version of the dyeing machines using the technology of steam dyeing have been introduced in 1984.

The steam process allows dyeing of lots upto 300 kilograms at a time. In steam dyeing, the wool is not stirred but the steam heated dye water is circulated around it. As a result, the yarn retains a stronger fibre with less felting.

4 Weaving

Nepalese carpets are woven on a vertical loom made of wood or steel. The loom is nothing but two vertical poles fixed by a horizontal base to keep it rigid. In the upper and lower portion of loom are placed two movable horizontal wooden beams upon which the cotton wrap threads are tied in the form of an endless chain. When the carpet is woven to a certain height, the tension is released and the woven part is pushed downwards to a workable height and the unwoven part is moved upward behind the loom. This process is repeated till the weaving is complete. For easy maneuvering of the woolen yarn is rolled into balls of different colours.

Weaving is the most important aspect of

carpet making. The loom size can vary according to the size of carpet to be made, but the most common loom is 10 ft high and 13 ft wide. Weaving is done manually by making knots of woolen yarn into the cotton warp thread with the help of a metallic weaving rod. In big looms upto 12 workers weave simultaneously. Weaving does not require physical strength but it requires deft fingers and hence female workers outnumber male weavers. The hand knotted carpets of Nepal are woven in Tibetan knotting system. Other systems of weaving carpets practiced in other countries are the Turkish Knot and the Persian Knot.

In the Tibetan knotting system the woolen yarn is tied with two warp threads at different positions with the help of a weaving rod. This process is continued breadth-wise from left to right. The cotton weft is then inserted in between the warp threads alternatively. Then it is beaten with a hammer and the wool around the weaving metallic rod is cut with a pile cutting blade and thus the woolen pile or carpet surface is formed. The pile height is determined by the diameter of the weaving rod used. It is at this stage that the design and colours of the carpet are achieved, by using various coloured yarns during the weaving (knotting) process.

The overseas importers have found that they can impart their own specialized looks into the carpets by providing their own designs and working closely with the manufacturers.

The degree of fineness of carpets depends on the fineness of the yarn. The finer the yarn the more knots are to be made per unit area. The carpets with 35 to 100 knots per square inch are manufactured. Naturally the more the knots per square inch the more the cost of the carpet. At present carpets with 40-60 knots per square inch are predominant.

After the carpet is completed it is removed from the loom and designs are clipped in physical relief according to the buyer's choice.

5 Carpet-Washing and Finishing

Until a decade ago, all carpets were exported unwashed, while the importers were washing the products in their own wasting plants in Europe. As carpet production increased, the European washing facilities were overburdened, resulting in considerable delays in timely delivery. Hence, carpet washing was introduced into Nepal, by necessity. There was an added advantage that carpet washing could be done at a much cheaper rate locally.

In 1990 a considerable number of carpet washing units opened up in the Valley, giving rise to the concerns about effects of carpet washing on the Valley's environment and the quality of locally washed products. But carpet washing in Nepal has come to stay and the quality has been comparable to the sophisticated European process.

At present; most carpet washing facilities are manual. Carpet is washed in a solution of various chemicals (sulphuric acid, caustic soda, bleaching powder etc.) and detergents. The wet carpets are placed in open flat concrete platforms and manually washed using large wooden flat spade-shaped scrubbers. This is done with intermediate rinsing and final washing with water. But mechanised carpet washing has also been lately introduced in Nepal. It is expected that many mechanical washing units will be

established in coming years. At present more than 80 percent of the carpet export is in the washed form and the remaining quantity is exported unwashed for washing overseas before marketing.

After washing the carpets are dried in the sun and checked for any defects. Using scissors any excess wool is trimmed off. Also clipping of designs is done in physical relief to give the carpets a finished look. During carpet washing some portions of the carpets may lose colour, in which case these parts are redyed before packing the carpets for export.

Technology in Use

Till the commercial production of carpets in the early 1960's, the carpet industry was basically a traditional cottage industry, utilizing the ancient technology used for centuries in Tibet. Even now it remains as such in a scattered form. But in the last three decades it has gone through a gradual metamorphosis specially in the last decade, a much more marked change has taken place in the production process and the technology used. The introduction of modern technology in the areas of combing, dyeing, designing, and washing has made the industry much more efficient. The weaving technique is however maintained to give the Nepalese carpet the handicraft look, for which it has become popular.

1 Wool Technology

As the organised carpet industry came to Nepal from Tibet, originally 100 percent Tibetan wool was used for carpet making. This quality wool comes from the flocks of sheep raised in the high Himalayan plateau, where the climatic conditions are severely cold. The colder the climate the better the wool. The high lands wool from Tibet is rich in lanolin which ensures longetivity. The Tibetan wool, with extended use, will only get better shine and lustre. The Tibetan wool has another advantage: it has a medulla - a soft, oily inner core through which the colour dyes are absorbed. That is, every hair of the wool absorbs dyes from inside out. That is why the Tibetan wool is more desirable, as the colour is more durable. It can be washed and the colours do not fade easily; they are locked inside.

But as the carpet industry gathered momentum, the supply of wool from Tibet and highland regions of Nepal could not keep pace with the demand. Hence other supply sources were explored and the Newzealand wool was tried about a decade ago. A carpet made from 100 percent Newzealand wool while initially soft lustrous and luxurious, would not wear well with time. Hence the blending technique of Tibetan and Newzealand wool was practiced. Originally more of Tibetan wool was blended with less of Newzealand wool. This percentage slowly changed to 50:50 till today when the ratio of Newzealand wool to Tibetan wool is generally 80:20. Of course, still some carpets are produced with 100 percent Tibetan wool and some manufacturers produce carpets with as low as 5 pr 10 percent Tibetan wool also. Normally, the blending ratio is fixed according to the agreement between the buyer and the manufacturer. The higher the blending of Tibetan wool, the higher price the carpet fetches.

There are many varieties of wool depending on the type of sheep, sheering age, climate etc. Even the wool from the same sheep varies according to the part of the body

from which the wool comes. For carpet making good quality long fibre is the best. Hence the standard of wool imported from Newzealand has been fixed at 128 type 4-6 inches fibre length.

2 Wool Carding Technology

Before 1984 all the processes of carpet making were manual or hand operated. The combing (or carding when machines are used) of raw wool was done by hand using brushes or combs of metallic wire. Today, carding is almost wholly done mechanically with machines imported from India. With the introduction of the carding machines the blending of Tibetan and Newzealand wool has been better. Also it has made spinning easier and smoother, increasing substantially the amount of yarns a spinner can produce per day.

The introduction of carding machines has also created some problems. These machines could also blend well the waste wool (cut pieces from the weaving process called Zhindu) into fresh wool. The price of Zhindu being almost 20 times cheaper than new wool some unscrupulous manufacturers began to blend upto 10 to 15 percent zhindu with fresh wool causing the quality of carpets to deteriorate, which in turn created problems in marketing.

3 Dyeing Technology

The biggest technological revolution in the carpet industry of Nepal has taken place in wool dyeing process. Like carpet weaving, primitive wool dyeing technique also came to Nepal from Tibet. Vegetable dyes were most commonly used supplemented by only a few dyestuffs like rhubarb, lac, indigo etc. Dyeing was a closely guarded secret, the tradition being passed on by fathers to sons or valued friends. The tradition of vegetable dyeing continued, though vegetable dyeing takes more time than chemical dyeing. Vegetable dyed carpets also commanded higher prices. The range of colours that can be extracted from a single substance depending on its preparation, mordants, and types of pots used, is tremendous. Hence it is almost an art.

Vegetable dyeing can produce many shades of brown, yellow, blue and red colours. Tea, walnut and catechu are used to get brown colour. Lac is used for red, magenta and pink shades. Indigo is used for blue colours. But dyeing is such a sophisticated process that the water, vessels used etc can give a different shade. Also vegetable dyeing requires repeated dyeing to achieve the correct shade.

Vegetable dyed carpets were mostly in demand till the early 1980's. Now, mostly the per-metalised dyes imported from Switzerland (Sandoz, Ciba-Geigy) and Germany (BASF) are used. Cheaper variety of dyes, imported from India are also used, but for quality carpets the European dyes are preferred. Dyeing machines from India and .....have been introduced. However producing a particular shade of colour requires the utmost technical expertise and artistry. But in Nepal the technical know-how has spread well and even the loftiest level of dyeing can now be accomplished. Unlike the vegetable-dyed carpets the colours of chemically-dyed carpets do not change over time.

4 Design Technology

In the beginning most of the carpets

produced were influenced by Tibetan designs depicting dragons, snow lions, phoenixes, flowers etc. Significant change has taken place in designing new carpets. Symbols of religious significance, the most commonly used designs, have slowly given way to modern designs and colour pattern. Most carpet factories have full-time designers to come up with new original attractive designs. The importers have also arranged to provide their own designs and specifications as well as colour patterns.

The versatility and adaptability of the Nepalese weavers to weave newer designs every time has contributed a lot for the boom of the carpet industry in Nepal. The trend now a days include ethnic designs, oriental themes, and country styles. The western consumers are also interested in cultural and historical aspects. The borders have changed for flower and geometric designs. Modern geometric designs on the whole carpet have also become quite important.

The early weavers needed an original carpet to copy the designs into a new one. They began to learn to weave graphic art designs into a carpet. Now of course any complicated design can be easily handled by the weavers.

5 Weaving Technology

The weaving technology as such has not changed during the last three decades of the industry. The looms also have not changed apart from some improvements. In fact, it is this hand weaving technique that gives the uniqueness to the Nepalese carpet, and the technology is better left unchanged, otherwise the peculiarity of the Nepalese carpet could be lost affecting the market share of exports.

6 Washing Technology

The carpet washing was an unknown technology to the Nepalese and all of the carpet exports was in unwashed form. In the last decade the washing technology has been absorbed by the Nepalese manufacturers. Initially manual washing technique was used, but now mechanised washing is beginning to take roots. It is not at all a complicated technology. The only important thing is to be environment-friendly i.e. disposing the effluent water only after treating.

Manpower and Training Facilities

The carpet industry for the initial few years from 1960 employed mostly the Tibetan refugees. However in the late 1960's and early 1970's many private sector entrepreneurs entered the carpet business. The techniques were learnt from the Tibetans and now they are in a very small minority. It is estimated that about 2,50,000 to 3,00,000 people are engaged in the carpet industry. The reason for easy access to the industry for the common man or woman is that in most of the carpet making process not much skill is required . For example, in wool scouring, washing and dying operations raw unskilled hands can be used without any problems. For spinning of yarns a few days of training is sufficient to start with and for weaving, a few weeks of apprentice training will do to start work. Practice improves their skill and efficiency. Since most of the yarn spinning and carpet manufacturing units pay at piece rates, the workers have to improve their efficiency and productivity to earn more and more. This has played a vital role in self training of the

manpower.

For the specialized types of man-power like supervisors, dye-masters, weaving masters etc. the Department of Cottage and Small Industries (originally the Department of Cottage and Village Industries) has been providing training to appropriate candidates. Short term (6 months) and long-term (1 year to 2 years) courses were being provided, but now the long-term courses have been discontinued because of its doubtful performance or use. However, the Department is rethinking about the training programme in coordination with the Carpet Industries Association and the Carpet and Wool Development Council.

For specific jobs like designing and quality control, some expatriate experts are also given work permits and non-tourist visas. Many skilled workers from India are also abundantly used. But for most jobs the labour contractors or the manufacturers themselves are providing on-the-job training. The Carpet and Wool Development Council has recently been providing short-term (two weeks) training on wool dyeing.

But considering the importance of the carpet industry and its growing nature, training facilities at present are negligible and it is felt that a full-fledged training centre catering to the carpet industry dealing in all aspects is of utmost importance.

Quality Control and Competitiveness

The Nepalese carpet is a unique product with superior quality. The quality of a carpet depends on a series of factors like, wool quality, proper scouring and combing, uniform hand spinning, use of good dyes and dyeing technique, proper weaving craftsmanship according to given design and colour pattern and maintenance of knot density and pile height, washing and finishing process etc. Hence quality control has to be done at each stage of production.

The world carpet business is very competitive. The major suppliers of hand-knotted carpets to the global market are India, Pakistan, China, Afganistan, Nepal, Iran, Turkey, Morocco, Germany, U.K. etc. The highest market share (25%) is captured by India with China (21%) just trailing behind. Nepal has done very well in the past few years to overtake many other countries and reach the fourth largest supplier position with a market share of about 10 percent in 1991. This has been possible because of the strict adherence to stungent quality control of the product. Of course, some business men, with an itch to make quick money have tried to export lower quality products using wool waste, more Newzealand wool ratio, low quality dyes, lesser knot density etc. Fortunately, such evil practices have been controlled to some extent, and the market has not reacted too badly. Also the major importers have their own representatives in Nepal to check on Quality, and the real carpet manufacturers have good credibility.

The Nepal Bureau of Standards and Metrology has brought out many national standards relating to the carpet industry and is, at present, working on some more. The existence of national standards on all aspect of carpet manufacture will go a long way in helping the further growth of this industry.

Environmental Issues and Health Hazards

Carpet Industry is concentrated in the Kathmandu Valley. Almost fifty percent of

the carpet industries are located in Boudha, Jorpati, Chabahil and Baneshwor, Fig.7.1. Other areas are Koteshor, Tahachal, Dallu, Swayambhu and Balaju, besides of areas of Bhaktapur and Patan. Most of the units are scattered along the Bagmati, Bishnumati and Dhobikhola, the reason being that plenty of water is required for wool scouring, dyeing and carpet washing. Also it is easier to just let the effluent flow into these streams.

This is exactly why the carpet industry has become the target of criticism in some quarters. The frequently heard criticism, is that the carpet industry (washing and dyeing) is responsible for the water pollution in the Kathmandu Valley. However the arguments have been publicised on an ad hoc basis without detailed studies or facts and figures. The fact that sewage and garbage created by the alarmingly dense population of the valley is the main source of river pollution is ignored. This is not to say that the carpet industry is not polluting the environment. Only, the valley's rivers would be polluted whether the carpet industry existed or not. The pollution resulting from the carpet dyeing and washing seems to be small compared to the sewage pollution.

In April 1992 a report on carpet washing commissioned by GTZ and prepared by a German Consultant, H. Roolart was published. Although Mr.Roolart identified several ways on improving the carpet washing process, he did note that "the opinion that carpet-washing is the reason of the filthy dirty water in the rivers is definitely not true."

But because of the hue and cry made by the "environmentalists" and the concern shown by Western buyers, progressive carpet manufacturers have also become sensitive to environmental issues. They have begun to ensure that there are no negative impact on the environment.

For example, some manufacturers neutralize the chemicals in the effluent before being discharged into the river. Some new washing and dyeing units have also established effluent treatment plants.

There is also some solid waste from the carpet industry in the form of waste wool clippings from the weaving and finishing process and ash from boilers (using rice husk) in the dyeing plants. But these are environment friendly and act as excellent fertilizer. The waste wool loosens the soil and retains water and generates nitrogen so essential for plants.

In the carpet making process the workers are exposed to wool fibre, dyes and chemicals, including acids and alkalis. With proper protection like gloves or masks these health hazards could be minimized. Most of the workers involved in carding and spinning units complain about respiratory diseases as a result of inhaling fine wool fibers. The carpet weavers seem to have wrist pains. But any occupation has its own hazards, and hence the carpet industry cannot remain an exception. Hence the industry should be watchful and prepared for treatment of its workers. Also efforts should be made to minimize the hazards.

The Case of Child Labour

Another criticism leveled at the carpet industry concerns the use of child labour. This is such an emotional issue that anyone with a little sense will be touched by the wide media coverage. It is a fact that child

labour is used in carpet industry, but definitely not to the extent of 50 percent as sweeping ad hoc claims are made. There are two kinds of child labour-the first being the children of weavers themselves who join their parents in a sort of fun-and-game attitude, and the second being the children who are sent by their parents to work due to compulsion of their poverty. Besides child labour is also widely being used in other sectors as well.

Of course one should not try to justify the use of child labour. Children are best left at school, but have those people who frown upon child labour calculated how many more schools are needed every year to meet the need of new arrivals. Are there enough schools in the country at present, to take care of all the children under fourteen ? Can the people most of whom have to worry about a square meal afford to send them to school ?

The paradox of child labour is that it is being viewed with the eyes of a Westerner. The citizens of western countries are living in a society where everything is guaranteed by the state. What social security do we have in Nepal ? If all the carpet manufacturers were to leave out the proven child labour from the industry, who will make proper arrangements for their welfare?

There is already a law banning the employment of child labour (under fourteen). But in a country where birth certificates are the exception rather than the rule, it can be quite a challenge to determine the age of the hill tribe youngsters, who look under fourteen even if over twenty, because of the the Mongdoid nature (the absence of beard or moustache in young boys).

Anyway, His Majesty's Government of Nepal has recently taken action against a few carpet manufacturer's for employing child labour. This action may have satisfied the people who profess for the cause of prevention of child labour to some extent.

Policies and Programmes of HMG

The carpet industry has established itself as the most important industry of Nepal. It has made significant contribution to the economic progress of the country and to social justice by providing jobs to the poorer section of the people from remote areas. It is the biggest employer after agriculture and it is the biggest foreign currency earner since the last few years.

The credit for the success of the carpet industry mostly goes to the private sector carpet manufacturers. But the government policy towards the carpet industry of not interfering with the market forces, has no doubt helped. Realizing the importance of the carpet industry His Majesty's Government of Nepal has established the Carpet and Wool Development Board, under the chairmanship of the Assistant Minister of Commerce. The main aim of this council is to provide a one-window service to the carpet industry to make it easier for them to work with the Government, and also to address to the issues of the carpet industry like quality, market development, environmental protection, child labour and other problems.

The broad policy and programs of the government towards the carpet industry has been as follows:

a) Encouragement to the private sector for development of the carpet industry

b) Liberal attitude for import of raw materials, machinery and other equipments

c) Open General License (OGL) system for import of wool and other materials.

d) Inclusion of Manual Carpet Weaving in the Cottage Industry category so that no excise, sales tax, or income tax is levied.

e) Upto 50 percent of the investment on pollution control or environmental protection measures to be deducted from taxable income.

f) Exemption of customs duty and sales tax on raw materials used and excise on the product if exported

g) No license system for carpet export and only 0.5 percent duty on export

h) Income tax exemption on earnings from export

i) Commercial Banks provide upto 80% pre-export finance on the basis of L/C

j) Retention scheme of foreign exchange for exporters on their export earnings

k) Organized system for the issuance of the GSP (Generalised System of Preference) form

l) Testing and Certification services by Carpet and Wool Development Council for using IWS wool mark label

m) Weaver's training program conducted by the Department of Cottage and Small Industries and the Cottage and Small Industries Development Board.

n) Wool Dyeing training program carried out by the carpet and Wool Development Council (CWDC)

o) Colour forecast and shades matching services provided by CWDC

p) Light fastness, wet fastness and grease content testing service by CWDC

q) Quality development and export promotion services by CWDC

r) Up-to-date information services on product land market provided by CWDC

s) The trade Promotion Centre (TPC) has been involved in market promotion and expansion, playing the role of match maker between International Market and the Carpet Industry

t) Participation in International Trade Fairs for exploring potential markets

u) Publicity of the Nepalese carpets in new market areas (like USA, Australia, New Zealand, Japan etc.) by distribution brochures and booklets through UNDP and International Trade Centre etc. by TPC.

v) Keeping the carpet industry in harmony with the environment

w) Discouraging child labour in the carpet industry

x) Prevention of quality deterioration and use of waste wool etc.

Suggestions and Recommendations:

Although the carpet industry has come of age, the market competition suggests that the industry should always remain alert and watchful. Many problems being faced by the industry should be analysed carefully and solutions sought so that it can flourish without hinderance. Some suggestions and recommendations have been provided as follows:

1) Everyone involved in the carpet industry must honestly work hard to maintain the image of the Nepalese carpet as a unique and quality product and win the confidence of the consumers. Quality should not be sacrificed for quick money.

2) There is still a big gap in qualified and skilled manpower, hence extensive training programmes on various aspects of the industry, like dyeing, designing, weaving, washing etc. should be launched jointly by the industry and HMG.

3) The Carpet and Wool Development Board should be developed further as an institution to provide any information, technical and other support services to the industry

4) The Board should also have a statistical and monitoring unit to collect and disseminate all necessary information about the industry.

5) The Nepal Bureau of Standards and Metrology should develop the Standards for Nepalese Carpet to maintain its uniqueness

6) The Carpet and Wool Development Boarn International Market and the Carpet Industry

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5) The Nepal Bureau of Standards and Metrology should develop the Standards for Nepalese Carpet to maintain its uniqueness

6) The Carpet and Wool Development Board should formulate a clear cut policy on all aspects of the carpet industry

7) The environmental issue being of technical nature, detailed studies and analysis have to be conducted and standards and norms fixed for compulsory following

8) The child labour issue is a tricky problem. Child labour should be discouraged in the organised production units. Maybe this will provide jobs to adult unemployed.

9) The minimum export price (FOB) for the carpet should be fixed and reviewed after calculation of all costs of production. Provision of incentives or extra facilities to companies exporting at higher prices should be considered to increase the foreign exchange earning.

Conclusion

In Western Europe the Nepalese carpet is seen as a trend setter. It has brought new meaning to the idea of interior decoration.

The importers themselves are employing qualified artists and designers to come out with new designs with attractive combination of colours and ideas in close cooperation with the manufacturers.
It is because of these innovations that the sale of Nepalese carpets is growing. The basic reason for the success of the Nepalese carpet in the Western markets is that it did not enter the market as a competitor to other carpets but rather as a unique product in its own right. But it should not be forgotten that to remain in the market lots of dedication and innovation are required from all concerned quarters to maintain the image of the Nepalese carpet as a unique product, amidst similar copies being flooded by other countries.

Evidently, Nepal and its people have reaped many benefits from the magnificent carpet industry. The rapid growth of the industry has created its own problems and complications. But the solutions to the problems are not so challenging or insurmountable. By working in close harmony rather than being at odds with one another, the carpet industry and His Majesty's Government of Nepal should be able exploit the favourable economic situation generated by the carpet industry, so that it should flourish even better for many many years to come.

Table 2.1 Carpet Exports

Fiscal Year	Export Quantity sq.m.	Value '000 Rs.
1972/73	10,458	2,497
1973/74	13,065	3,772
1974/75	18,577	7,853
1975/76	19,784	9,276
1976/77	47,473	27,906
1977/78	26,530	23,944
1978/79	53,279	45,819
1979/80	66,775	55,367
1980/81	79,623	65,590
1981/82	98,204	83,929
1982/83	105,622	137,756
1983/84	262,826	263,350
1984/85	227,199	248,361
1985/86	329,518	376,414
1986/87	465,296	627,535
1987/88	802,100	1211,785
1988/89	913,582	1589,191
1989/90	1154,000	2284,496
1990/91	1628,318	3701,992
1991/92	2371,451	7130,928
1992/93*	979,950	3057,056

*First four months.(Compare with corresponding figures for 1991/92 : approx. 706,100 and 2120,000 respectively).

Source : **Trade Promotion Centre**

Table 2.2 Carpet Export compared to Total Export

Fiscal Year	Total Export Rs.'000	Carpet Export Rs.'000	Percentage share of carpet
1972/73	135,051	2,479	1.84
1973/74	172,280	3,752	2.18
1974/75	166,792	7,853	4.71
1975/76	266,303	9,276	3.48
1976/77	363,296	27,906	7.68
1977/78	601,329	23,944	3.98
1978/79	849,515	45,819	5.39
1979/80	780,605	55,367	7.09
1980/81	604,659	65,590	10.85
1981/82	462,307	83,929	18.15
1982/83	289,692	137,756	47.55
1983/84	483,738	265,350	54.85
1984/85	1,118,978	249,361	22,28
1985/86	1,760,786	376,414	21.38
1986/87	1,659,826	627,535	37.81
1987/88	2,488,643	610,778	24.54
1988/89	3,040,937	1,589,193	52.26
1989/90	4,388,989	2,294,694	52.28
1990/91	5,670,977	3,701,992	65.28
1991/92	12,184,836	7,130,928	58.52
1992/93*	4,531,294	3,057,056	67.46

* First Four months

Source : **Trade Promotion Centre**

Table 2.3 Registration of Carpet Units

Fiscal Year	Carpet Weaving	Woollen Yarn Spinning	Wool Carding	Carpet Washing	Total
Upto 1986/87	1942	574			2516
1987/88	166	311			477
1988/89	255	200			455
1989/90	347	216			563
1990/91	556	447	11		1014
1991/92	764	496		2	1262
1992/93*	115	34		1	150
Total	4030	2244	11	3	6437**

* First 8 months

** Assuming that only 50 percent are in operation there exist more than 3000 units.

Source : **DCSI (Department of Cottage and Small Industries)**

Table 2.4 Investment in Carpet Industry

Rs.'000

Fiscal Year		Carpet Weaving	Yarn Spinning	Wool Carding	Carpet Washing	Total
Upto	1986/87	2,942,788	507,000			3,449,788
	1987/88	91,711	169,283			260,994
	1988/89	104,274	64,639			168,913
	1989/90	624,867	153,584			778,451
	1990/91	208,380	166,430	11,134		385,944
	1991/92	313,950	204,000			517,950
	1992/93*	279,424	50,704		1,200	331,328
	Total	4,565,394	1,315,640	11,134	1,200	5,893,368

* First 8 months

Source : **DCSI (Department of Cottage and Small Industries)**

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PRESENT SCENARIO OF CARPET INDUSTRIES

Bijaya Bahadur Shrestha
President
Central Carpet Association

Introduction

The story of growth of the Nepal Carpet industry is one of the most remarkable success stories in the annals of South Asian business. It is a story of private enterprise of people responding creatively and energetically to economic opportunity to build together this phenomenal market niche. The art of weaving carpets is almost as old as civilization. The pile carpets dates back to more than 2000 years and may have been use in Tibet for at least the last 900 years.

The carpet weaving was introduced in Nepal in 1960 under Swiss Aid Program through aegis of Swiss Red Cross to rehabitate the Tibetan refugees. After three decades this carpet weaving is transformed into multi-billion export business from virtually zero in 1960. The Tibetan carpet was an art de object till late seventies. Only those people interested in Tibetan art, culture and heritage bought these carpets or it was a collectors item for scholars and for students for study.

Major break through and change took place in late seventies when creative importers were able to blend Tibetan weave with West European design then this art de object transformed into commercial product. The product was then commercially viable and industrially feasible with enormous growth potential turned into a reality today.

The need to increase export earning and employment has become all the more prominent, as highlighted in the approach paper to the Eighth Plan. The government policy of trade liberalization will necessitate increased amount of foreign exchange to overcome the ensuing deficit in trade balance consequent upon import liberalization. If liberalization is continued by continuous recourse to foreign borrowing, then the liberalization episode will come to an end fairly soon under the pressure of mounting debt service obligations and balance of payment crisis. So whether liberalization could be successfully carried our depends upon whether export earning can be increased sufficiently over some intermediate-to-long-run time horizon. An examination of export prospect of different items shows that only carpets have a better prospect. Though handicrafts are also emerging as a promising export items, they do not hold the same prospects as carpets. The prospects of garments is rather uncertain, as their exports have been quite erratic. From employment view point view point also carpets have a great potential of generating significant employment opportunities to the semi-skilled as well as unskilled labor force because of industry's labor intensive operation .

Salient Features of the Carpet Industry

It is the biggest foreign exchange earner, it has earned over 4 billion Rupees in 8 months of the current fiscal year. It has also played important and have given significant contribution in enhancing the foreign

exchange reserve from 14 billion to 23 billion Rupees. It is a piece history that we have such abundant foreign exchange reserve that the Dollar is falling against Rupee 2% fall recorded in one month. 60% of the total foreign exchange earning of the overseas export comes from carpet. It has taken over tourism in foreign exchange earning since last fiscal years.

Single Biggest Employer

It is the single biggest employer employing over 300000 people, employing more people than all the industrial districts of Nepal put together. It employs more people than HMG and only the industry which helped to diversify excess labor from agriculture to industry helping to remove unemployment under employment and disguised unemployment. It employs mostly people from remote hills and people living in subsistence level.

Mostly people whose annual income was less than US$65 per annum considered to be poverty line income before they came to carpets. This industry is greatly responsible to nearly eradicate bonded labor system from Nepal.

Made in Nepal Creation

This industry could be pride of nation because it is our industry. We create it .... like Morita of Sony created Walkman-mobile music. As mentioned earlier it was a market niche. When we came, we did not disturb the market of traditional carpets, carpet types like Heriz, Tabriz, Diozan, Bidraj, Kasan, Sulatbad, Schrbaff, Kasgan, Ardabil, Mira, Moud, Kashmir Ghoum, Naini, Isfahan, Sohagi, Yaze, Sarak, Joshegan, Shiraz, Kirman, Khorasan. It is not a overflow business industry like garments which is operated by marketing skills and product quality more by bilateral diplomatic relation. We look towards India towards for everything but India looks towards Nepal and copies Nepal when carpet is concerned. In Europe , it is often said Tibetan carpet is bought for its color and idea. Carpet importers and exporters work closely with DUPONT and IWS (International wool /secretariat) for the future color forecast. New Zealand Wool Board which is one of main reason why Nepalese carpet has been able to satisfy the trend and demanding customers.

Product Characteristic

Raw Wool: The use of Tibetan Wool (in 50 :50 ratio) was a special product character. Every step should be taken to ensure to maintain our product identity. It is said that colder the climate, to better the wool and the Tibetan plateau, the roof of the world is a excellent place. In the modula of the Tibetan wool which produces air filled cells is the best for carpets. One can easily visualize the quality of Tibetan wool if both the wool is seen at unscoured stage. The New Zealand (N.Z) wool is scoured and wool fibre are opened by a machine similar to carding machine before export. However, N.Z wool has better color, its sheep breed produces all white wool which is not possible for Tibetan wool.

The sheep breeds like Romny, Perrandale and Cop-worth are the product of years of research by WRONZ.

The equal blend of Tibetan and N.Z wool would give us the advantages of minimum residual grease content, vegetable matter content, resilience and whiteness of Y-2 =4

with value of Y=being 60.

Further to answer the question of over production. I would like to recommend type 128 5/7 instead of 4/6. This wool is full fleeced and is not available through out the year.The quantity is not available through the year . This recommendation if and implemented would guarantee of even better quality and would control of current problems of over production to some extent. However,I would like to asset that this at present point of time is an independent suggestion.

Carding and hand spinning of woollen yarn: Carding hides all the sins of carpets. It was a bad decision of the HMG to permit the use of huge carding machine to replace hand carding. It lead to mass production. This is dangerous. So I had lobbied carding machine should be banned but I was then a lone crusader and now there are many who think on similar lines but it is too late . The other lobby was more powerful,so carding machine have come to stay and we all must accept it. If carding machine were not introduced, we would not have mass production and possibility of recycling cut piece would not have existed.

Design: I think it would not be wrong to say Nepalese carpets are European carpets, made in Nepal. It is made to suit European taste and decor. The designs of Nepalese carpets are quite different from traditional carpets like Persian, Afgani, Bhokara. Our carpets are of design that is made to suit the textile fashion currently in Europe particularly in reference to curtains and so far and other dominating interior decor.

The constant reinforcement of new ideas, innovative concept and colors help to keep the market buoyant for the Nepalese carpets. However, the level of innovation and quantity of production is not kept in balance. The production has increased dramatically but not the innovation.

The present designs, and colors are not suited to the Americans buyers. Trying to market our designs and colors would be like trying to sell cheese to Chinese.

Hence, it would be a thoughtful and productive step to invite American designers to tell us/show us what is American style ? What they like / want / prefer? How are the product development possible ? How are product use possible ? Inviting a American designer will be a excellent and fruitful idea.

In the first phase, we would produce the samples accordingly, then moving into the second phase would be to invite American importers and departmental stores to give us their feedbacks, suggestion on how this would fore in the American market. The Central Carpet Association has already submitted a proposal to USAID through Economic Liberalization. We are awaiting its sanction and implementation.

Serious steps should be taken to balance it. Otherwise all the product would look alike then only price might become a deciding factor, which could be a signal to the beginning of end of premium product. It is a open secret that huge machine spinning plant are operating even during the night to produce yarn. If the government does not act on these illegal operators. Our other main product identification character hand spun shall be gone.We shall ruin the foundation that took us years to build. Then our carpet would look like any other carpet

of the far east our product, mark, product identification, product feature, product character would all be gone .

On Carpet Industry

The entrepreneurs responding to spurt in international demands have bought the industry to the present level of achievement. However, the quest to further enhance more growth should continue.
The main character of good marketing is to ensure good production and good supply and good taste in the international market. However, it is understood that a great deal of new comers in the business are offering low price using machine spun yarn, short wool, even recycled wool. At present emerging number of producers and exporters do seem to concerned with quality of price and carpet. Some importers and exporters agree to say that there is over marketing in Germany around 70 percent. Table 2.1 - 2.5

Marketing for New Markets

At present 90 percent of the carpets go to EEC markets. The concentration is in three countries export whereas to USA is negligible. If these market cease to exit there shall be a server set back and server impact to the national economy leading a to shortage and massive unemployment . Given such a situation it is not immediately possible to switch export to other markers. Exploration of new markets is an important issue. It is inoperative possible marketing of our carpets to USA, Canada, Australia should be explored . Even export to EEC should be taxed to provide incentive subsidy to participate in trade fair develop new market .

Product Life Cycle

The product life cycle can be a very important issue. There is the product launch, the growth, the boom, then recession, and then fall. Many products in the market had early product cycle or went into recession because they didn't keep an eye on possible competition. One appropriate example is the video industry. Video parlors are facing difficulties because they did not envisage the possible market of satellite TV, same as papers did not think of TV.

In the similarity there could also be serious threat to Nepalese carpets. There are companies trying with African carpets, and dense hand tufted carpets from China and flat weave from Spain, so we have to be aware of all developments to keep the engine product life cycle going.

Anti Pollution Norms

There should be clarity of what is pollution. There is pollution even when one washes hand, phosphate is used. Mr. Jindel of Thermax said at a seminar held on 19th May on Air and water pollution at Hotel Kathmandu. A human being disposes 50 grams of pollutant everyday. This would be quite huge when one million inhabitant of the valley disposes everyday. No industry in the world today is able to make industrial water effluent drinking water. But definitely we could treat to a extent that the fishes and plants don't die.

Considering the chemicals,
we use
- Acetic acid
- Chlorine
- Caustic soda

This would be difficult since they all are chemicals used in household. Acetic acid is vinegar mostly used in salad and cooking . Chlorine is used by water and sewage department to treat water and make it bacteria tree. Caustic soda is widely used in making of household soap. We even use the powder for washing. Sulfuric acid if used to neutralize, by proportionate, chlorine and caustic soda. there is no situation that is so alarming and to be prepared for wartime emergencies as Barbara Adams puts it.

However, washing at ridiculously low price of US$ 2.99 per square meter. It would be possible economically to make it environmentally friendly. Most of the chemicals can be easily neutralized through proportionate use. If at all acidic this can be neutralized by lime treatment as well . But the agony of the story is : Hardly any carpet people know about river system with even collecting a effluent water tank .

Garden washers who do not meet the above standard should be closed down or move to remote areas as per industrial zone classification.

It is not difficult to meet above standards if set . Although the ideal situation would be by a certificate by German Agency for Technical Co-operation certifying this is pollution free establishing a unit in kathmandu. See Table 3 for SIS Standard for liquid effluent and inland surface water.

Floor Price : Trade Promotion Center who holds the secretariat of valuation committee has never explained the purpose behind explicitly. What is floor price and its rational or the objective.

Is it a instrument to control quality

Is it a instrument to control leakage of foreign exchange ?
Is it a necessary check and balance instrument of quality and price ?
If valuation committee does not answer these questions, it could become a tool of bureaucratic machinery to suit their requirement lobbying platform at the expense of industry itself .

Now, with the inception of Carpet and Wool Development Council, these above point would be seriously considered. I am confident that it will take step based on HMG's Commerce Policy para 4.8 to gradually eliminate the requirement of floor price .

Child Labor : Nepal is a very populous country. We have no shortage of labor. Not even 2% of our population is engaged in industrial activities. We have so much unemployment , disguised unemployment more than 5 million.

This industry can easily do without child labor. Nor is our carpet so much knotted oriented that we need nimble fingers. Nepalese carpets are popular by the innovative design, color and new ideas no by the density, of knots. Child labor may play significant role in making high quality, high knotage Persian but it is totally a myth in case of Tibetan carpets.

Labor Act 2049 is drawn which strictly prohibits the use of child labor. Many trade unions have demanded that no child labor should be used and the government has now the legislative power. So government should send random cross check inspection squad. Any factory employing child labor should be totally closed down. There should be no mercy/ compassion understanding/ for

illegal activities. However, if the child works for his father or mother then it is difficult to say it is child labor. In View of Indian experience, Swamy Agnivesh and his campaign about children exploited to weave carpets.

The children of Bhir had a negative attitude and same could happen to us. We have to take measures not to suffer like the Indians. We have to hunt for every positive avenues, look for certificate free of child labor to endure continuing success for carpet industry .

Recently in close acquaintance and link with Department of Labor, a Labor Overview Committee has been formed. Our Association and the Labor Department have randomly inspected few selected factories. We are launching soon awareness drive urging the factories not to use child labor making them aware of legal framework .

On 17th September , I had the opportunity to be invited to supporting Nepalese Tibetan Carpets Association. ANTC, is the only body outside Nepal solely devoted to save and promote Nepalese carpet. There at SNTC, I presented my view that child labor is a socioeconomic problem. More the parents earn less is the chance that the child will work , so paying more wages to parents would result in multiplier effect.

SNTC is very serious, they are on verge drawing serious plans, for child labor elimination program before it could produce multi dimensional impact. Hamburg radio reported that they were plans to celebrate 18th September as day of the CARPET CHILDREN.

We have to save the children and our industry. All concerned parties should work cohesively,seriously, actively on this ever emerging issue before it takes its toll.

Conclusion

There should be a clear cut trade fair policy subsidized trade fair show should be allowed in region where Tibetan carpet has gained enough exposure and momentum. New Market Area/ Nw country subsidized trade show is appreciated.

Contract system and wage links productivity is the foundation of carpet success story. This should continue to make carpet industry flexible and market responsive. One can enhance the production or lower the production to the requirement of the market. Pollution norms / standard should be set immediately. Those not meeting the standards should be closed down. The carpet industry can do without child labor. So immediate step should be taken to stop factories using child labor.

We had good times and bad times now is he changing time, in this time it is very difficult to work in isolation . A united joint approach should be taken. Before, the government never took us seriously because there was lack of joint approaches from the exporters and importers. Our association's main objective fosters such feelings. With this objective and mutual development of exporters and importers and to enrich the future of Nepalese Carpets, the Carpet Development Council has been formed and I hope this important seminar will further foster the relation in between wool exporters and carpet exporters and importers to work for innovative market ideas, new concepts and higher segment of the market.

Carpet Exports From Nepal (1966/67 to 1991/92)

S.No.	Fiscal Year	Exports in sq. Mt.	Total Value in 000 Rs.
1.	1971/1972	NA	1,703
2.	1972/1973	10,458	2,497
3.	1973/1974	13,065	2,497
4.	1974/1975	18,577	3,752
5.	1975/1976	19,784	27,906
6.	1976/1977	47,473	27,906
7.	1977/1978	26,530	23,944
8.	1978/1979	53,279	45,819
9.	1979/1980	66,775	55,367
10.	1980/1981	79,623	65,590
11.	1981/1982	98,740	83,929
12.	1982/1983	150,622	37,756
13.	1983/1984	262,862	65,350
14.	1984/1985	227,199	49,361
15	1985/1986	329,518	76,414
16.	1986/1987	465,296	27,535
17.	1987/1988	802,100	1,211,785
18.	1988/1989	913,580	1,589,191
19.	1989/1990	152,000	2,290,000
20.	1990/1991	1,628,000	3,700,000
21.	1991/1992	2,371,000	7,130,000
22	1992/1993*	980,000	3,057,000
*	First nine months		

Source : Trade Promotion Center

Carpet Export from Nepal by Destination

	1985/86	1986/87	1987/88	1988/89	1989/90
Germany	51.0	40.1	50.4	53.5	57.8
UK	25.1	25.3	18.8	14.4	9.9
Switzerland	17.3	25.3	21.6	18.7	17.8
France	1.4	1.1	0.9	1.0	0.7
Belgium	1.2	4.2	4.4	5.6	6.5
Netherlands	0.4	0.7	1.0	1.3	2.4
USA	2.6	2.4	2.2	4.0	3.5
Total	99.0	99.1	99.3	98.5	98.4

1. Import to Germany
(Hand-knotted Carpets)
in 1000 Sqm (German Statistics)

1976	4.747
1988	5.260
1980	5.561
1982	5.076
1984	5.378
1986	5.614
1988	8.001
1989	8.041
1990	7.766

2. Import to Germany
International comparison
in % of Quantity (German Statistics)

	1988	1989	1990
Iran	15.5	15.0	14.6
Indian	29.2	31.9	30.8
Nepal	6.6	9.2	12.6
China	7.9	9.0	10.9
Morocco	20.2	18.8	15.2

3. Import to Europe
Country - Comparison
EC - Statistics

	1000 Sqm in 1990	%
Morocco	1.165	17
Iran	0.150	3
Pakistan	0. 48	7
India	1.839	27
Nepal	1.104	16
China	2.050	30
Total	6.832	100

4.Import to Europe
From Nepal
EC- Statistic / 350 knots per m.

	1900	1000 Sqm.	%
Benelux	0.102		9.2
Germany	0.868		78.6
France	0.014		1.3
Italy	0.006		1.3
Netherlands	0.026		2.3
UK	0.078		7.0
Tota	1.104		100

ISI Standards for Liquid Effluents and Inland Surface Water

S.No			
1.	TSS.mg/l	100	100
2.	Particle Size of TSS (p) (Floatable) (Settleable)	850	1000 850
3.	TDS mg/l	2100	-
4.	Temperature C	40	45
5.	pH	55.90	55.90
6.	BOD mg/l	30	100
7.	COD mg/l	250	250
8.	Oils & Grease mg/l	10	20
9.	Ammoniacal Nitrogen(as N)	50	50
10.	Phosphates (as S)mg/l	5	5
11.	Sulphides (as S)mg/l	2.0	-
12.	Fluorides(as F)mg/l	2.0	15
13.	Cynides (as CN) mg/l	0.2	0.2
14.	Lead (as Se)mg/l	0.1	1.0
15.	Selenium (as Zn)mg/l	0.05	0.05
16.	Zinc (as Zn) mg/l	5	15
17.	Copper (as Cu) mg/l	3.0	3.0
18.	Nickle (as Ni) mg/l	2.0	5.0
19.	Cadmium (as CD) mg/l	2.0	2.0
20.	Chromium (as Cr) mg/l	0.1	1.0
21.	Mercury (as Hg) mg/l	0.01	0.01
22.	Arsenic (as Hg) mg/l	0.2	0.2
23.	Phenotic Compounds mg/l	1.0	5.0
24.	Residual Chlorine (asCl)	1	1
25.	TKN mg/l	100	100

PLAN AND POLICY OF HMG IN TEXTILE INDUSTRY OF NEPAL

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Introduction

The textile industry is of major importance to the economy of Nepal. The textile sector covers a vast number of sub-sectors. According to the Nepal Standard Industrial Classification (NSIC), the textile sub-sector comprises of the following industries:

NSIC 321 Manufacture of Textiles

3211 Spinning, Weaving and finishing of textiles

3212 Non-wearing textile goods

3213 Knitting mills

3214 Carpets and Rugs

3216 Jute manufacture

NSIC 322 Manufacture of Wearing Apparel except Footwear

In the case of Nepal the non-weaving textile goods is only of minor importance. The carpet industry has been dealtwith separately and jute manufacturing also constitutes a separate category. The manufacture of wearing apparel (or garments) has also developed into a significant industry of Nepal in terms of foreign currency earning, and hence needs to be considered separately. This paper deals with only the sub-sector 3211 finishing of or spinning, weaving and textiles.

Historically, most countries started their industrial development through the textile industry, as also did Nepal , because textile is a basic necessity of human beings. It is a labour intensive industry, and a good catalyst for economic development. The textile subsector has backward and forward linkages which generate employment and value added opportunities throughout the economy. Most significant are the linkages within the textile sector as shown in Figure 1.

Historical Background

Textile weaving activities in the households of rural and semi-urban areas have been a way of life for many centuries. Normally these households wove cloth for their own use. Modern weaving was brought to Nepal in 1921 A.D. by Mr. Tulsi Mehar Shrestha, who had learnt about spinning and weaving in the Ashram of Mahatma Gandhi, in exile. The Rana Prime Minister, Chandra Samsher had provided him the Charkha and cash support. The establishment of a trust named Tri-Chandra Kamdhenu Charkha Pracharak Mahaguthi, in 1926 heralded the new era in textile spinning and weaving. A handloom textile factory was established in the central Jail for the prisoners. Weaving training programs

were also introduced in 1930 along with cotton cultivation in Kathmandu.

In 1939, the " Nepali Kapada and Gharelu Eelam Prachar Adda" (at the site of the current Department of Cottage and Small Industries) was established for promotion of weaving cloth. It provided training and also distributed looms on installments. Till 1942, the hand-loom, or throw shuttle loom dominated the scene. Gradually the fly scuttle loom (pedal loom) began to take the place of the throw shuttle loom. The Department of Cottage and Village Industry Training and Development was set up in 1955 with the assistance of Ford Foundation; and in 1956, the Cottage Industry Handicraft Sales Emporium was set up to provide raw materials, equipments, and designs to the various weaving units, as well as to market their products. The Government continuously involved itself in the textile industry at the cottage level, providing all necessary support services.

However, the beginning of the modern textile industry in Nepal was heralded in 1942, with the establishment of the Morang Cotton Mills Ltd. This factory had a capacity of 13,000 spindles and 162 powerlooms. After the end of the Second World War, the textile industry revived in India, and this infant unit could not survive the fierce competition of the Indian products. Inexperienced management and financial trouble hastened it to close down.

During 1960's many textile weaving units with powerlooms were set up, to produce synthetic textiles, with yarns imported from Japan. Their products were chiefly exported to India. But because of the introduction of restrictive provisions on export to India in the Nepal India Trade Treaty in 1971, many such textile units closed down. The textile industries have been since then encouraged to meet the domestic demand. The Balaju Kapada Udyog Ltd. with 119 powerlooms and a finishing plant was set up in 1971.

The rehabilitation of textile mills was started in the 1970's The Morang Cotton Mills Ltd. was auctioned off by the government. It was renamed as Ganapati Cotton Mills Ltd. In 1976, the Gopi Kapada Karkhana was established, and in 1979 the Hetauda Textile mills Ltd, constructed with the cooperation of the People's Republic of China, started production. It has 14688 spindles and 486 looms. This is the only integrated textile mill with a fully equipped finishing plant. Many other cotton and synthetic textile fabric (Power loom) industries have been established during the last two decades. Major among them are Eastern Textile Industry, Annapurna Textile Industry, Pashupati Textile Industry, Ganesh Textile Industry, Purna Lalit Textile Industry etc. Two spinning units Butwal spinning Mill Ltd. and Jyoti spinning Mills Ltd. have also been set up to supply yarn to the numerous textile industries, specially those in the cottage sector.

Current Status of the Industry

Hand spinning and hand weaving have a long tradition in Nepal, and these activities continue to play a major role in the economy, specially as a source of additional income for the rural population. But the advent of machine made products has confined the handloom weaving to the remote areas, being naturally protected through lack of transport facilities.

Though a modern textile industry has gradually come up, it is still very small and

meets only a fraction of the domestic cloth demand. There is, at present, only one integrated textile mill in operation-Hetauda Textile Industry Ltd. The progress of the textile industry seems to have been impeded by the tough competition from cheaper and better quality fabrics imported from India and China, and non-availability of local raw materials. Cotton growing is very limited. See Table 3 for cotton production data.

1. Spinning

Hetauda Textile Industry Ltd. was the only textile manufacturing unit with its own spinning plant, supplying yarns to many small weaving units, till some years ago. The lack of interest for putting up spinning plants appears to be the inadequate supply of cotton from domestic cultivation. Because of inadequate spinning capacity, yarn used to be imported in considerable quantities. Cotton yarn was mainly imported from India, while synthetic yarns came from Singapore, Korea, Japan, Hongkong, Taiwan etc.

The Butwal Spinning Industry came into operation in 1990. Its capacity is (25,088 spindles) 1530 MT cotton yarn and 1225 MT blended yarn per annum. Another spinning mill. Jyoti Spinning Mills Ltd. came into operation in 1992. It has a capacity of 3663 MT cotton, polyester and blended yarns.

The technology predominantly used in Nepal in spinning is the ring spinning system. The Hetauda Textile Mill and Butwal Spinning Mill have been equipped with conventional ring spindles. But Gait Spinning Mills has been supplemented with rotors, besides the ring spindles. Actually the ring spinning process has maintained its dominance.

Even in the international scene, though major innovations have taken place in the spanning technology. The primary advantage is its universal applicability in the production of fine yarn. Thus the technology being used in Nepal is quite adequate.

2. Weaving

The weaving industry of Nepal basically comprises of many decentralized weaving units in the cottage and small sector, with a few medium and large establishments combining both weaving and finishing. There are about 31 textile mills producing cotton and synthetic fabrics. The total production capacity in 1989/90 was estimated at 60.5 million meters consisting of 16.9 million meters of cotton and 43.6 million meters of synthetic fabrics.

The weaving units in the cottage sector are quite scattered, and the production statistics are hard to come by. It is very roughly estimated that the production capacity of fabrics from the cottage sector is about 48.5 million meters, mostly cotton, for the corresponding period. The most notable factor in production is the pronounced shift in favour of synthetic fabrics and corresponding decline in cotton cloth.

The demand for fabrics is mostly met by large quantities of imports, thus fabric production offers potentially a thrust area for growth. However, the textile industry needs to be reasonably protected by reviewing the existing duty structure. This is considered to be of paramount importance to provide the right environment to make investments in textiles commercially and economically attractive.

The technology level of weaving in Nepal is also quite wide from the

most traditional throw shuttle handlooms to modern power-looms. The throw shuttle handlooms are still the most widely used looms in Nepal. The total such looms in the cottage sector is estimated to be about 50,000. The productivity of such handlooms is quite low-hardly 2 meters per shift (8 hrs). The slightly improved version of fly-shuttle looms are also widely used. It is estimated that about 15,000 fly shuttle looms are in existence. Its productivity is much higher with 6-8 meters per shift.

The major weaving activity in the organized sector takes place in power looms. The ordinary powerlooms have been replaced by automatic looms and then by shuttleless looms (airjet looms). About 2000 powerlooms are estimated to be in operation in Nepal.

Out of this about 50 per cent constitute non-automatic shuttle looms mostly in the decentralized sector. The other 50 percent are automatic shuttle and shuttleless looms.

Hetauda Textiles, Balaju Kapada Udyog and Shree Textiles have Chinese shuttle changing looms. Shuttlers and projectile looms obviously made their debut in Nepal in synthetic weaving. Ashok Textile and Eastern Textile have Japanese Sudakomo rigid rapier looms whereas Annapurna Textile have swiss Sulzer projectile looms. Automatic looms from India are also widely used.

3. Sizing and Finishing

Only large textile mills have these facilities. Processing of the woven fabrics can be broadly divided into bleaching, dyeing, printing and finishing. Hand dyeing and bleaching is still practiced in the cottage sector. But because of the lack of processing facilities in the decentralized weaving industry, considerable value addition is deprived. Also the quality of the fabrics could be very much improved by the finishing process. There is a big gap in this process, which needs to be urgently bridged.

Due to the lack of processing facilities most of the cottage sector produce twisted and hand dyed yarns to manufacture loom-finished fabrics. But the synthetic weaving industries have introduced some of modern wet processing technologies such as jet-dyeing, hot-stenters, flat-bed screen printing machines, decatising etc.

Manpower and Training

Nepal has a surplus of labour. However there are shortages of trained manpower . The majority of the labour force lacks education and industrial skills. Therefore several industries are employing Indian skilled labour.

Skill development trainings are conducted by the Department of Cottage and Small Industries and the Cottage and Small Industries Development Board. In textile training, generally weaving skills and dyeing and printing skills are imparted. Mobile training is also conducted in different districts as per demand from the local textile industries. However the training facilities are traditional and out-dated. Training is provided in handlooms and semi-automatic looms. But the training programme is being reviewed, and depending on the demand for training modern arrangements are being planned.

Training of skilled people for repair and maintenance of looms, batik printing etc. are also being planned for the coming years to supply the needed manpower. However there is a big need for training middle-level technicians to cater to the growing textile industry. The higher level engineers, designers etc. have to be trained abroad.

On an international basis, Nepal has probably the lowest wage rate for production workers. In 1986 the hourly wage rate in Nepal was estimated at US $ 0.15 cents, compared to 48 cents in India, 22 cents in Bangladesh, 59 cents in Pakistan, 19 cents in Srilanka and 22 cents in China. The comparison of wage rates to other developing and some of the developed countries is given in Table 4. The cheap labour gives the textile industry of Nepal a considerable international competitive advantage.

Domestic Consumption of Fabrics

Nepal has a relatively small market for textiles. Despite the growth of domestic market over the past years, the current per capita consumption of fabrics is well below international standards. The per capita fabric consumption of Nepal in 1985/86 is estimated to be about 8.5 meters compared to the Asian average of 23 meters and the global average of 40 meters. The per capita textile consumption in Kg in the world is given in Table 5.1. Assuming 1 kg of fiber is equal to 6 meters the per capita consumption is also shown in meters.

In 1985/86, the total fabric use in the country was about 141.9 million meters. Only about 30 % of the total consumption was produced domestically. The rest was imported. However, because of the open border trade with India (and also China, to some extent) it is difficult to arrive at the exact consumption figures. The apparent Domestic Consumption of textile fabrics is shown in Table 5.2. The consumption seems to be declining. The increase of the unofficial border trade may be the reason for such discrepancy.

Technology and Trend

The textile technology can be broadly divided into three main categories:

a. Yarn Forming or Spinning
b. Fabric Making or Weaving and Knitting
c. Processing (Bleaching, dyeing, finishing)

A brief review of the technological development is presented below.

The fibre for making cloth can be natural or man-made. The classification of fibers is given in Table 6.1. The most predominantly used fiber in Nepal for making fabric are cotton and polyster. The age-old hand spinning (or Charkha spinning) can be still seen in the villages. The first mechanization of spinning was done in Europe in the 19th century. It consisted of a number of spindles in a spinning carriage and was powered by mules. The invention of ring spinning in the beginning of this century brought about a real break-through in spinning technology. Various modifications and new spinning methods have been introduced but still 75 percent of spinning in the world is done by using ring spinning method. Spinning techniques are given in Fig.6.2.

1. Fabric Making

Fabric making is done by three methods: 1) Weaving, 2) Knitting and 3) Non-weaving. In weaving two series of warp and weft threads interlace each other in definite pattern to weave cloth. In knitting one series of thread (warp or weft) makes fabric in different loop structures. In the case of non-woven fabrics, fibre layers are laid in different patterns then bonded together by needle punching or fusion method. Each of the above methods has made rapid technological strides, but the weaving technology is still predominant in making fabrics. Weaving can be broadly divided into the groups shown in Fig.6.3.

Traditional hand weaving still exists in developing countries. But production of 4/5 metric tons on handlooms to 400/500 metric tons per day in jet looms speaks of spectacular technological evolution that has taken place in the last few decades.

Among unconventional spinning techniques only the rotor spinning is gaining commercial success because of higher productivity. Other processes have limited applications. But the conventional ring spinning has been greatly improved and the spindle speeds have been increased from 1000 to 25,000 rpm. Also the long ring frames of upto 1008/1200 spindles (from 480/500) have been made possible with mobile automatic doffing and computer controls etc.

Equally impressive is the improvement in production technology of synthetic fibre. Easy care and durability properties combined with elegant look and feel has popularised the man-made fibers. Today more than 40 percent textile fabrics are made from artificial fibers mostly in blended forms. Texturising of man-made filament yarn has added new dimension in textiles, also making it cheaper.

2. Processing:

Processing of fabric is done to enhance its aesthetic appeal. It consists of the following main steps:

a. Designing, Scouring, Bleaching
b. Dyeing
c. Printing
d. Finishing

Hand dyeing and block printing is still practiced in the cottage sector. Bleaching, dyeing and printing can be done at the yarn stage or fabric stage as required.

Conventional processing machines have been gradually replaced by high speed production machines to bring down the cost and improve the quality. Processing technology got a real boost with the use of synthetic fibers, because manmade fibers demanded precision machines with perfect controls on processing parameters. Along with the development of machines like pressure Jiggers, Jet and Beam dyeing machines, special dyes, chemicals etc. were also developed.

In recent years, much research and development efforts are directed in improving dyeing and printing techniques. Operations like washing, hydroextraction, drying, padding etc. are fully automated. With computerization of colour matching and colour processor it is now possible to manipulate dyes and colour selection and improve quality. In short, spectacular all round technological developments have taken place in textiles industry. But for developing countries should carefully select

appropriate technology to balance the high unemployment rate.

Problems and Constraints

The textile sector produces the types of commodities for which Nepal should expect to have a great comparative advantage, because it uses simple manufacturing technology and cheap labour of minimal skills. The prospects for the textile industry is good, but the following problems are the most serious ones hindering the balanced growth of this industry.

1. The lack of adequate domestic raw material base, cotton or synthetic fibers.

2. The low level of technology and labour productivity

3. The low level of skills and education of Nepalese labour and management

4. Inadequate infrastructure in the country, like transportation, storage, power, and various industrial support services

5. Inappropriate investment incentives, specially with respect to implementation

6. High transport costs to the seaport both in terms of money and time spent

7. Small size of the domestic market

8. Foreign Exchange and finance constraint

Most of the constraints are endemic to the Nepalese economy. Hence the solutions to these problems are macro-oriented and economy-wide. HMG recognizes the need to combat these constraints. The major thrust of the new Industrial Policy is to encourage private investment.

Policies and Programs

The textile industry is of crucial importance to the national economy, but it has not received due attention by way of policy and institutional support. The policy framework has broadly two components. The first is a set of macro-economic policies which promote industrialization in general. The second set of policy and institutional mechanism are those which are specific to the textile sub-sector.

The new Industrial Policy, 1992 has taken care of most of the first set of considerations. The textile industry has been included in the list of Industries of National Priority.

Textiles constitute an essential basic need item of mass consumption with a substantial volume of growing demand, which if not met through local production, have to be imported spending a lot of valuable foreign exchange. The industry can provide substantial employment in manufacturing as well as cotton growing. The technology is not complex and can be absorbed easily.

The total demand for all fabrics are estimated at 277 million meters in 1994/95 and 432 million meters in 1999/2000, whereas the current level of production is only about 35 million meters. It is not possible or desirable to aim at self-sufficiency, because of the order of investment required and the trained

manpower needed. Hence the programs and policies for the expansion of the textile sector in the coming years have aimed at slow and steady growth. Also because of transportation problem and distant scattered markets it is desirable to allow decentralized handloom and power loom industries.

The policies and programs being followed are illustrated in the context of liberal industrial policy.

1 The yarn and fabric production textile industry is relatively capital intensive. Hence Nepal does not have any significant advantage in export of these products. But being a basic need item, the thrust is in import substitution, and manufacture of typical fabrics for supporting the readymade garments industry.

2 Cotton textiles will remain the main demand item of the domestic market, and hence the policy has been to promote local cotton growing through the services of Cotton Development Board.

3 Two spinning mills have been promoted in the last decade to cater to the scattered weaving industry, and bring about backward integration.

The blending of cotton with synthetic fibers have been allowed according to the consumer preference. The cotton yarn demand in 1994/95 in 1999/2000 is expected to reach 10,500 MT and 17,400 MT respectively, hence additional spinning capacity has to be promoted.

4 The textile industry is given complete freedom to produce the variety of cloth (coarse, medium, and fine) for popular end use.

5 Integrated textile mills from fibre to fabric are also encouraged according to production costs and economies of scale.

6 The expansion of spinning and weaving capacities are being planned in the coming five year plans.

7 Since local production of synthetic fibers is not cost effective at the present demand level, the policy is to allow free import of such raw materials.

8 The policy has been to encourage the growth of the textile industry in the organized sector to be cost effective, and also encourage the handloom cottage industry for employment promotion and social justice at the rural level.

Recommendations

Textiles being a basic need item, there is always a growth in demand all over the world. In Nepal, too the demand for textiles is ever growing, but most of the demand at present is being met by imports. There is already a tradition of textile production in Nepal to build on, yet there is a very lethargic growth pattern of this industry. This clearly suggests that there is no favourable policy and environment for its growth. Hence the root causes have to be annalist and policy adjustments made. Some recommendations are given below:

1. Restructuring of Duties

The prevailing duty structure on fabrics does not seem to favour the efficient growth of textile industry. This has to be reviewed to provide an effective protection of about 30% to the industry.

2. Decentralized Production

The weaving industry should be allowed to grow on a decentralized basis in clusters of powerlooms. This would encourage the private sector. Yarn production can also be decentralized, with flexibility to produce cotton and blended yarns. Independent finishing units should also be established to provide such facilities to small production units.

3. Access to Investment Funds

The overall investment envisaged in the textile industry is quite great. Priority should be given to investment funds in the textile sector.

4. Raw Materials

The raw material should be freely provided to the industry either locally or through import. There should also be freedom to import yarns by the power-loom industry.

5. Product Flexibility

1 The production policy should provide complete freedom to the mills to produce any type of fabric using any type of fibre, so that the industry can respond to the changing market conditions automatically.

2 The present study structure puts cotton textile industry at a great disadvantage vis-a-vis synthetic textiles leading to distorted development. This should be corrected to make both of them work on equal footing.

3 Self-sufficiency should not be planned at any cost. But a greater balance between spinning and weaving capacity within the industry should be aimed for.

4 The Textile Board was established under the Ministry of Industry some years ago, but it seems to be non-functioning, at present. Such a Board, manned with adequate professional staff is essential for the growth of textile industry.

Conclusion

The textile subsector is a vast industry. The yarn spinning and fabric weaving industry is basically for import substitution. This industry has not grown satisfactorily as compared to the other related subsector industries like Woolen carpets and readymade garments, which are basically export-oriented. But because the textiles is a basic needs product, it is a very important industry. If the fabrics are not locally produced, the demand has to be met by imports, spending valuable foreign exchange. At present, the major chunk of the fabrics demand is met by imports. Hence there is sufficient scope for expansion of the textiles industry. The very fact that it is not growing in a healthy manner, despite the vast demand, asks for deep analysis and review of policies and incentives provided to this industries.

Table 3

Cotton Production Statistics

Year	Area (ha)	Production (MT)	Yield (MT/ha)
1981/82	401	353	0.88
1982/83	731	1050	1.44
1983/84	1275	985	0.77
1984/85	1673	1278	0.76
1985/86	1650	1546	0.94
1986/87	1612	778	0.48
1987/88	1919	1770	0.92
1988/89	2246	1532	0.68
1989/90	2298	1497	0.65

Source : **Cotton Development Board**

Table 4

Compensation Costs for Production Workers in Textile Mill US $ /hr.

Country	1978	1982	1985	1988	Ratio to Nepal Wage
Nepal			0.15	0.18	1
USA	5.32	7.37	8.52	9.31	51.7
UK	3.47	5.20	4.70	7.98	44.3
Sweden	8.50	8.99	8.56	15.17	84.3
Netherlands	9.10	8.85	8.07		44.8
Germany	7.73	7.95	7.32	13.78	76.6
France	5.28	6.40	6.07	10.92	60.7
Spain	3.04	4.22	3.70		20.6
Italy	5.12	6.44	6.30	11.05	61.4
Ireland	3.40	4.81	5.00	8.54	47.4
Greece	2.61	3.90	3.65		20.3
Israel	2.40	3.39	2.78	6.00	33.3
Japan	4.08	4.15	4.71	9.32	51.8
Korea	0.67	0.93	1.06	2.05	11.4
Hongkong	1.19	1.63	1.74	2.49	13.8
Singapore	0.89	1.72	2.06	2.41	13.4
Taiwan	0.52	1.11	1.39	2.62	14.6
Brazil	1.04	1.48	0.91		5.1
Mexico	1.89	2.32	1.99		11.1
Thailand			0.53		2.9
India	0.35	0.45	0.48		2.7
Bangladesh			0.22		1.2
Pakistan	0.34		0.51		2.8
China			0.20	0.23	1.3

Source : **ESEC Report on Textile & Leather Sub-sector, 1992**

Table 5.1

Per Capita Textile Consumption in the World (1982)

Country	Per capita consumption kg	Average Temperature °C	Per capita Consumption m
USA	18.9	12.6	113.4
Canada	14.5	6.7	87.0
W.Germany	19.2	9.5	115.2
Italy	10.5	16.1	63.0
France	14.3	11.4	25.8
UK	14.9	10.8	89.4
Switzerland	17.3	9.8	103.8
USSR	15.8	4.4	94.8
Poland	10.9	7.8	65.4
Australia	20.3	14.8	121.8
Japan	16.9	15.3	101.4
Korea	9.7	11.1	58.2
Egypt	6.8	21.1	40.8
Tanzania	1.8	25.7	10.8
mexico	5.8	15.1	34.8
Brazil	5.3	23.2	31.8
Iran	5.5	16.5	33.0
Indonesia	2.0	27.0	12.0
Thailand	2.6	28.0	15.6
India	2.0	25.3	12.0
Pakistan	2.1	25.8	12.6
China	4.5	17.8	27.0
Average of West	15.4	-	92.4
Average of Dev-loping Countries	3.4	-	20.4

Source : **Feasibility Study Report on Textile Mill, JICA 1986**

Table 5.2

Apparent Domestic Consumption of Fabrics

(in '000m)

Year	Domestic Production	Import	Export	Apparent Consumption
		Cotton Textile		
1984/85	34023	81215	257	114981
1985/86	33073	85571	320	118324
1986/87	34922	65450	226	100146
1987/88	27314	62230	120	89424
1988/89	20757	60697	133	81321
		Synthetic Textiles		
1984/85	5910	18920	160	23950
1985/86	9769	13878	73	23574
1986/87	14161	5323	103	19381
1987/88	16163	6661	33	22791
1988/89	13748	3552	147	17153
		Total		
1984/85	39933	100135	417	139651
1985/86	42842	99449	393	141898
1986/87	49083	70773	329	119527
1987/88	43477	68891	153	112202
1988/89	34505	64249	280	98474

Source : **Textile Subsector Industrial Plan, UNIDO/HMG,1992**

Fig. 6.1

Classification of Fibers

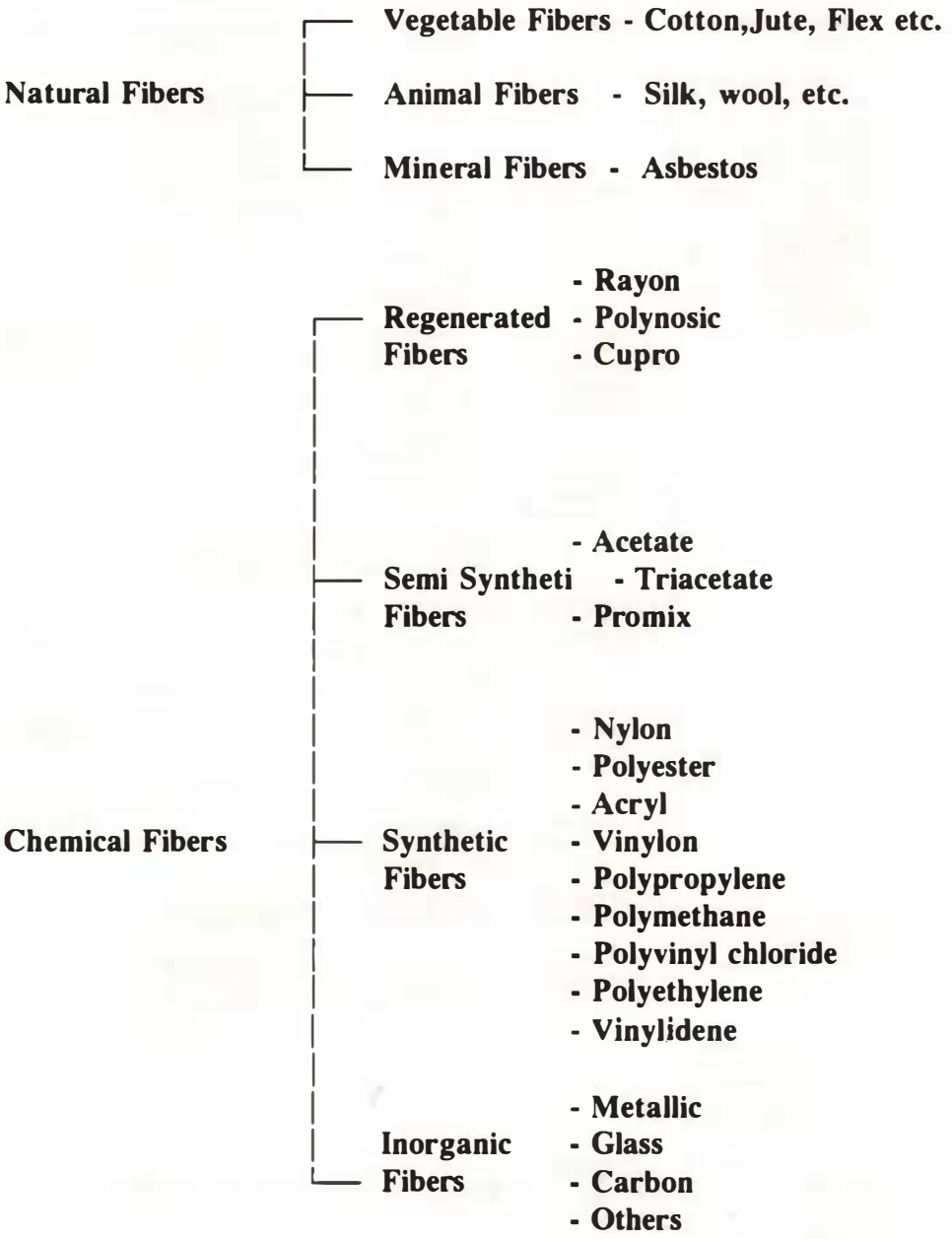


Figure 1

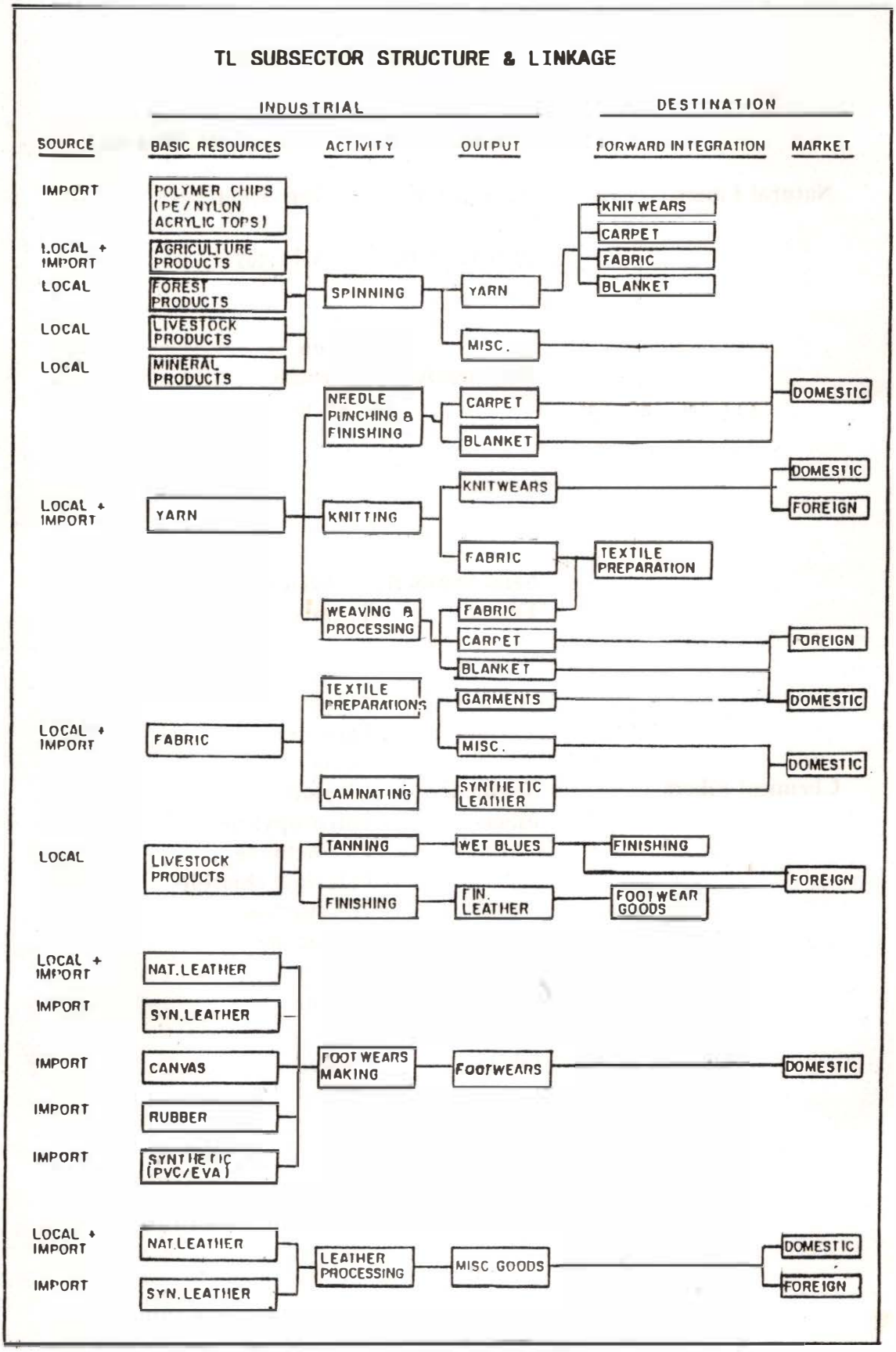

TL SUBSECTOR STRUCTURE & LINKAGE
INDUSTRIAL
DESTINATION
SOURCE
BASIC RESOURCES
ACTIVITY
OUTPUT
FORWARD INTEGRATION
MARKET
IMPORT
POLYMER CHIPS (PE / NYLON ACRYLIC TOPS)
LOCAL + IMPORT
AGRICULTURE PRODUCTS
LOCAL
FOREST PRODUCTS
LOCAL
LIVESTOCK PRODUCTS
LOCAL
MINERAL PRODUCTS
SPINNING
YARN
KNIT WEARS
CARPET
FABRIC
BLANKET
MISC.
DOMESTIC
NEEDLE PUNCHING & FINISHING
CARPET
BLANKET
LOCAL + IMPORT
YARN
KNITTING
KNITWEARS
DOMESTIC
FOREIGN
FABRIC
TEXTILE PREPARATION
WEAVING & PROCESSING
FABRIC
CARPET
BLANKET
FOREIGN
LOCAL + IMPORT
FABRIC
TEXTILE PREPARATIONS
GARMENTS
DOMESTIC
MISC.
DOMESTIC
LAMINATING
SYNTHETIC LEATHER
LOCAL
LIVESTOCK PRODUCTS
TANNING
WET BLUES
FINISHING
FOREIGN
FINISHING
FIN. LEATHER
FOOTWEAR GOODS
LOCAL + IMPORT
NAT.LEATHER
IMPORT
SYN.LEATHER
IMPORT
CANVAS
IMPORT
RUBBER
IMPORT
SYNTHETIC (PVC/EVA)
FOOTWEARS MAKING
FOOTWEARS
DOMESTIC
LOCAL + IMPORT
NAT.LEATHER
IMPORT
SYN.LEATHER
LEATHER PROCESSING
MISC GOODS
DOMESTIC
FOREIGN

FIGURE 6.2

YARN FORMING METHODS

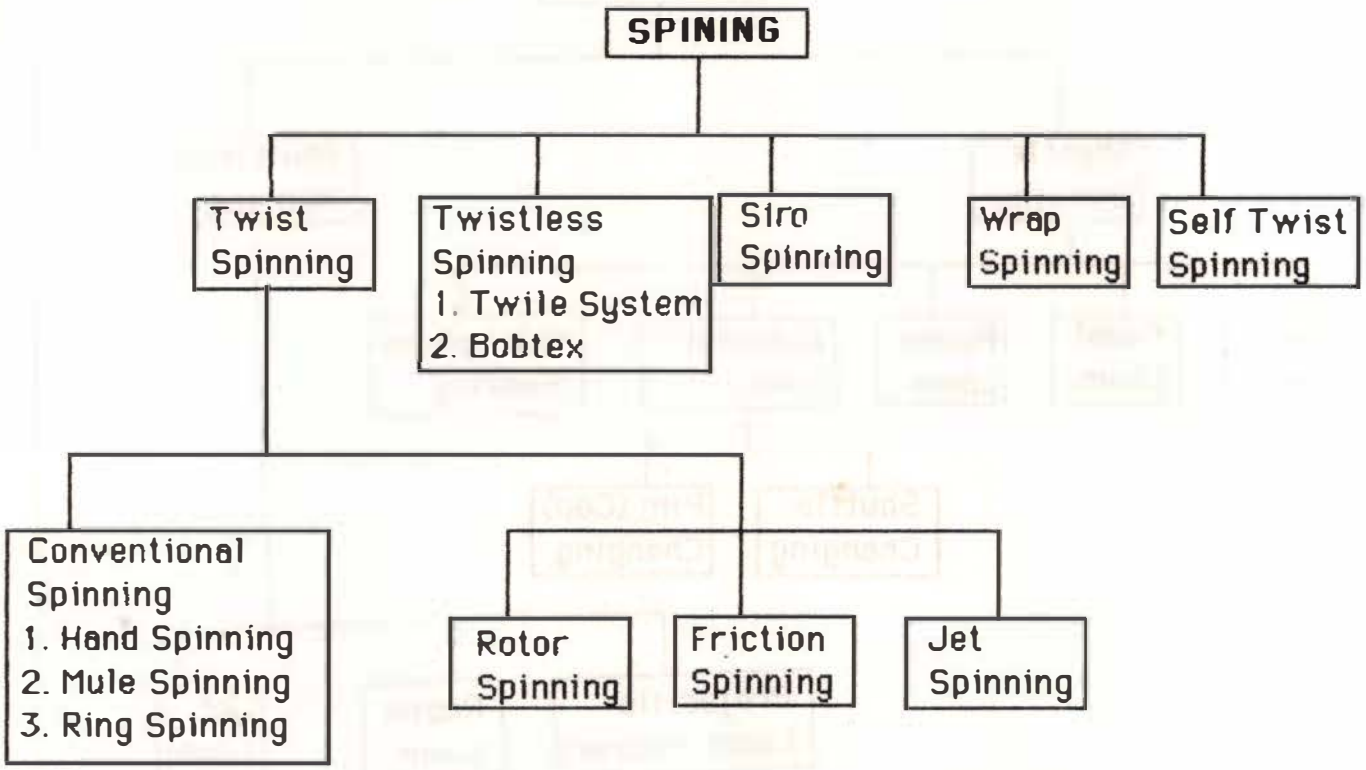
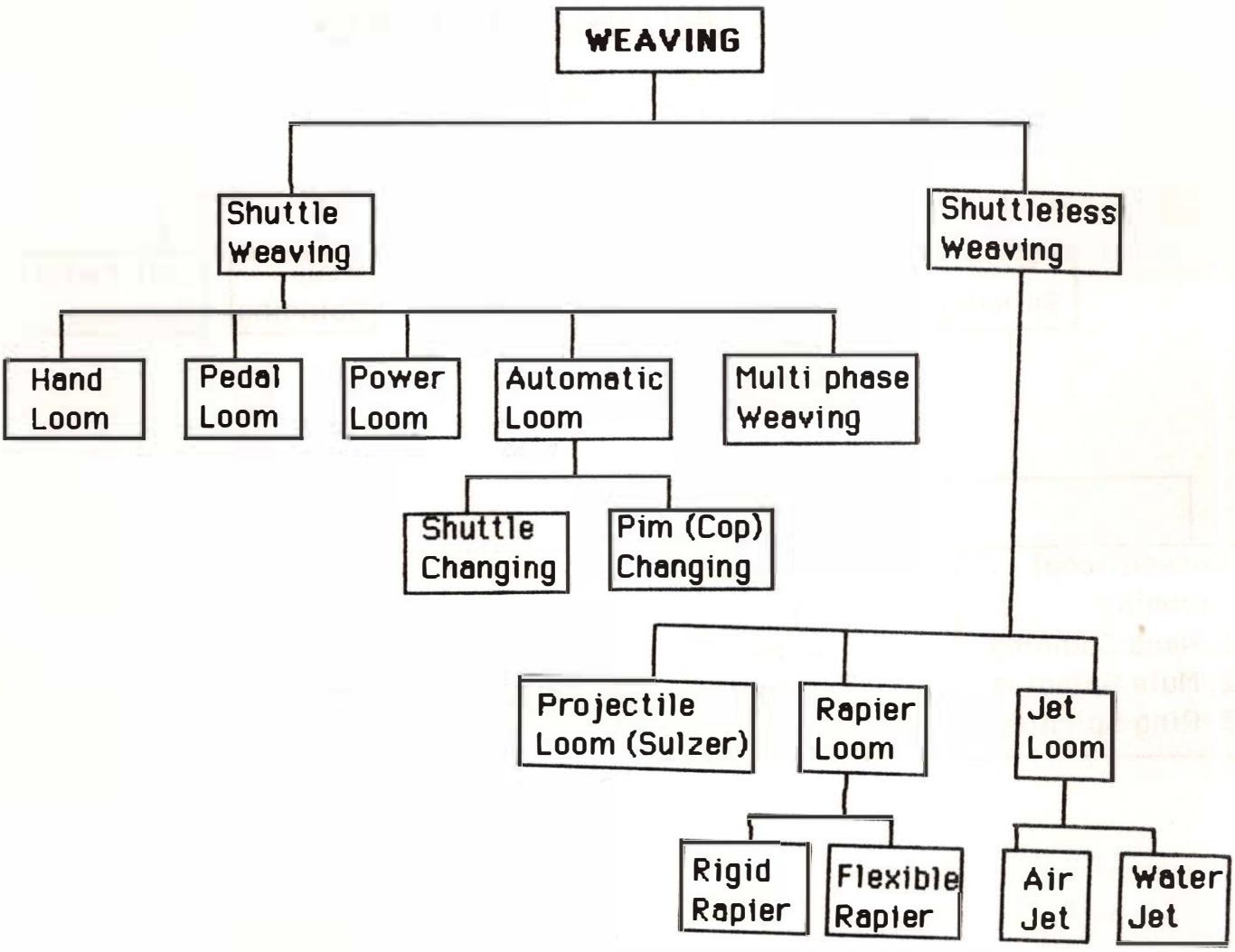


FIGURE 6.3

WEAVING METHODS



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TEXTILE SECTOR

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Ownership Structure

The throw shuttle looms estimated around 55,000 numbers, are mostly spread in the un-organised sector and operated only occasionally during idle hours. There were 327 spinning / weaving / finishing textile units in the country as per Census of Manufacturing Establishments, Nepal, 1986-87 and their ownership were as follows:

Government owned - 5

Private owned - 313

Foreign owned - 1

Joint ownership
(foreign & domestic) - 3

Others - 5

Total : - 327

The textile units by legal status were as follows:

Sole proprietorship - 267

Partnership - 20

Public limited - 7

Private limited - 29

Others - 4

Total: - 327

Level of Technology

The textile technology can be broadly divided into three stages namely yarn forming, fabric making and processing.

The technology mostly used in yarn forming in Nepal is the ring spinning system. Both Hetauda Textile Mill and Butwal Spinning Mill are equipped with Chinese made ring spindles of conventional type. Jyoti Spinning Mill is equipped with ring spindles and rotors in open-end spinning, made mostly by Reiter and produced in Switzerland, Germany and India.

There are quite different levels of weaving technology in the country ranging from the most traditional throw shuttle handlooms to modern powerlooms.

In the area of handloom weaving, the throw shuttle still has a high share in the total number of looms, mainly producing cloth for household consumption. The productivity is very low, hardly 2 meters in 8 hours, with a width of only 9-28 inches.

Fly shuttles constitute now the most important segment of the handlooms sector. Its productivity is 6 to 8 meters/8 hours and intricate designs can be woven.

The pedal loom or semi-automatic loom, an improved version of the handloom is designed in Nepal and its operation is less strenuous and its productivity is significantly higher with 12 to 15 meters/8 hours.

In the powerloom sector, there are quite

different technological levels in operation in the country, ranging from non-automatic shuttle looms over automatic shuttle-changing and cop-changing looms to the most advanced technology, the shuttle less rapier and projectile looms.

There are about 2000 power-looms, out of which around 50 per cent are non-automatic shuttle looms, predominantly of Indian origin and another 50 per cent of automatic shuttle looms, mostly of Chinese origin and shuttleless.

Ashok Textiles and Eastern textiles possess Japanese Sueadama rigid rapier looms, while Annapurna Textile owns Swiss made Sulzer projectile looms.

Decentralised and cottage industry units generally use twisted and hand dyed yarns and sell the products as finished by the loom. Processing can be broadly divided into bleaching, dyeing, printing and finishing. Though hand dyeing and bleaching is still practiced in some areas, the activity in all the categories is done through machines. There exists very well up-to-date processing facilities in a number of synthetic weaving industries and processing houses.

Source of Machinery

As mentioned earlier, the ring spindles for spinning come mostly from China and India.

Throw shuttle, fly shuttle and pedal looms are fabricated in the country itself, Non automatic shuttle looms come mostly from India, whereas automatic shuttle looms come mostly from China and India. Shuttleless looms come from Japan and Switzerland.

Labour

There are seven distinct job under spinning, eleven distinct jobs under weaving, fifteen distinct jobs under processing and two distinct jobs under general category excluding the supervisory and above class and unskilled and helper class.

Raw Materials

There is an ongoing shift from the production of cotton fabrics to synthetic cloth since 1986 after the certain alleviation of HMG regulations which had imposed strict preconditions on the authorization to produce synthetic fabrics.

Local cotton production was only started in 1970's by state farms land now overwhelmingly by private farmers. The domestic production of cotton is not sufficient and the rest is imported from Pakistan, China and India. Synthetic yarn is imported from Japan, Korea, Taiwan and also locally produced.

The sericulture is still in its beginning in Nepal. Silk weavers use imported raw materials.

Productivity Improvement

Presently ongoing technology improvements in the weaving sector have reached higher product quality and higher productivity.

The number of persons engaged by 212 spinning/weaving/finishing textile units in 1987/88 were as in Table 1.

Table 1

		Male	Female	Total
a)	Number of persons engaged	5708	3408	9116
b)	Working proprietors and unpaid family workers	297	77	374
c)	No. of employees:			
	I) Operatives and contract workers			
	Nepali	3812	3188	7000
	Non-Nepali	557	88	645
	II) Technical workers			
	Nepali	211	29	240
	Non-Nepali	107	-	107
	III) Administrative workers			
	Nepali	623	26	649
	Non-Nepali	101	0	101
	Sub Total:	5411	3331	8742
	Total number of Persons Engaged in 2314 Manufacturing Establishments	115400	29025	144425

ENERGY SITUATION AND MICRO HYDRO IN NEPAL

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Nepal Micro-hydro Association

Introduction

Energy Situation, Consumption Pattern In Nepal

Nepal is a country with large numbers (about 6000) of rivers and streams flowing from north to south creating a huge amount of hydro potential of around 83000 MW. The flow rate of these rivers and streams is about 5000 cubic meter per second. But present development of hydro is only 233 MW in the National Grid or, Integrated Nepal Power System (INPS) and 6 MW in the isolated local system.

1. The first hydro was commissioned at Pharping 500 KW in 1911 AD.

2. The second was installed after a time interval of 23 years.

Looking at the hydro potential available and demand for energy, the developmental rate of hydro power in Nepal must be classed as very poor development.

Today only 9 % of the population have been connected with electricity according to the 1990/91 statistics. Out of total energy consumption only 0.79 % has been contributed through electric energy.

The traditional energy such as fire wood, agricultural waste and animal dung dominates the energy consumption pattern in Nepal. The share of non-commercial fuel is 94.7%. The rest 5.3% is contributed through commercial energy such as petroleum products, coal and electricity.

The forest resource has been supporting the energy need of Nepalese since long time. But with the rapid growth of population today we have reached a situation where we consume 11.99 million tonnes of firewood (1990/91) whereas the sustainable yield of firewood from 3.34 million hectares forest is only 6 million tonnes. It is estimated that in 1990/91 about 2.48 million tonnes of agricultural residues and more than 2 million tonnes of animal dung were consumed as household fuels.

On sectorial basis domestic sector is the main consumer of energy with over 93 % share in the total energy consumption followed by industry and transport. More than 75% of total energy consumed in domestic sector is used for cooking alone.

There is a contribution of 45 MW in the INPS by thermal (diesel) plants, which serves as stand by units to meet the peak load. Apart from this there are many diesel plants of 50 KW (average size) in Hotels, Hospitals and Industries. Cost of energy generation by diesel plants is expensive so these units are used mostly as back-up units.

The LPG is basically used for cooking purpose in the urban areas. Apart from using in the kitchen, LPG has also been used in cottage and small scale industry. In the year 1990/91, 3800 tonnes of LPG was imported.

Nepal is rich in non-conventional energy resource as well. The estimated raw energy available in the form of solar radiation is $3x10^6$ GJ. Wind power can also be tapped in some part of the country, but its potential has not yet been properly assessed. Some attempts have already been made to harness these non-conventional energy resources with micro hydro plants, bio-gas plants, solar water heaters, rice husk briquettes, etc. But technological breakthroughs and sound environments are required to utilize these resources in mass scale. Hence the non-conventional energy sources cannot be viable option to substitute the bulk of present energy supply in the short run.

The present level of per capita energy consumption in Nepal is only about 14 GJ or, 3888 KWH or 326 kg oil equivalent, which is one of the lowest energy consumption in the world.

Nepal has no proven commercial deposits of fossil fuels such as coal, natural gas and oil. So these items has to be imported with expense of a major portion of export earnings. Because of different reasons the most abundant hydropotential remains virtually unutilized.

Demand, Supply and Shortfall

The total demand for commercial energy has been increasing by over
7% per annum during the 1980's which was much higher than the overall GDP growth rate during the same period. It has been estimated that the demand for electric energy alone is growing at the rate of 15% but growth rate of supply is not well enough to reach equilibrium. That is the reason today the situation of 50% load shading for 13 hours a day has come. This has created negative impact in daily life and economy of the country. The energy sector of Nepal exhibits a chronic structural imbalance between demand and supply.

Future plans and prospectives

In the near future Jhimruk project 12 MW will join the Intergrated Network Power System and Arun III 268 MW first phase is going to be started. Apart from above projects, hydropower projects like Kali Gandaki (110 MW), Bagmati (140 MW), Budi Gandaki (600 MW) and Sapta Gandaki (225 MW) are under consideration.

Recent implementation of Hydropower Development Policy, 2049; Water Resources Act 2049 and Electricity Act, 2049 has opened the doors for the development of hydropower in the private sector. The new policy has made such an arrangement that upto 1000 KW no license shall be required. Similarly royalty and income tax has also been relaxed.

But for hydro projects of more than 1000 KW minimum amount of royalty and no income tax for a period of 15 years has been fixed. Khimiti Khola (60 MW) hydro project is one of the examples going to be constructed and operated by private sector.

General Situation of Micro-Hydro

UN publication "Energy Issues and Options for Developing Countries" classified a hydro

scheme below 500 KW as a micro, between 500 KW to 10 MW as small scale, plants between 10 MW to 100 MW are referred to as medium scale and above 100 MW as large hydropower projects. But in the Nepalese context, hydropower below 100 KW is considered as micro hydro.

From 1977 upto now more than 600 units of water turbine has been installed by the local companies who are involved with the design, fabrication and installation of microhydros. Almost all of these turbines are used for agro-processing operations and most of these are crossflow turbines. However there are about 60 units to which electrical generators have been added, ranging from 3 to 40 KW used for domestic lighting. There are about 95 privately owned microhydro power plants with a total capacity of about 1 MW of electric power. Assuming the average capacity of 5 KW of mechanical power generated by the turbines for agro processing, these 500 units have a capacity of 2.5 MW of mechanical power.

Besides modern turbines and turbo-generators there are an estimated 25,000 traditional water wheels or "ghattas" consisting of vertical axis wooden paddle wheel. These have low efficiency and can power for grinding grains only. These wooden paddles can be replaced with metal multi cup runner with pulley thus to make it multi purpose power unit and increase the efficiency. A small generator can be added if desired. At the moment there is a NGO called Centre for Rural Technology (CRT) actively involved in the modification of ghattas. If all these ghattas can be improved then a power of 25 MW can be generated.

All the microhydro units that have been mentioned above are not in sound situation, there are numbers of sick projects for different reasons such as technical error, management problem, economic reason. Quite recently a study sponsored by Agriculture Development Bank/Nepal and Intermediate Technology Development Group (ITDG), is going to be made to determine the numbers and reason of sick micro hydro projects.

General and Technical Aspects of Micro Hydro

After a request is obtained from promoter, survey of the site is conducted to determine the head and quantity of water available. At the same time socio-economic data are also collected by means of interviews with few inhabitants. If a map is not available, a rough map is drawn with estimated distance for the purpose of transmission and distribution of electricity.

For the purpose of head measurement pressure gauge, Abney's level, tape, range finder, theodilite and altimeter may be used. Measurement of water quantity is always a problem regarding accuracy. If the water to be measured is very little say upto 10 litres per second and if it is possible bucket method is employed. In very few cases the weir method is utilized. Most commonly used method is the float method. Some time selfdilution method is used to measure the discharge of the stream more accurately, but then a conductivity meter is required.

Due to lack of rainfall and temperature data for small catchment area normally good hydrological models may not be available and for this reason most of the surveys related to microhydro are carried out in the dry period of the year for reliability of the survey.

Then cost estimation and feasibility analysis is carried out to determine pay back period, break even point etc. If these indicators are satisfactory loan is forwarded to the party by the Development Bank for the execution of the project. Earlier was a subsidy of 50 % cost on the electrical portion of the project, and this subsidy is
75 % for remote districts.

1. Civil Work: Normally in the wild river and stream, intake is made by diversion weir build on loose boulders and in normal river gabion wire weir is build. For most of the microhydros no permanent cement structure is used by private parties. Earthen channel in most places have been used for carrying upto 150 lit. per second discharge. Maximum scouring velocity permitted is 1 meter per second. Sometime stone wall with cement tipped channels are also used, looking at the site use of HDP pipe as head race channel is also practiced. Length of the channel approximately lies between 200 meters to 1000 meters depending upon the head that can be economically gained. Small forebay with spill ways on cement work is practiced in most of the installations. In some installations a flushing system is provided to clean forebay tank.

2. Penstock: Penstock which connects forebay with turbine is fabricated from the MS sheet and sometime looking at the site situation HDP pipe of required class and dimensions are also used. Expansion joints are also used with M.S. fabricated penstock looking at lengths and change of temperature of the site. During the selection of penstock dimensions, some calculations are done so that optimised penstock size is selected. The major criteria considered for optimization is the value of energy that can be produced more over time period for minimum project cost.

3. Turbines: A water turbine is a device that converts the energy of falling water into the rooting mechanical energy. This energy in the rotating shaft of turbine may either be used to operate agro processing machine or couple to a generator to generate electricity.

Turbines are classified as Reavtion turbines such as Francis and Kaplan (propeller) and Impulse such as Pelton, Turgo and Crossflow. The common turbine for microhydro purpose in Nepal is crossflow. The application range of the cross flow turbine is 3 to 100 m head with flow rates from 30 to 150 lit. per sec. Multi Purpose Power Unit (MPPU) which is similar to turgo turbine in construction is also used to replace the old traditional "ghatta". Use of single and multi jet pelton turbines in microhydro is gaining momentum. These turbines are high head turbine and used for head of more than 60 meters. Some propellor (Kaplan) with fixed pitch blade has also been installed in some places.

4. Electricals: Both synchronous (normal) and a synchronous (induction) alternators are used for converting mechanical energy into electrical energy in the microhydro scheme. Synchronous alternators are commonly used which need to be imported from India or overseas country, whereas induction or asynchronous generator is the modification of induction motor to generator by adding capacitor. These alternators are very reliable and local modification is possible. These induction generators have been installed for a capacity of upto 15 kw in microhydro scheme.

5. Electronic Controllers: There are two

types of controller Electronic Load Controller (ELC) and Induction Generator Controller (IGC). The function of these controller is similar to mechanical or oil pressure governor. ELC and IGC operates in such a way so that there will be constant load to the turbine irrespective of consumer load. It always sends surplus power to ballast load. Ballast loads are normally resistive heating elements and can be used for heating water. ELC senses frequency whereas IGC senses voltage to control speed of the turbine thus the frequency of the electricity. Both the controllers can be assembled locally, but for ELC controll board has to be imported. All the microhydro system may not have the controller or governor. In such cases the plant can be run either at constant load or by manual control. Manual control can be flow modification or, load modification.

5. Transmission and distribution: The power generated at power house should be taken to the users. This is done with transmission and distribution lines. the economics of a rural electrification depends very much upon the transmission lines and losses during transmission. Normally transmission of power is done using locally made. ACSR (Aluminum Conductor Steel Reinforcement). But for small power over a short distance transmission is done using PCV copper wire of standard size.

Ceramic insulators are used to hold the wire in the pole. Normally wooden poles are used for transmission purpose. Some installation have high voltage transmission of 1 kv and 11 kv. Distribution consists of house wiring and connecting line from transmission line to house wiring.

As most of the microhydro plants being small in nature, have been designed to meet the base load of the user. The electricity sold to user is in terms of flat power and not as energy for the reason, that the system will not have peak loads. There would be an agreement between user and owner that certain amount of power in watt will be allowed to use by user for certain hours of a day for a fixed cost. To check that the user does not consume more power than what he has subscribed, load limiting devices like PTC, ECC, ECO may be installed at user's line. Installation of such devices will help to protect power house being over loaded and simplifies the collection of revenue.

Indigenous Capability, R&D Related to Micro-Hydro Power Technology

Looking at the development occured during a period of 15 years in microhydro. Today there is capability in the country to construct small and micro hydro schemes. If better environment can be created further improvement of indigenous capability in hydro power industry can be made.

The capabilities of the hydro power industry for Micro and Small Hydro at present in Nepal is as shown below in Table 1.

Many R&D have already been done related to microhydro power technology and end uses of microhydro power. Result of the R&D conducted by these companies on their own has today created this level of indigenous capability in microhydro power technology. Development of crossflow turbine, pelton turbine and other turbines in Nepal are the result of R&D conducted inside the country. The use of induction generator in microhydro scheme is the result of R&D by few companies. Recent development of low cost over speed protection for pelton turbine using jet deflector and electro magnet is also mentionable. Few mechanical and electro mechanical governor were also developed one time, but they are not used with micro hydro scheme because of its reliability. Development of static and electronic

automatic voltage regulators to be used with brushless synchronous generator is in the way. Today Electronic Load Controller (ELC) upto 100 kw and more can be made in the country except the main control board, which has to be imported. The Induction Generator Controller (IGC) upto 15KW can be made in country. In the process of R&D, electrical protection devices, current limiting devices such as ECC, ECO, are also developed. The R&D is non-ending business, still lot to be done so that capability for going to bigger size would be possible.

R&D related to end uses of electricity is under way, development of low wattage cooker, heat storage cooker, hot shower, lokta boiler are few example of outcome of R&D.

Scope and Prospectives

There is a great scope and prospect toward the development of microhydro in Nepal. The National Grid or INPS runs along the Terai belt of the country, where population density is high. The northern side of the country which is mountainous region has many scattered small villages. The main source of energy for these village is firewood and agricultural waste. It is practically and economically not possible to supply energy for these village from INPS for the present context. On the other hand due to the availability suitable topography. There are plenty of places suitable for micro hydro installations, which may partially or fully support the energy need of these villages. These facts indicate that scope and prospects are therefore micro hydro.

Institutions, Policies and Plans Related to Micro Hydro Power Development and Utilization

There are some institutions in Nepal looking for the development of micro hydro. ADB/N has been active long since as financing agency for microhydro. Quite recently, Micro Hydropower Development Programme a short term joint project of WES and UNDP has started. This project will conduct technical, economical and social feasibility assessment relating to micro hydro.

ITDG which is an INGO has been involved for the development of micro hydro, since five-six years in Nepal. It has conducted some training courses relating to micro hydro. This year ITDG is conducting a international training course on micro and small hydro at Pokhara. It has also done some research related to micro hydro and its end use. NGO like CRT is involved in the dissemination of improved ghatta and pettric set. One time RECAST, T.U. use to be involved in the research activity relating to micro hydro. Since its establishment RONAST was never been very keen for the development of micro hydro, though it has done work on other sector of energy.

Recent provisions of "Nepalese Legal Provisions on Hydro Power Development" shall help lot for the development of Hydro Power in the country. There are plans for the development and utilization of Large, Medium and Small hydros, but there is no dedicated plans for the development and utilization of micro hydropower as such.

Problems and Constraints

Lack of long term plans for the development of micro hydro, the subsidy which was therefore five-six year, is not available now for the promoters. The microhydro power stations because of its nature, normally does not have reasonable plant factor. The plant factor use to be in the range of 20 % to 25 %, whereas NEA has load factor of about 50 %. The reason for being low plant factor is that the micro hydro power plant does not have proper end uses after mid

night and in day time, which can generate revenue.

Recent increase of interest rate to 18 % on loan has also made bad impact toward the development of micro hydro. These facts has made the declining growth role of micro hydro institutions.

These days all the job of the micro hydro has to be done on turn key basis. This type of approach or trend is not good for the standing development of micro hydro. If different groups can be formed one for survey, other for fabrication and another for installation and maintenance. Then the work of micro hydro get very simplified. But such thing require some cooordinating point.

As technology needs improvement, that means research should be a continuous process. But till now most of the research relating to micro hydro has been conducted by the concerned companies themselves, virtually no grant is available for the research activities.

Suggestions and Recommendations

Based on observation and experience there are few suggestions and recommendations:

1) Micro Hydro and other renewable sources of energy alone may not solve the problem of energy crisis of the country. So some large and medium and many small hydropower project should be started. Such project will help to solve the energy crisis of the country and also help to improve the economy of the country by selling energy to the neighbouring country.

2. Looking at the demand for energy in the dry season one steam thermal plant driven by coal and agricultural waste is highly recommended for short term solutions of energy crisis untill Arun joins INPS.

3. Development of micro hydro needs long term plan and funding through some focal point organisation.

4. A subsidy programme for microhydro equivalent to NRs.40,000 per generated KW should be incluided in the long term plan.

5. Easy access to credit, and more favourable interest rates than current ten year credit at 18% interest rate.

6. Research grant should be made available for potential group or person through proper channel.

7. Technology transfer and training should be as it is necessary.

8. There should be support of any tyipe to the companies involved in the microhydro from the government and others.

Table.1

	Company/Address	Activity	Capacity
1.	Nepal Hydro and Electric (Butwal)*	Francis	0.10-2MW
		Pelton	0.03-2MW
		Repair capability upto 10MW	
2.	Balaju Yantra Shala (Kathmandu)	Crossflow	3-250KW
3.	Kathmandu Metal Industries (Kathmandu)	Pelton	0.5-200KW
		Crossflow	0.5-40KW
		Propeller	0.5-20KW
		MPPU(Turgo)	1 - 10KW
4.	Thapa Engineering (Butwal)	Crossflow	2 - 125KW
5.	Nepal Machine and Steel Structures(Butwal)	Crossflow	2 - 80KW
6.	Butwal Engineering Works Structures(Butwal)	Crossflow	1 - 75 KW
7.	Nepal Yantra Shala (Patan)	Pelton	1 - 60 KW
		Crossflow	1 - 40 KW
8.	Agro Engineering (Butwal)*	Crossflow	5 - 25 KW
9.	National Structure and Engineering(Patan)	Crossflow	3 - 15 KW
		MPPU(TURGO)	2 - 15 KW
10.	National Power Producer (Bhaktapur)	Electrical and Control Equipment for Micro Hydro	
11.	Development and Consulting Services (Butwal)	Installation of equipment Research and Development	

* These companies are not members of Nepal Micro Hydropower Development Association.

DEVELOPMENT OF TECHNOLOGICAL CAPABILITIES: CASE STUDY OF INDIA AND SOUTH KOREA

Indira Shakya
RONAST

Introduction

To start the process of industrialization a developing country must first acquire technology. Many developing countries, setting up new production units, have tended to purchase the latest in technology. This has usually provided their firms with means of transformation, but have left them ignorant about why the technology functions. Thus, technology has become a "black box", supplied to them by outsiders, The implications of this has been serious, as it has affected the firms' ability to adapt technology to local conditions, operate it efficiently, upgrade and further adapt it once it is operating.

Mechanisms of Technology Transfer

Technology transfer as the acquisition of technology is called can be divided according to two characteristics:

1. Technology transfers mediated formally, through the market or informally, outside the market,

2. Active or passive role for foreigners in the transfer, or if they play a passive role

Under this definition there are four different categories of technology transfers.

1. Formal market transfers with foreigners taking active part:

In this case foreigners will influence the quality and quantity of the knowledge and skills involved in the transfer. They will also be able to set conditions for the use of the technology and be in a strong position when it comes to setting the price of the technology. Examples of transfers in this grouping are direct foreign investment, joint ventures, turnkey projects, and licensing.

2. Formal transfers with a relative passive role for foreigners:

This type of transfer limits foreigners' control over the use of the knowledge embodied in the technology transferred. The main example in this category of transfers is machinery purchase.

3. Informal transfers of knowledge with an active role for foreigners:

This cover transfers of knowledge such as active feedback from foreigners on the shortcomings of exports, and specifications for new products. This is a form of learning-by-exporting which is usually be regarded as a costless method of transfer, and it is informal in the way that the knowledge is not sold in a market.

4. Transfers that are non-market mediated and where foreigners play a relatively passive role:

Examples of this type of transfer are imitation, scientific exchange and the distribution of trade journals. Here foreigners do not initiate or take active part in the transfers, nevertheless knowledge is transferred to developing countries at a low cost.

From the experience of the New Industrializing Countries it is learnt that the development of technological capability is necessary, but not sufficient for economic

growth. Often, the fastest, cheapest and most efficient way for developing countries to acquire technology is to import it. However, it is vital that this process of technology transfer instills a certain level of knowledge which will allow this technology to be absorbed by the host country and diffuse throughout its economy. It is therefor crucial that in choosing the technology and negotiating the transfer the host country - and in particular the government - should be mindful of its appropriateness to the needs of the country and of its dynamic potential as a source not only of output, but also of the assimilation of skills and procedures which can be linked to other firms and new activities.

Development of Technological Capabilities

Besides the main activities involved in the setting up and efficiently operating a manufacturing firm, LDCs and their industries must acquire the capabilities needed for mastering them. Knowledge and skills can only be acquired through a long process of learning. This process can be both extremely complex and varied, depending on a firm's industry, its competitive environment, developments in its input and output markets, their accumulated base of technological knowledge and experience, direct investment in the creation of new knowledge and skills, and the availability of imported technological knowledge form abroad. Knowledge and skills involved, can be grouped into three broad categories: Investment, Production and Innovation capabilities.

There are three technological capabilities which will help in the to serve the objective of establishing and maintaining efficient industries in the Third World.

1. Production capability

Encompasses the skills which are required for production, maintenance and upgrading, where production management, production engineering, repair, maintenance, and the identification of uses and markets for outputs are the main activities. The learning process involved in developing this capability can be accelerated by studying the production process and providing training and practice for the employees, in advance of the start up of production. Other such means include systematic efforts of gathering and analyzing information from similar production domestically and from abroad, undertaking experiments in the adaptation and modification of technology, acquiring technological knowledge from suppliers, customers and other sources, and keeping record of all such new information.

2. Investment capability

The ability to independently undertake activities in stage one and two of the development process of a firm, which include: Project management, project engineering (including detailed studies, and engineering for providing core and peripheral technology), procurement of technology, organizational structuring and planning, ability to embody technology into physical capital, and the skill to start up production and attain predetermined standards. In addition, skills in searching for and analyzing various technological alternatives prior to the investment decision, and skills in manpower training, are required if a firm is to have an independent investment capability.

3. Innovation capability

The ability to carry out small and large changes to existing technology, the invention of new devices, products and processes, and making commercial use of them. Previous experience in production and investment activities is, generally required for the

development of this activity, since the development of new technology requires knowledge of what changes in current technology are needed, what process and product changes are technically feasible, and knowledge of by what means this technology can be developed. It is important to note that the development of this capability, is dependent on the explicit allocation of money and human resources, because of uncertainty involved in producing and marketing new technology.

Limits to the Development of Technological Capabilities in a Firm

The most obvious restraint on the development of technological capabilities in a Third world manufacturing firm arises from
Limited resources in terms of human and financial capital, including foreign exchange.

Nature of the technology and the external environment, confines the technological activities of a firm. The nature of a technology is seen in terms of its complexity, speed of change, required scale, interactions with different technological disciplines,Government policies affecting directly or indirectly the direction, speed and depth of technological efforts.

A limitation of local human capital worth making explicit, is entrepreneurs' ability to correctly identify technological needs and existing conditions in the operating environment, such as the supply of capital, energy, skilled labour and other necessary inputs.

The interests and objectives of the owners and managers of a firm can be important in limiting a firms technological efforts, especially when there is divergence between private and social costs and when the market and industry structures are uncompetitive.

National Technological Capability

The National Technological Capability (NTC) of a country is reflected in

1. Achievement of a country in acquiring technological skills and knowledge in production, investment and innovation, across old and new industries.

2. Competitiveness of its manufacturing firms in the international market.

These will in addition depend on structural factors, incentives and pressures operating in the national economy. The industrial sector of a country may have built up, or have the potential to build up, considerable experience and expertise in production, investment and innovation activities, however, when faced with outside competition they can fall short and be unable to make use of their real potential, because of restrictions imposed upon them by forces in their operating environment such as

1. Structural factors

2. Incentives,

3. Constraints imposed on industry by trade policies,

3. Functioning of factory

4. Product markets,

5. Efficiency of institutions set up to support the functioning of these markets,

6. Provision of infrastructure, especially with respect to education, transport, communications,

7. Political traditions.

Promotion of Technological Capabilities in India and South Korea

With an outline of the main issues now established, it may be useful examine the way in which two newly industrializing countries - India and South Korea- have approached the task of developing Technological Capabilities, and with what success.

In both countries it should be said, there has been very active government participation in the process, although quite different policies have been pursued. Beginning with Korea, its success is well known. success. The evolving structure of industrial activity is shown in Table 1. It indicates the success of the two countries in moving away from relatively simple low value added activities to more skill based and capital intensive ones. Their economic performance (Table 2) over a period shows a growth since the 1970s has been without precedent, achieving from 1965 to 1989, a average annual growth rate of GNP per capita of 7.0%. During this period it can be seen how both these countries have changed the pattern of industries after initial encouragement of only light labour intensive industries.

The two major factors contributing to this growth are:

1. Soaring exports (an average rate of 23.2%. per year especially during (1970-80))

2. Very high investment. (12.7% during 1970s)

Role of Government Policies

South Korea was established as a separate state in 1948. Initially the government focused upon building up production and export capacities encouraging light labour intensive manufacturing industries.

In 1970 a change in industry policy took place. Since then the Korean Government has actively pursued a vigorous industrial and technological development policy. Large scale, synchronized development of industries with linkages has been attained within a system of Five Year Plans. In moving into these industries, including steel, machineries and petrochemicals (industries new to Korea), a precise system of requirements were stipulated and incentives outlined for acquiring the necessary technological capability.

As an incentive for investment in new industry by Korean and foreign firms, the following steps were taken

1. National Investment Fund was established to provide loans for capital projects at less than the market rate.

2. Tax privileges were also granted under the Foreign Investment.

3. Infrastructure was provided for new investment projects.

4. Imported technologies were screened under the Foreign Capital Inducement Law and categorized in order of preference as

    a. Technologies with high export -expansion potential, technologies for producing components for Korean capital goods industry,

    b. Technologies which would be costly too develop domestically and technologies with potentials for cost reductions and productivity increases.

    c. Imposition of strict terms on

payments made for technologies and on the right to export goods and to have access to improvements developed for the technology during the contract period.

The government generally has managed to agree terms with suppliers of technology that have allowed Koreans to absorb the technology rapidly, enabling high rates of output, productivity increases and cost reduction to be attained rapidly. It has also played a crucial role in the development of skills and human capital which have made for technological development, employing 46.5 scientists and technicians per 1000 people in 1980-1988. The government also insists that companies must spent atleast 5-6% of their total budget on education and training programs. Also the proportion of GDP spent on research an development in South Korea was 2-3% in ad is planned to reach 5% by the year 2000.

India gained its independence in 1947 and introduced its Industrial Policy Resolution in 1948. The policy undertook the following steps:

1. Limited role for private sector

2. Direct control over National Investment was controlled by Licensing Authority which controlled the activities of the manufacturing firms (kind of product, scale of firm, type of technology,source of inputs, payment to workers, price of finished goods)

3. Encourage growth of small scale industries

4. Controlled production and price of essential commodities

5. Enforced high excise duties on luxury goods

This resulted in foreign exchange constraint and export pessimism.

In 1950 They embarked upon nationalistic import- substitution strategy with self reliance in most sectors as a goal. This had serious implications for export imports. This protected local manufacturers. The government set up state run science and technology infrastructure, provided incentives to set up and strengthen in-house R&D efforts of manufacturing industries. Furthermore the government has actively aimed its education policy /at providing industry with large base of skilled technological manpower.

After 1978, import restrictions were eased slightly to allow the upgrading of technology by introducing some competition, with mixed results. In general the regime created high cost and inefficiencies, with growth being arrested in many sectors. Restricted access to the latest foreign technologies, together with reduced need to develop marketing skills, limited incentives and infrastructural constraints have characterized the Indian Industrial sector.

Some of the positive achievements in Indian technological effort including; adaptation of capital goods to meet local customer needs; transmission of technologies to subcontractors, new product development and diversification in response to international competition; and some recent cost -saving measures.

Acquisition of Knowledge and Skills

Investment in human resources in terms of formal education and training has been recognized as an important factor in the process of economic development. Supply of skilled workers and entrepreneurs is very

important to any industrializing country. Required education and training increases with complexity of technology and level of industria-lization although complex Table 3. presents a comparable data on educational attainment for the two countries and some industrialized countries.

Extent of Vocational Education in India and South Korea is shown in Table 4.

It gives an indication of the spread of basic skills and available supply of skilled labour in the industry.

The measure of production capability is well depicted by the high rise in the increase of exporting firms and their recognition abroad. Refer to Table 5 and Table 6.

The investment in R&D related with industries gives a good picture of the rise in the interest and capability of the countries in the innovation of the industries. This is well reflected in Table 7.

Conclusion:

The success of South Korea in developing a relatively technological capability is revealed in

1. Technology export
2. Education structure
3. Ability to absorption of foreign technology
4. Factors which have contributed to this success are
5. Entry into capital goods and chemical industries
6. Building up technological capability
7. Substituting imported goods
8. Comprehensive planning by government and industry
9. Ensuring necessary resources
10. Adequate infrastructural elements and developing of supporting institutions for industry
11. Serious and uncompromising negations with all potential foreign technology transfers, including manpower training and rights to future
12. Improvements in the transferred technology
13. Adoption of technologies
14. Emphasis on production and export of capital and high value - added consumer durables
15. Built up of forward and backward linkages in the economy.

Although Indian industrial development is less impressive
compared to South Korea is worthy of admiration when compared to other LDCs.

Despite the pitfalls their success can be said to be determined by:

1. Acquisition of advanced technological knowledge and skills
2. Pursuits of nationalistic goals
3. Self reliance objective
4. Heavily regulated domestic environment

Table 1
Industry Structure in India and South Korea (Percent of MVA)

	Food Beverages & Tobacco		Textile & Clothing		Machinery & Transport Equipment		Chemicals		Others	
	1970	1988	1970	1988	1970	1980	1970	1980	1970	1980
India	13	10	21	13	20	27	14	17	32	33
South	26	11	17	15	11	32	11	9	36	33

Source: World Bank Report 1991

Table 2
Gross Domestic Product and Gross National product per Capita

	GDP			GNP	
	1965	1989	Growth Rate Rate per annum		Growth per annum
			1965-80	1980-89	1989	1965-86
India	50530	235220	3.6	5.3	340	1.8
South Korea	3000	211880	9.9	9.7	4400	7.0

Source: **World Bank Report 1991**

Table 3
Education Enrollment in Selected Countries (% of Age Group)

	Primary		Secondary		Higher	
	1965	1988	1965	1988	1965	1988
India	74	99	27	41	5	9
South Korea	101	104	35	87	6	37
Japan	100	102	82	95	13	30
UK	92	107	66	83	12	23
USA	100	100	n.a.	98	40	60

***Source*: World Development Report 1991**
World Bank Development Report 1988

Table 4
Tertiary Level Students in Technical Fields in India and South Korea ('000 and %)

		General Science and Engineering		Natural Science Maths,Comp Engg		Engineering only	
	Years	Nos.	%	Nos.	%	Nos.	%
India	1980	1443.0	0.21	1269.9	0.19	397.0	0.06
South Korea	1987	585.4	1.46	320.6	0.76	227.6	0.54

***Source*: UNESCO, Statistics on Science and Technology 1987**

Table 5
Industrial Project Export, Consultancy Export and Direct Foreign Investment in India.

Activity	Cumulative Industrial Project Exports (mid 1982) %	Consultancy Exports (1978-1979) %	Foreign Direct Investments (August 1980) %
Manufacturing	91.7	63.1	81.7
Non Manufacturing	8.3	36.9	18.3
Total	100	100	100

***Source*: Lall**

Table 6
South Korea, Licensed Project-related Exports, by Industry Sector

Activity	Overseas Construction	Plant Exports	Direct Investment	Disembodied Tech Exports
Manufacturing	2055	472	67	-
Social Overhead	41777	2098	35	85
Services	121	-	-	93
Total	43953	2570	103	472

***Source*: Westphal, Rhee, Kim and Amsden**

Table 7
R&D Expenditures in India and South Korea

	Year	R&D % of GDP	% R&D in productive sector (% of GNP)	% R&D financed by productive enterprises	Scientists and Enggg. in R&D Nos. ('000)	Population million
India	1984	0.9	26.0 (0.2)	13.0 (0.1)	100.1	132
S. Korea	1986	1.8	67.1 (1.2)	80.9 (1.5)	47.1	1133

***Source*: Lall, Buildind industrial Competitiveness in Developing Countries**

LOCAL CAPABILITY ON HYDRO POWER SECTOR DEVELOPMENT IN NEPAL: AT A GLANCE

Junelee Pradhan
RONAST

Introduction

Power is one of the basic infrastructures for the socio-economic development of a country. Self reliance demands that the problem of providing energy must be solved. For a developing country like Nepal which consumes at least 50 percent of its total foreign exchange income in the import of petroleum products, this aspects assumes an especially important dimension.

Energy Sector Synopsis Report 1990/91 of Water and Energy Commission (WECS) reflected overall energy situation in Nepal to be a predominant dependence on traditional energy resources. This constitute about 95 percent of the total energy consumed in the country. Among traditional energy resources, fuel wood is the major component and accounts for about 74.5 percent while agricultural residue and animal waste account for 11.6 percent and 8.3 percent respectively. Among the commercial energy sources, petroleum product accounts for about 3.8 percent while coal and electricity account for about 0.86 and 0.8 percent respectively. (Table 1)

There has not been any finding as far as deposit of oil, coal or natural gas in Nepal. It has however great potential for hydropower potential. Out of the theoretical potential of 83000 megawatt, it is estimated that 27,000 megawatt can be economically exploited, which bring to this fact that only 0.28 percent of theoretical potential so far has been produced and utilized and less than 8 percent of the total population has access to electricity.

Certain achievement have been made so far in the energy sector development.

However as the country gears up to be in the pace of development more efforts are further envisaged. Eight Five year plan makes strategic plan under national planning programme that the generation of 29700 kilowatt of additional electricity from various generative projects and will construct 405 kilometers of transmission lines of various capacities. On the alternative side, it is planned that energy equivalent to 631 giga watt hour (GWH) will be supplied through the construction and operation of 30,000
units of biogas plants 2,50,000 improved cook stoves will also be distributed.

All above cases depict that the attaintment of energy sufficiency to some extent uncompromisingly requires to strengthen the indigenous capabilities among professionals and institutions involved in this field.

Microhydro Systems

Microhydro power is important in view of improving the quality of life in remote areas, as 90 percent of the population are living in such isolated rural areas of the country.

Basically three types of microhydro systems are considered for rural application. These are:

1. Traditional water Wheel
2. Multi - Purpose Power Unit
3. Cross Flow Turbines

Traditional water wheels, made with traditional skill and materials, have been in

use for centuries in the hilly areas of Nepal for grinding different types of grains. Despite its low output power generation capacity of 1 Hp, it is estimated that there are over 30,000 such water wheels operated in Nepal. Wood is the most common construction material and is used for all part of the wheel except the main points of rotation, where steel sleeves or bearings are installed.

The multi-purpose power unit (MPPU) is basically an improvement on traditional water wheel. There is marked increase in unit efficiency because of improved blade design and closed penstock. Though the unit is not powerful enough to drive all of the machinery simultaneously, the equipment can be changed easily by disconnecting one drive belt and connecting another such as generator.

Lower capacity cross flow turbines (5 - 15 KW) units are particularly suitable for electrical add-on-systems, whereas medium capacity (25 - 50 KW) units are suitable for electrical power production. The basic design of this type of turbine is a cylindrical runner with curved blades fixed on the outer rim.

There are number of institutions which are directly involved in the promotion of microhydro system to improve the functions of the traditional water wheels. Among others Balaju Yantra Shala (BYS) with Swiss assistance, Development and Consulting Services (DCS) and Butwal Engineering Works (BWE) with United Mission to Nepal assistance and Kathmandu Metal Works (KMW) played pivotal roles in developing and producing the turbines.

Indigenous Capability

The capacity of the turbine industry for small, mini and micro hydro at present in Nepal is as shown in Table 1.

Role of Local Manufacturer in Microhydro power

The manufacturers have until now played an important and innovative role in microhydro development. There are several manufacturing companies which are involved in providing energy plants. Among them, contributions made by BYS, DCS, BEW and KMI are truly noteworthy. They are currently involved at various stages from identification of potential customers to site survey, manufacture of plants, installation of these units and operation and maintenance. However, the examples from Table 2 show that in dissemination of MPPUs and turbines, the level of their expansion has not been in keeping with the growth that has to take place, also the number of suppliers does not seem to have multiplied in any significant way. This is indicative of either the saturation of demand or the lack of incentives to manufacturer to expand their production. This is a matter of serious concern.

The Agriculture Development Bank of Nepal has been taking active leadership in the development and distribution of microhydro system. The Bank not only provide loans but also help in surveys, feasibility studies, promotion of manufacturers involvement and training as and when needed. The ADB/N efforts were facilitated by two important policy decisions made by the government concerning rural electrification.

1. Delicensing of all electric installation below 100 KW

2. 50 percent subsidy (75 percent in case of remote areas) on electro-mechanical costs including generator (1985)

Assessment of local manufacturing industries

Study covered approximately 50 percent of the manufacturing establishment involved in the production of power generating equipment. This covers visit to BYS, NSE, NYS, KMI, several hidden facts were revealed that the demand for power equipments are still there, by their own effort they perform field survey which exceeds 30 sites per year, but the manufacturing hardly get 2-3 orders only which stagnates the further production. (Table 3)

Strategic plan in the energy sector development always calls for the intervention of indigenous technologies for sustainability. The immediate requirement is the development and continuity to exist in propagating the indigenous technologies. The companies were established. The required manpower were trained, the required material were made available but the production remained stand still. Although the demand for technology and power plants are eminent, the manufactured products could not find proper market. End users are financially not sound, the governments subsidy policy and ADB/N's loan scheme attempted to encourage purchasing capacity of users. But viability of repayment was a problem so there has been a change in the Banks priority.

All the cases discouraged the manufactures and entrepreneurs for the continuation of development and production of power plants, thus creates situation decreasing trend in whole process.

There are spontaneous discussion for the potential utilization and positive aspect of indigenous technological capabilities however, there are limitation of achieving its meaning.

The study reveals that existence of indigenous technological capability can only be properly utilized for productive purpose if appropriate financially viable proportion and technical simplicity for end users applicable be realized and actually put into use.

Similarly based upon the personal communication with concerned authorities at industries, it is found that number of staff involved in the production of power generation equipments is decreased as there is no order from private sectors. Industries are found to change their priority in the production level. Some of the industries are involved in producing auto mobile parts while some are producing suspension bridge parts instead of power generating equipments. Level of technology in the industries are also very low. They still rely on mechanical works rather than automatic or computerised system.

Involvement of private sector in the development of appropriate technologies has no doubt played a very important role in the popularity and dissemination of microhydro systems in Nepal. The Nepalese expertise is recognised in the international circle, as evidence of manufacturing industries which being exported to other countries shows the encouraging trend in the recognition of indigenous technologies. The latest addition to this healthy trend is availability local manufacturing to producing electronic goods.

Table 1

Energy Consumption Pattern in Nepal 1990/91

Energy forms	Percentage
Traditional	94.48
Fuel wood	74.54
Agricultural Residue	11.64
Animal Wastage	8.03
Commercial	5.03
Petroleum Products	3.87
Coal	0.63
Electricity	0.08
Others (Biogas, Charcoal, Briquettes)	0.22

Source: **WECS, Energy Sector Synopsis Report 1990/91**

Table 2

Production of MPPUs and Turbines: Kathmandu Metal Industries (KMI) and National Structure and Engineering (NSE)

Fiscal Year	KMI	NSE	
	MPPU	Turbine	MPPU
1981/82	2	0	0
1982/83	4	1	22
1983/84	5	3	36
1984/85	4	4	30
1985/86	2	3	35
1986/87	0	5	19
1987/88	1	4	22
1988/89	2	12	11
1989/90	0	6	8
1990/91	0	5	5

Source: **D Bajracharya, A M Nakarmi and K M Singh / Development of Microhydro systems in Nepal: Problems and Prospects**

MICRO-HYDAL MANUFACTURERS IN NEPAL
AT A QUICK GLANCE

	Est Year	Technical Assistance	No. of Staff	Turbine Type		No. of Turbine Installed	Source of Raw Materials and Machinery	Level of Technology	R & D	Clintel	Priority Change from Water Turbines - to
				Cross flow	MPPU						
Balaju Yantra Shala Kathmandu	1976	SATA	150	Yes	No	100	Locally available Iron (Indian)		Yes	Asian and African Country	Electricity Generation Syst Load Control
National Structure and Engineering Pvt Ltd., Lalitpur	1971	-	17	Yes	Yes	196	Locally available Iron (Indian) Bearing - Japan Alternator England	Mechanical Automatic	No	Nepal Bhutan Shrilanka India	Automobile Parts
Nepal Yantra Sala Lalitpur	1975	-	14	Yes	No	50	Locally available Indian Iron	Mechanical	No	Nepal	Suspension bridge parts
Kathmandu Metal Industries Kathmandu	NR	-	10	Yes	Yes	70	Locally available Iron Bearing - Japan	Mechanical	Yes	Nepal Shrilanka Bhutan India	
Everest Technical Concern, Lalitpur	1992	-	6	Yes	No	1	Locally available Iron (Indian) Bearing - Japan Alternator - England	Mechanical	No		Paper plants

REPORT ON THE WORKSHOP

Hon'able Chairman Dr. Binayak Bhadra
Ho'rable Vice-Chancellor, Dr. Huq
Mr. Pottinger, Mr. Rishi Shah
Dear Participants
Ladies & Gentleman

In this report I shall attempt to summarize briefly what has gone on in this workshop over the last three days. We have of course been discussing the question of technology capability and at the very outset it was pointed out that there are important considerations that have to be borne in mind in the case of Nepal. Any discussion that relates to Nepal must always recognise that we are discussing a landlocked economy with very large neighbouring economics. However it must be recognised that Government policy with respect to industry has been undergoing substantial changes in the recent past.

The workshop began on Monday with a series of conceptual and background papers which shaped the framework for the factory visit on Tuesday and the reports which were presented this morning. The background papers covered three industries: carpet textile and micro-hydro and the reports were written after visits to a carpet factory an a micro hydro plant.

Overall Performance

Perhaps the most striking feature that emerged from the background papers and reports is that there are quite substantial differences across these three industries in a number of respects. There differences are seen not in the sectors' overall performances. The growth in production and export of carpets has been extremely impressive. In contrast, the textile industry seems to be in almost irreversible decline suffering from competition from low-cost suppliers such as India. The competition appears to have penetrated well into the local market. The third industry, micro-hydro meets a clear domestic need and has enjoyed some success in exporting.

Technologies and Resource Inputs

Again here are considerable difficulties across the industries. The Technology of the carpet industry is labour using and this fits fit the relative abundance of labour in Nepal. Indeed the industry is the major industries employer in Nepal with some 250,000 labours. However the labours which has been absorbed comprises large numbers of poor and previously unskilled labour, most of these are female, and a few expatriate workers with specific skills, for example in design. Indirectly it has also created employment in other labour intensive activities such as construction.

Then we also marked differences in the dependence on foreign sources of capital. Weaving in the carpet industry involves traditional, local equipment, but in those plants where there is modern machinery in use , in carding and dying, the equipment is imported from India with some coming from Germany and elsewhere. The micro-hydro here is a well established domestic capability in machinery production. Much of the equipment, although requiring plate imports from India can be manufactured locally. In addition, although complex parts such as lad control panels are obtained from Japan and the UK. Load controls and certain types of generators can be made in Nepal.

A broad area of similarity between carpets and textiles is in dependence on raw material imports. Micro-hydro is different, however, by the very nature of dependence as domestic water supplies.

Technologies and Scale of Production

One factor which emerges strongly in the discussion of textiles is that the ability to compete is severely constrained by the size of the local market. Inability to achieve economics of scale precludes the industry from competing with countries such as India not only in export but also in domestic markets. The economics of scale argument is not relevant,however, in the cases of micro-hydro and carpets. Micro-hydro production has evolved domestically to match local requirements. The major domestic constraint facing this industry is the low level of effective demand as a consequence of low incomes in the rural areas. However, the work that has gone into micro-hydro in Nepal provides a fine basis for further exploration of export markets.

It was argued at the beginning of the week that a marketing capability can be added as a component of the concept of domestic capability. That perhaps needs to be explored further in the case of micro-hydro. It would appear, however , that this dimension has already been firmly grasped with respect to the export of carpets. The carpet industry has developed markets in Western Europe partly because it offers a product in demand but also partly because it has established an important working relationship with European importers. This relation hinges around determining consumer tastes and then designing and producing in a product to satisfy that demand.

Lessons Learned

it would of course be wrong to suggest that a workshop such as this can answer that profound conclusion. Analysis of technological capability requires more detailed and time consuming work. Nevertheless, I think that several tentative lessons can be drawn from our discussions, albeit we considered only three industries.

First there are substantial differences in the extent to which technological capability has developed across industries. Secondly, domestic capability can be developed to satisfy particular market with or without a heavy dependence on external sources of finished products. Thirdly, even in a landlocked economy such as Nepal that capability can generate good for export.

Finally I would like to emphasise that developing and exploiting technological capability is a complex matter. It requires, as has been stressed in our discussions, an effective partnership of different groups. Industrialists, an organisation such as RONAST and Government must all be committed to forging cooperative and collaborative links. That is perhaps the most important lesson that we can take away from this workshop.

Thank you all.

Members of Group I

S.N.	Name	Organization
1.	Dr. Chandra Bahadur Joshi (Group Leader)	RECAST
2.	Mr. Bishnu Prasad Sharma	TU
3.	Dr. Bhola Pokhrel	CEDA
4.	Mr. Ghanendra Karki	NPC
5.	Mr. Pravin Raj Maskey	WECS
6.	Mr. Ram Bhakta Karki	DCS
7.	Mr. Lumin Shrestha	CRT
8.	Mr. Surendra Mathema	KMI
9.	Mr. M B Basnyat	BYS
10.	Mrs. Junelee Pradhan	RONAST

A Report on
The Brief Assessment of the Technological Capability of Balaju Yantra Shala (BYS)

Acknowledgement

The members of this Group express their gratitude to RONAST and Development Countries Research Unit (DCRU), University of Strathclyde, UK for giving us the opportunity to attend the workshop on "Indigenous Technological Capability at Industry Level" and prepare this report which is based on a brief visit and the information provided by the Balaju Yantra Shala - a pioneering mechanical workshop in the country.

The group would also like to thank Mr. Sridhar Devkota, General Manager of BYS who was very kind and helpful in sharing his long years experiences with us, in an open and free atmosphere. Our sincere thanks also go to all the supporting staff of RONAST who were very helpful in providing us with all necessary logistic support throughout the workshop.

All members of this group sincerely hope that this report will be of some use in fulfilling the objectives of the workshop.

Introduction to BYS

BYS is the first workshop of its type in Nepal. It was established in the year 1960 by a Swiss Technical Cooperation Agency, Helvetas, in cooperation with Nepal Industrial Development Corporation, NIDC. Its main objective in its initial stage was to create a minimal infrastructure needed to execute repair works of equipments supplied by the Helvetas for its other projects. The manpower required for the workshop was also generated by the same agency by establishing a separate mechanical training centre which was later taken over by the Tribhuvan University and is being currently run by the Centre for Technical Education and Vocational Training, CTEVT, Ministry of Education,HMG/N under the name of Balaju Technical Training Centre, BTTC.

Soon after the establishment of the BYS comprising of three basic equipments (lathe machine, drill machine and a welding transformer) and three workers to run them, it started in 1962 producing the first propeller turbine in Nepal. The production of cross-flow turbine, which is the most widely used turbine in the country, was fabricated, however, only in 1973. Since then it has fabricated and installed hundreds of these turbines in and outside the country and generating mechanical as well as electrical power for agroprocessing and domestic lighting, respectively.

Apart from these activities the BYS is also involved in various other mechanical sectors starting from minor repair works to the fabrication of huge and sophisticated mechanical plants. Currently 80% of its activities consists of steel structure fabrication and only 10% is involved in the micro-hydro power. The rest 10% of work is consist of repair activities.

All the raw materials and machine elements needed for the purpose are imported from India, except a few item which are purchased from more advanced countries in Asia and Europe.

Infrastructure

BYS is located at the north-west corner of

Balaju Industrial Estate and occupies a huge land of several hectares. It has also adequate building facilities for all kinds of managerial and technical jobs, including the ones for Research and Development. Presently it owns some 150 machines, mostly from Germany and Switzerland and employs about 250 people of various levels of skill and knowledge. Some 82% of the total staff comprises of technical people in which 40% are unskilled labour, 35% skilled technicians and the rest (5%) are of engineering level. From the remaining 18%, administrative staff represents 15% and the rest (3%) belongs to the managerial level.

The industry was set-up with an initial investment of Rs. 6 million. At present, its assets run to some 60 to 80 millions rupees, which do not include yet the cost of land and building as these still belong to the industrial district and not directly to the company. The present annual turnover is estimated at Rs. 40 to 50 millions.

Capabilities

During last 33 years of its history, BYS has grown up to one of the most renowned and experienced mechanical industries in the country. During this period it had several ups and downs and had to face a number of technical and administrative constraints (Fig. 1 & 2). But inspite of that it has pioneered several developments in the field of mechanical sector. Nepal's fame as one of the most successful countries in the development of micro-hydro power is largly done to this company. It has been fabricating water turbines not only for Nepal's own consumption but also for exporting them, on international competition basis, to various countries in Asia, Europe and Latin America such as India, Bhutan, Laos, Malaysia, Burma, Germany and Argentina. BYS has today the capability of producing the water turbines of up to a capacity range of 250 KW (Fig. 3 and 4) and has already exported one of this range. The very fact that 7 out of 11 turbines produced by BYS and run by the Small Hydro Development Project in different parts of the country are still giving satisfactory service proves its quality of on that. Although many of the local turbine manufacturers had in recent years to diversify their activities to some other sectors due to lower government investment in water turbines, BYS has been able to maintain its market share mainly because of its capability of gaining the market outside the country. It is this capability which has enabled it to attract several institutes and organizations receiving training from the company. Besides it has generated so many skilled labour that most of the mechanical workshops in the country are either run by them or are being directly or indirectly supported by them.

Constraints

1. One of the biggest problems the company has been facing currently is the crisis of faith the government has been having towards these kinds of industries and the tough bureaucratic procedures they have been adopting in going through the formalities related with the activities of these industries.
2. The other very much pinching problem is the lack of government's commitment towards the development of industries based on national resources and capabilities. Priorities are given most of the times to imported products and the locally manufactured products are usually rejected on some biased ground.
3. Similarly the open border at north and south as well as the government's policy of raising more customs on the raw materials rather than on the finished product have

been another serious obstacle for the development of these industries.

4. On top of them the lack of government co-operation has been felt as one of the biggest problems for these manufacturers.

5. There is a shortage of a strong Research and Development Centre and also Technical Information Centres which are needed for the continuous development, dissemination and effective transfer of technologies.

Government's Role

The importance of Government's continuous and proper guidance in the industrial development of the country has been well established by the experiences made by several countries like Japan, South Korea, Singapore, Taiwan etc. In Nepal, this has been virtually missing. There is no policy for technological development as such. Whatever industries or technologies have emerged in the past did so in a most random and haphazard way. Some of them have not even contributed to the country's development but have affected adversely. The need of infrastructure to sustain the technology was totally ignored. On the other hand, no plan and policy has been formed yet to elevate the indigenous technologies which based on natural resources and locally available manpower. The government therefore has a very big and important role to play.

Recommendations

1. It has been observed that various indigenous technologies and the capabilities for their development do exist in the country. But since some of these are still at their infant stages it has been felt that government protection is needed against the dumping of foreign materials that can be easily produced in the country itself. In has been further felt that the local production should be given priority against the unfair competition from foreign manufacturers. This observation has been made on the basis of the development of hydro power technology which is being constrained in because of the absence of such protection.

2. It has also been observed that the manufacturing industries have been facing various technical problems. But because of their infrastructural constraints they have not been able to solve them within their industries itself. Further, the existing research centres also do not seem to be in the position to solve these problems at the present condition. Hence, it has been felt that the existing research centres be strengthened and a strong link be developed between the industries and such research centres.

3. So far most of the materials and equipments required for the externally aided projects are supplied by the donor countries themselves. It has been felt that while carrying out agreements with the donor agencies, provisions be made such that part of the materials and equipments, which can be produced locally, be incorporated in such projects.

4. It has been observed that the technical capabilities of various institutions and organizations are at different stages. Development can be accelerated if those capabilities be disseminated among these institutions. There is, therefore a need of setting up of a centre for

technology information and dissemination in the country. RONAST can perhaps provide this role.

5. In the past several industries have emerged which are of vital importance for the national development in terms of employment generation, utilization of natural resources and increment of foreign earnings as well as raising of national glory and reputation.

It has been felt that these industries be identified or declared as national industries and all needful actions taken to develop them further.

6. There is a strong lacking of governmental cooperation with smaller local manufacturers as compared to the larger industrialists with a long chain of industries.

Apart from that, every new and well minded initiatives of these manufacturers are being seen with an eye of suspicion and tough and lingering measures are taken while handling their necessary formalities.

All these have been working against the development of these manufacturing industries. Hence strong government actions are needed to avoid this kind of trend.

7. None of the industries can flourish without a proper guidance and strong commitment of the government. Precisely these have been found to be missing in the country. Hence, it is suggested that they are being introduced in the country and the plans and programmes are made accordingly.

Members of Group II

S.N.	Name	Organization
1.	Pushpa K. Karki	ESEC
2.	Laxmi P. Gupta	NBSM
3.	Dharma M. Newa	NIDC
4.	Tej S. Bista	TPC
5.	Rabindra Pradhan	NDWC
6.	Mahendra Ranjit	NCST
7.	Parbati Rijal	RONAST
8.	Pratap Singh	RONAST
9.	Dilli R. Joshi	RONAST

Project: CARPET INDUSTRY

Name of the Company Visited: BHOLANATH NARAYAN CARPETS P. LTD

Location: HATTIBAN, LALITPUR

Promoter: Mr DINESH K. BARANWAL

Prologue

Participants of the workshop on "Indigenous Technological Capabilities at Industry Level" were divided into two groups. The first group was to study on Snowline Carpet Industry of Kirtipur, Kathmandu which is said to have about 235 looms of different sizes with 100 looms made of steel structures installed in two locations to have a total production capacity of about 25000 sq. meters per year. Unfortunately the management staff was not available at the time the group visited to that particular industry assigned (by RONAST) and the group members tried to visit another carpet industry at Ekantakuna, Lalitpur. However, the group members own effort succeeded in meeting management of one carpet industry on the third attempt at Hattiban in lalitpur near Harisiddhi, which is mentioned above.

Historical Background

The company promoter registered itself with the Department of Cottage Industry originally with a capacity of 10 looms and started the company with 2 looms in a rented house near Bijuli Bazar in Kathmandu mainly to acquire know-how about management of the carpet industry.

This Bholanath Narayan Carpets P. Ltd. is a new identity, with its own land of 7 ropanis costing Rs. 2.1 million rupees in 1990 and at this site the promoter invested 15 million rupees in fixed assets including land, building and looms and other equipments as reported. At present, this firm does not have dyeing facility at its site. However, this firm is still undergoing construction of buildings and is expected to be fully integrated soon, with its total investment reaching around 20 million rupees.

Process/Technology

About the process of carpet manufacturing, the group found that there are about 10 steps indicated below in manufacturing carpet from raw wool.

a) Washing, including scouring and drying
b) Carding
c) Spinning
d) Dyeing
e) Drying and ball making
f) Weaving
g) Trimming
h) Washing, dyeing
i) Stretching and training
j) Finishing (checking, a bit necessary mending and packing)

Capacity

This Bholanath Carpet at present does not have the dyeing process in its premises. The total production capacity in terms of carpet is about 1500 sq. meter per month, of which only 300/400 sq.meters are being produced in its own premises at present. However, this company plans to reach up to 3000 sq. meter per month as per its plan after completing the construction of the rest of the

buildings.

Capacity Utilization

The industry at present is using only 50-60% of its capacity, because the demand although going upwards, the price is falling down ad per the promoter of the industry and also, due to under construction of the factory.

Sales Information

The share of this particular industry in total carpet exports from Nepal is less than 0.5%. (The carpet industry earns 60% of the total foreign exchange earnings of the country.)

Market

- There is no sales of the industry in local market, whereas 95% of the total carpet industries are exported.

- The value addition in the industry is around 63% .

- There are about 100 persons working in this firm (Bholanath Narayan Carpet) in which about 50 persons are skilled labours, 20 persons are semi skilled and 20 persons are unskilled. Rest 10 are managerial staff.

Market and Price

Bholanath Carpet exports mainly to Germany, Belgium and the Netherlands and attempts are being made to explore new markets in other countries like Canada and USA. At present government has fixed its floor price at 55/60 US$ FOB, whereas buyers are paying only 40/45 US$. In the process buyers have to open L/C at floor price value and the difference is paid back by carpet manufacturers in local currency or in the process of sales, carpets exported in quantities more than invoiced. However, market for Nepalese carpet appeared to have adjusted in the western world due to flexibility to change in its pattern to suit buyers needs and designs whereas in the case of Iranian (Persian), Afghanistan and Pakistani carpets(which are Red Carpets) they have their own skill and design traditionally fixed for decades.As is understood, Nepalese carpet manufacturers are aggressively participating in various fairs in the western world such as Domotex Fair primarily acquiring knowledge on buyers taste and interior decoration patterns.

Raw Material

Originally 100 percent Tibetan wool was used for carpet making as the technology was introduced by the Tibetan refugee. Tibetan wool is said to be fine and better compared to local or other imported wool. Tibetan wool is said to be rich in Lanolin which ensures longevity. As highland or tibetan wool could not keep pace with demand, New Zealand wool were tried and mixed with Tibetan wool. At present, bending of highland wool with New Zealand one is maximum up to 20 : 80 but the ratio depends on the demand from buyers.

Normally one square meter of carpet needs the following quantities of raw materials :

a) Wool- 5 Kg
b) Cotton thread - 1 Kg

Cotton thread is bought at present from local market. Previously, it was bought from India. In case of wool the demand being not fulfilled by Tibetan wool it is mostly imported from New Zealand.

1. Washing

Tibetan wool is imported in very raw form and it has to be washed before combing or mechanical carding.

2. Carding

Early in the 1980s' the carpet making process entirely depended in manual process. Carding is done now a days by machines imported from India. This has enhanced blending of wool and hand spinning .

3. Spinning

Spinning is done in charkhas, an indigenous hand operated machine, which is composed of a steel spindle and a wheel made of timber. Some slight improvement has been noticed in one or two places in style and shape of charkhas.

4. Dyeing

Wool dyeing process depended initially on vegetable stuffs like tea, walnut, catechu and others. These vegetable dye stuffs can give different shade depending on water vessels used etc and said to have dyeing process repeated to get desired shade. This process of vegetable dyeing is done only by very highly skilled and experienced dyers for good results. At present most of carpers are manufactured with metallic dye stuffs generally imported from Switzerland and Germany. Cheaper variety are available from India as well. Dyeing machines are now used in different sizes. These machines are available from Taiwan, Hongkong and India. Indian machines are equally good in comparison to Taiwanese or Hongkong made in their performance and price. In the process of dyeing they use Amollen 1 Kg, Acetic Acid 1 Kg, Ammonium Sulphate 1 Kg, Glower salt 1 Kg, Liquid soap 100 grams and 1500 liters of water for a batch of 100 kg wool yarn and roughly 5 kg of steam used. For steam, husk fired boilers are used.

5. Drying and Ball making

After drying wet yarn are put into motorist hydro-extraction for drying and yarn is ready for ball making which is manually done.

6. Weaving

Weaving is done manually ever since its origin of carpet making in Nepal. It has been told that Nepalese carpet maintains 40/48 knot per sq. inch. Higher the knots count, better the quality of carpets in term of its life. Nepalese carpets are knotted through a line of loops in a steel rod unlike carpets which is said to be individually knotted and hence costly compared to Nepalese ones. Conventional looms were made of timber and their life were 3/4 years. Since last decade or so steel structured looms have become popular for its life and jacking system introduced. Previously each loom had to be rested on walls. Now steel looms do not rest anymore on walls but one against other economizing in building space requirement, cost and labour.

7. Trimming

After weaving carpets are pulled down from looms and trimmed for evenness.

8. Washing

Since last five years or so Nepalese carpet manufacturers are exporting washed carpet along with unwashed. Washed carpets fetches higher value compared to unwashed and have given rise to greater employment opportunities for male labours. Generally washing is done with river water and tap water . Used water allowed to flow back to river generally untreated as seen in Harisiddi, Kalanki and other locations.

9. Stretching and painting.

Most of hand woven carpets are not always accurately rectangular in its shape so they have to be stretched on one side or the other . To even the size of carpets they are stretched with the help of rope and steel frame anchored in ground base. To prevent it from backing out to original shape, synthetic glue is said to be in use now. This is another new input in the process of carpet making.

10. Finishing .

It is simply finishing of uneven yarn and in this both male and female labours are used .

Indigenous technological capability in selected areas

Design : This industry is trying to develop its own design but most of the carpet design is sent by the buyers themselves. The designs consists of the Nepalese tradition and culture.

Machinery: The spinning wheels and looms are manufactured locally. In this area we are self sufficient in design as per our requirements. But in case of dyeing most of the manufacturers have imported machinery specially from India but the traditional dyeing techniques is use of copper vessels which are manufactured locally but this is not continued.

Assembly : The weaving machines/loom are assembled by the local people. A team of the skilled manpower is formed by the carpet association who looks after the installation, maintenance etc.

Role of the Government in Promoting technological capability

The government has not played any supportive role for the particular industry.

Recommendations

Since Carpet industry is one of the highest foreign exchange earner in the country, the government has to take necessary steps in promoting this industry such as giving more financial and technical support to the needed ones. The small carpet manufacturers find difficult to get the international market for exporting its product, hence the Association as well as government bodies should coordinate.

- To protect the image of Nepalese carpet in international market it is essential that good quality of carpet should be exported. For it the standard should be formed.

- In technology side there is a chance to develop such looms from which different sizes of carpets could be manufactured in one loom. For this, necessary fund training if needed, should be provided by the government and Association to interested persons.

- In context to environmental pollution in Kathmandu valley it is better that this industry should be established outside of the Valley.

To the Government:

1. Since the market is limited, the Government should try to limit the licensing in some cases to protect the national interest.

2. The technology should be screened before importing into by the entrepreneur.

3. The Government should provide incentive to the interested person who want to develop the indigenous technology.

4. The Government should screen out the priority sector where the technological capability can be development and can be used within the country (i.e. self reliance) .

5. Import of experts/technocrats should be done only, if not, available within the country.

6. There should be a Nepalese standard to check the quality of the product.

To RONAST:

1. RONAST should develop or help in developing the manpower skills for evaluation of technology to be imported in the country.

2. RONAST should play the role of coordinator between government and the entrepreneur.

For the Seminar:

1. This seminar first of all has very short period.

2. In Nepalese context, a study on how the technological capability improvement should be discussed broadly instead of limiting in lecture.

3. More industrialist should be called for such seminar as this one .

CLOSING REMARKS

Hon'able Vice-Chancellor
Dr. Huq, Dr. Love
Mr.Pottinger, Mr. Rishi Shah
Dear Participants
Ladies and Gentleman

I would like to express appreciation to you all for having identified some of the problem areas in relation to the technology capability building in Nepal. Ofcourse you have taken few examples from few industries, but I think a lot of these problem are generic and they are something we have to try and tackle as we go. Let us say that we in our country like Nepal are faced with a number of challanges, and most of the challanges I feel are related one way or the other with building up capacities. They are either in the form of institution building or in the technology arena or as usual it is in the process of formulating policy and programes. We seem to be weak in all these three areas. So I am not at all surprised to see some of the recommendations as they have come out. I beleive that a workshop like this or seminar like this is very important, because it helps you to only to have discussions but also cristalize some of the silent confusions one might have regarding these problems. I think I was very much encouraged to see that you have taken the pains to go the through the arguments and try to come up with a set of recommendations, which you perhaps felt isgoing to solve the problems you are facing, not as individuals only but also upto some extent that is true as well, but also as people in all those industries. I know most of you here are unusual in the sense of that you are dedicated to a paticular tipe of industry or profession and you are trying to the best you can in these specalized fields. But clearly the problem still remain and they remain because the government policies at times are not most conducive and at other times we have policies which are contradictory to one another. That is even worse than not having policies. Problems are also there in terms of carring over the policies that we formulate in to action. I think this problem of translating policies into action is perhaps one that I think we can only propose as we go along. There is no use formulating another policy saying that we will resolve these problems. I think the emplimentation or the traslation of these policies into workable programes and plans, I think these cannot be resolved through another set of policies. Action is required and action is some times not forthcoming. I know this is what you expect me to say here because I am from a planning organization and it is very easy for me to put the blame on people who are not in the planning.

But I think there is something to this issue of formulating policies. The policies I think need to be as workable, as operational as possible and this is where I think there are a lot of difficulties. I think in the beginning we had the presentation from Dr. Love, who indicated very clearly that this analysis of technological capability building is something that requires further elaboration, further indepth work. That is not to disagree with some of the recommendation you have made here. Thery are clearly those are obvious ones at one times and at another not obvious ones at one time and at another not obvious. But let me say that to make these policies workable or these recommendation workable we still have to work hard at them.

I would say that for instance in the case

microhydro there are many problem. Not all of which are technological. One of the major problems we are facing now in the microhydro field is in institutional kind of state and that is coupled with the problem of finding funds.

Clearly the policy making side of this is not a problem. The policies we have formulate are perhaps ingeneric terms quite general and in the right direction. But they are again clearly faced with operational difficulties. We are facing we know they still need to be refined, not from the print of view the policies as from the perspective of the implimentation. I would like to add that there are many initiative the are government has taken recently to try and solve this quagmire of formalities, the red tapes, the people have to go throug in establishing of industries and so on. But I think this is perhaps well known to you that we are now try to adopt a one window policy by which all potential investers in verious sectors would have only to go to one particular institution or entity and not have to deal with the whole quagmire of red tapes.

But this one window policy is one that again is not really found practical at this point and time. There are many difficulties as you know. Let me not bore you with for the elaborations on that. Let me assure you that we have made the start and I think the only way to go is to go forward, that we have to gradually try and reduce them.

Now I must add at this point that many of your recommendations are very welcome from our side. But I must say that some of them may have been some what hastily draw. For instance, the protection of the infant industry agrguments that has been put across in the context of Microhydro. I do not feel sincerely that there is any threat in this point of any body really coming up with any technology which will be able to compete with our indigenous technology. But there is always danger of dumping as you said. I think we are very conserned about liberlization and privatization that does not mean we allow unfair dumping practices that we are always vigilant and we should always be vigilant about this.

I think in this respect we will certainly get help from RONAST and other institutions like that. But I think more importantly I would like to sound on an accord that most of the recommendations you have put across in promoting these industries, these are very closed to our hearts. But again as I said we need to work beyond these general policies, we need to make them more operational. There needs to be some specific regalution and guidlines that needs to be formulated from these and most importantly I think it is very necessary for us at this point to identify a responsible party and of course make them accountable. Who is responsible for micro hydro at this point ? There is nobody. That is probably the reason why we have not much happening at in that area. Simalerly I think in case in textile I know that there is the Trade Promoting Centre which does a tremendous amount for promoting these trades. But there is not really a special, specialized unit within the government which looks after specific problems and specific industries. We have I think come to a point where we discussed about evolving the technological capabilities in the country. We have seen some areas of greater or comparitative advantage like microhydro, carpets. But I think what is important for us to do at this point is also to think about the institutional support of all these industries need and ofcourse the institutional support is the support that is going to translate the policies government makes into operation regulation.

With these few words I would like to congratulate all of you for having gone through these deliberations. I think these recommendation are very

meaningful to us. Although again I say we need to operationalize these further, but I think that is the sort of thing which we will be getting in the future, hopefully within RONAST venue and proceed from here. I think this is a tremendous start.

Thank you all.

VOTE OF THANKS

Hon'able Chairman Dr. Binayak Bhadra
Dr. Huq, Dr. Love
Mr.Pottinger, Mr. Rishi Shah
Dear Participants
Ladies and Gentleman

First of all I will really like to congratulate you all for having gone through this rigorouse three days exercise. I must say that you now have a proof of what you have gone through and this has also added some responsibility on you I think. Now if some study or some issues come in these areas people, are going look at you, people are going come to you and RONAST in particular will look towards to you and try to get your involvement and your support. Of course three days exercise would no enable one to be an expert on his own. I think this is a beginning you have been exposed to some of methodologies I presume and this is a start. Now it depends upon us all really to use it and use this methodologies to expand our horizon and knowledge base and contribute from whenever we are. Of course RONAST will be more than happy to provide the forum for you If you want to do something. I would like to assure you at this moment that if you want to continue this sort of activities or study or what ever you have. If you need some documents photo- copied or if you want to get some document from abroad we shall be more than happy to help you. This I would like to assure you and also I think we shall be getting all the papers and your contribution in the form of a proceeding and we will get try to give each a copy of that also. What I mean to say is that, this link is not only between RONAST and Straclyde but between RONAST and our fellow participants from different institution will continue. Hopefully this sort of workshop will be held again, presumably next year we hope and we would will like to see you all and we do hope that there will more detailed discussion, more presentation from participants and it would be more meaningful excersise so that on the long run we shall be able to contribute towards the industrial development of the country. Of course my task has been to propose the vote of thanks. At the out set I would like to sincerely thank Hon'ble Dr. Binayak Bhadra who inspite of his busy schedule, I know how busy he is, particularly during this period of year, trying to work out plans for the next fiscal year, he could come out and give us a very inspiring talk. Knowing him for so long, he himself has been involved in this sort of study and anylasis. His remarks were really very important I think and very useful and his speaking from the depth of the knowledge that he has and having a man like him at the policy making level. Of course as we all see things are going in the right direction. But as he has rightly pointed out we have problems of implimentation, certainly we will have to work together and overcome these difficulties and see to it that the nation in the long run will prosper.

His Hon'ble member of the National Planning Commission Prithivi Raj Legal was here the day before yesterday to inaugurate this workshop. Again on be half RONAST and myself I would like again to put on record our sincere thanks and appreciation for his valuable presence and for his deliberations.

I think the most important in this workshop has been our participants. Without the participants we wouldn't have had the workshop. they have really put up with the tough works. I would say within 3 days, we

have been able to come up with very interesting and useful recommendations. Again I must say because of the austere measures that we have been trying to add here too. I am sure you might have been put to certain physical difficulties. I do not know whether the foods were that good. Normally these sorts of workshop generally are held in the hotel environment. But we thought it is better to have it in our own premises. I do hope that the workshop in this environment has not been that harsh or that difficult, even if it was and it was not intentional, on behalf of RONAST I simply beg your indulgence. I also like to thank the institutions who have cooperated with our field visits. It was also an important part of the workshop and we really appreciate their help.

The authors who presented very valuable papers. Who wrote and presented as a matter of fact, were also very useful and we like to express our sincere appreciation and thanks to them all.

Likewise the British Council, who have been instrumental in supporting for the success of this workshop, in particular Mr. Pottinger. He has been very active actually, he has been comming to us so very often inquiring about the arrangement for the workshop. He was quite concerned about it as a matter of fact and for the interest that he has shown and for the help that he has rendered. I would like to put on record our sincere appreciation and thanks to British Council, in particular to Mr. Pottinger.
Similarly, all the staff of RONAST and in particular those who have worked behind the scenes, without whose active sopport, the organization would have been rather difficult or even impossible I would say, I would like to thank them all.

Lastly but the not least the guest speakers Dr. Love and Dr. Huq, who have come all the way from Strathclyde to Kathmandu and helped us to conducted this workshop and impart the knowledge, whatever they have to us, impart the methodologies and the experiences that they have. I would really like to thank both of them and as a token of our appreciation I would like to present both of them with a small piece of gift. I do hope that our link with them will prosper in the years to come and grow from strength to strength. Hopefully in the next workshop we shall have them both again and have more useful deliberations. Similarly, through them I would like to express our thanks to the University of Strathclyde. I do hope the link between RONAST and Strathclyde will be an enduring one.

Thank you all.

General Programme

First Day : 19 April 1993, Monday

Venue : RONAST Meeting Hall

Inaugural Session

Technical Session 1

: Industrialization and Development: Basic Issues

: Promoting Technological Capability in a Developing Country

: Discussions

Technical Session 2

: Policy and Programmes of HMG in Carpet Industry of Nepal

: Present Scenario of Carpet Industries

: Policy and Programmes of HMG in Textile Industry of Nepal

: Discussions

Technical Session 3

: Textile Sector

: Energy Situation and Micro Hydro in Nepal

: Discussions

Second Day: 20 April 1993, Tuesday

Venue : RONAST Meeting Hall

Field Visit

: Formation of Groups

: Identification of Group Leaders

: Site visit

Technical Session 4

: Group Discussion "Indigenous Technological Capability: Lessons from Developing Countries"

: Final Report Preparation

Third Day: 21 April 1993, Wednesday

Venue : RONAST Meeting Hall

: Final Report Presentation

: Evaluation of the Workshop by Participants

Closing Session

: Presentation of Report

: Recommendation and Suggestions of the Workshop

: Certificate Distribution

Annexes

List of Chairmen and Rappoteurs of the Sessions

Session	Chairman	Rappoteurs
Technical Session 1	Mr. Rishi Shah Secretary, RONAST	Dr. Ramesh M. Singh RONAST
Technical Session 2	Dr. M.M. Huq DCRU University of Strathclyde UK	Mr. Dilli R. Joshi RONAST
Technical Session 3	Dr. M.M. Huq DCRU University of Strathclyde UK	Mr. Pratap Singh RONAST
Technical Session 4	Dr. Jim Love DCRU University of Strathclyde UK	Mrs. Junelee Pradhan RONAST
Technical Session 5	Dr. M.M. Huq DCRU University of Strathclyde UK	Mrs. Indira Shakya RONAST

FIELD VISIT

Persons responsible for the Working Groups in TTC at Industry Level workshop :

1. Dilli Raj Joshi
2. Junelee Pradhan

Objective of project (factory visit) of the working groups:
"To Examine the State of Technological Capability"

Factories Identified:

a. Snow Lion Carpet Factory - Mr. Bijay B. Shrestha
b. Balaju Yantra Shala - Mr. Shreedhar Devkota

Work to be Executed :

a. Visit the particular factory
b. Collect relevant data
c. Compile a short report to introduce the plant in the context of technological capability achieved in the country.

How ?

Find :

a History of plant , total investment, life of project-

- source and type of raw material
- Capacity utilization
- Sales information
- Market (local/ international)
- Total Nepalese output (in this plant and in the industry)
- Organization status (labor, employment)

b. Technology in use/ type of techniques

c. Sources of machinery and equipment (by country)

d. Indigenous Technological Capability in Selected Areas :
design, local manufacture of machinery and equipment, assembly, installation, production, maintenance, innovation, etc.

e. Role of government in promoting Technological Capability

Commitee Members

1. Persons involved with participation

   a) Mrs. Junelee Pradhan

   b) Mr. Dilli Raj Joshi

   c) Mr. Pratap Singh

   d) Mrs. Indira (Sthapit) Shakya

2. Persons involved without participation

a) Dr. Ramesh Man Singh	-	Co-ordinator
b) Mr. Gopal Man Singh	-	Logistic support
c) Mr. Niranjan Acharya	-	Administration and Support services
d) Mr. Kaushal C. Subedi	-	Logistic support

WORKSHOP ON INDIGENOUS TECHNOLOGICAL APABILITY AT INDUSTRY LEVEL
19 - 21 April 1993, Kathmandu
List of Participants

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