

**NEPAL
COUNTRY PAPER**

**TECHNICAL ADVISORY COMMITTEE (TAC)
AND
GOVERNING BOARD MEETING OF ASIA AND
THE PACIFIC CENTRE FOR AGRICULTURAL
ENGINEERING AND MACHINERY
(APCAEM)
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SUMMARY

Nepal, a hilly country with total land area of about 147,181 sq.km, has brought only about 18% land under cultivation. Terai, the flat land (23% of total area) is the most fertile land where cereal production is mainly concentrated. Hilly region is emphasized for fruit production whereas mountains for livestock production.

Agriculture growth in Nepal is not coping with its population growth. Total farming population is 81% and is still reducing due to various reasons. Total cultivated land is 2.97 million ha. and average parcel size of agricultural land is 0.24 ha.

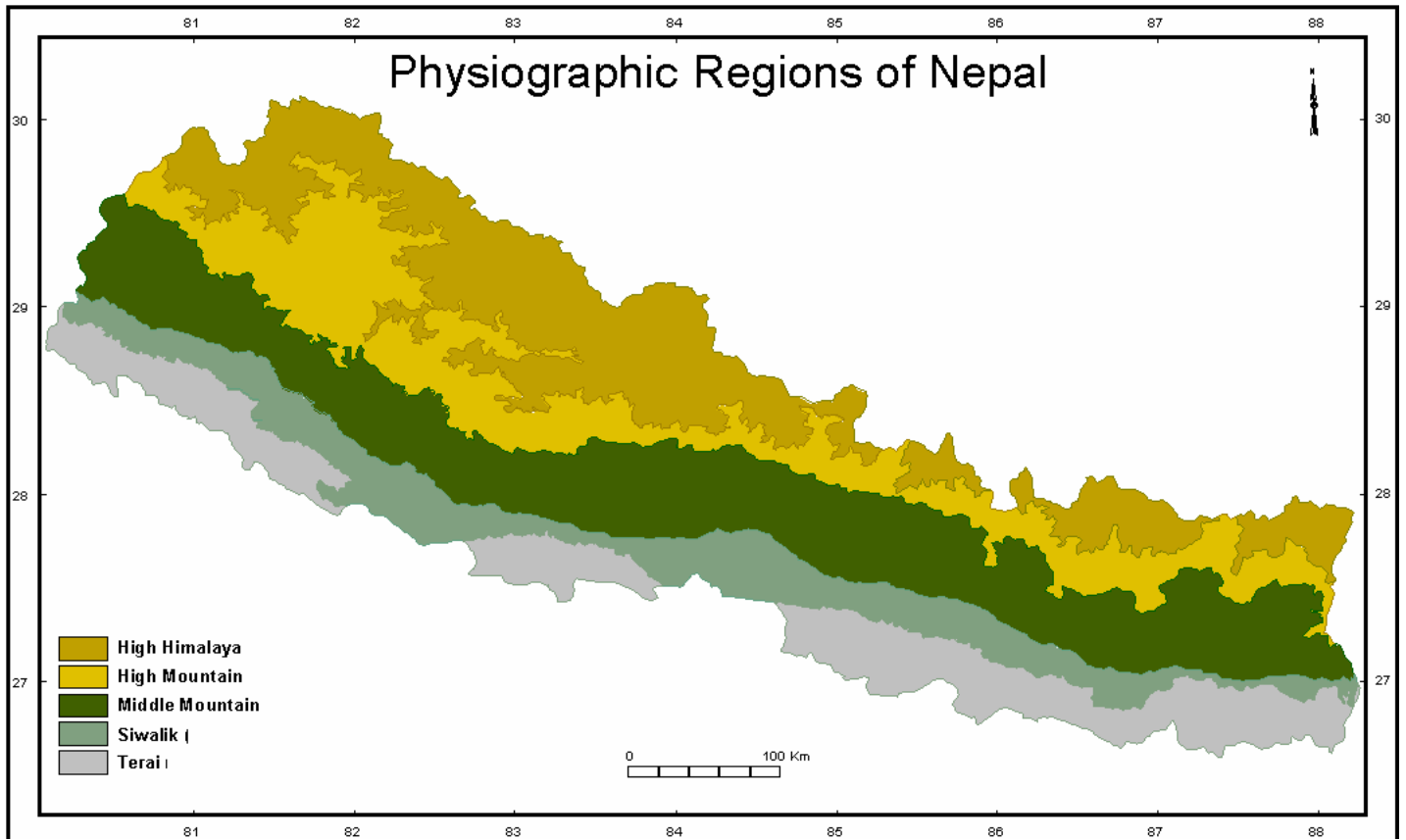
Major cereals are rice, maize, wheat, millet, and barley. Apple and Citrus are major fruits and tomato, cabbage and cauliflower are main vegetables. Sugarcane and potato are main cash crops and mushroom is coming up as a commercial crop.

Though Govt. has not mentioned agricultural mechanization in the country in the 10th plan, commercialization of agriculture has been stressed. Reduction on import duty to five percent on agricultural machinery, equipment and tools has helped agricultural mechanization in the country with import of more tractors totaling to 29665 numbers by June 2003. Farmers are using tractors, power tillers, threshers, etc due to higher labour charges involved to complete farm operations. Mechanical power is replacing human and animal power, as young generation is not attracted towards agriculture. Animal power is reduced to 28.3%, human power to 36.7% and mechanical power increased to 35%.

R & D being conducted by AED and AIRC are seed drill, rice transplanter, reaper, threshers, rice husk stove, cereal & fruit storage technology, rice & maize, fruit & cardamom dryer and is continuing. Agriculture research is grossly under funded (0.2% of AGDP). Status of agriculture machinery industry is affected by high cost of raw material, lack of financial viability, high cost of electricity and disparity in duties & taxes on raw material applicable to Agri. Machinery Industries (AMI).

Private agencies, dealers, INGO's (including CIMMYT), Regional Agri. Res. Station, ADB/N & NGO's are also helping in the promotion of agriculture machinery. AED (National Institute of APCAEM/Nepal) and Agri. Implement Res. Center, both under NARC are also involved in promotion of agriculture tools and machinery. Methods of promotion include demonstration, training, TV programs & replication of prototypes and Farmer's participatory research, Farmer's field day etc.

Prototype machinery required for Nepal is medium capacity power rice thresher, portable oil expeller, sugarcane harvester, tea plucking m/c and portable ginger peeler. Agricultural Mechanization policy should be emphasized in future. Establishment of National Agricultural Mechanization Research and Extension Center (NAMREC), incentive programs for collective use of agriculture machinery & custom hiring system, establishment of mechanization promotion cell at potential districts, revolving fund for replication of tested prototype equipment and machinery at NARC, bank loans at low interest rates to agriculture machinery manufactures on raw materials and special program for upliftment of blacksmiths are some of the measures suggested for promotion of agri. mechanization.



Country Profile

General

Location :	Latitude (26 22' N to 30 27' N) Longitude (80 4' E to 88 12' E)
Climate:	Sub-tropical to temperate
Annual rainfall:	2,000 mm (East) to 1,000 mm (west); 1,070 mm in Pokhara
Rainfall duration:	60-80% in monsoon season

<u>Population Estimates</u> (millions)	23.1 (2001), male: 17.5, Female: 11.6
a) Total rural population	85.8%
b) Farming population	81%
c) Unemployed population	5% (10 years and above)
d) Literacy rate	53.7% (2001)
e) Life expectancy at birth rate	59.7 (2001)

<u>Total Land Area (sq.Km)</u>	147,181 (~14.7 million ha)
a) Himalayan region	35.2%
b) Hilly region	41.7%
c) Terai region	23.1%

Land Holding size

Average size of farm holding:	0.96 ha (.068 ha for mountains, 0.77 ha for hills, 1.26 ha for terai)
Average no. of parcels/holding	4.0
Average parcel size	0.24 ha

Land Use Pattern (million ha)

a) Cultivated land	2.97
b) Non Cultivated Cultivable land	0.99
c) Forest	6.31
d) Pasture	1.75
e) Others	2.73

Irrigated Land (Million Ha)	0.951 (2000/01) 32.02%
GDP (Million Rs.) 2000/01	376433
a) Agriculture Sector	40.1% (2000/01)
b) Non-agriculture sector	59.9%
GNP per capital 2002/02	US\$ 237

Major Cereals 2000/01

	Crop	Area (HA)	Production (M.T.)	Productivity (MT/ha)
a.	Rice	1560044	4216465	2.7
b.	Maize	824525	1484112	1.8
c.	Wheat	641030	1157865	1.8
d.	Millet	259888	282852	1.08
e.	Barley	28194	30488	1.08
	Cereal Crop	3313681	7171782	

Cash Crop

Sugarcane	59422	2211781	32.22
Potato	129019	1313717	10.18

Others : Oil seeds, Tobacco, Jute

Source: MOA, Agri. Statistics Division 2000/01

Population of Livestock & Other Animals for Cultivation/Transport (in Million, 2000/01)

a. Cattle	6.98
b. Buffaloes	3.62
c. Sheep	0.85
d. Goat	6.47

AGRICULTURAL POWER**Land Holding Using**

No. of 2-&4- wheel tractor	29665 (June 2003)
Average Kw/ha	1.43 (Human & Animal Power)
Animal Power	26.1 %
Human labor	41.7%
Mechanical Power	32.2 %

NEPAL COUNTRY REPORT¹

S.K. Adhikary²

INTRODUCTION

Nepal, a mountainous and hilly country, has total land area of about 147,181 sq.km of which only about 18% has been brought under cultivation. Terai region, the flat belt is only 23% of total area and is the most fertile land where production of grains is concentrated. Hilly region has been emphasized for fruit production where as mountainous region for livestock production.

About 86% population is concentrated in rural areas and the farming population is about 81 percent. The contribution of agriculture sector to the total gross domestic production (GDP) 40.1 percent (2000/01).

]Major cereals are rice, maize, wheat, millet and barley of which rice is the main staple food. Apple, oranges, mango, banana etc. are the main fruit crops. Vegetables like potato, cabbage, cauliflower, beans, okras, tomato, etc. give more profit than cereals. Sugarcane is one of the cash crops and the sugar production is sufficient for local consumption.

ORGANIZATIONAL STRUCTURE

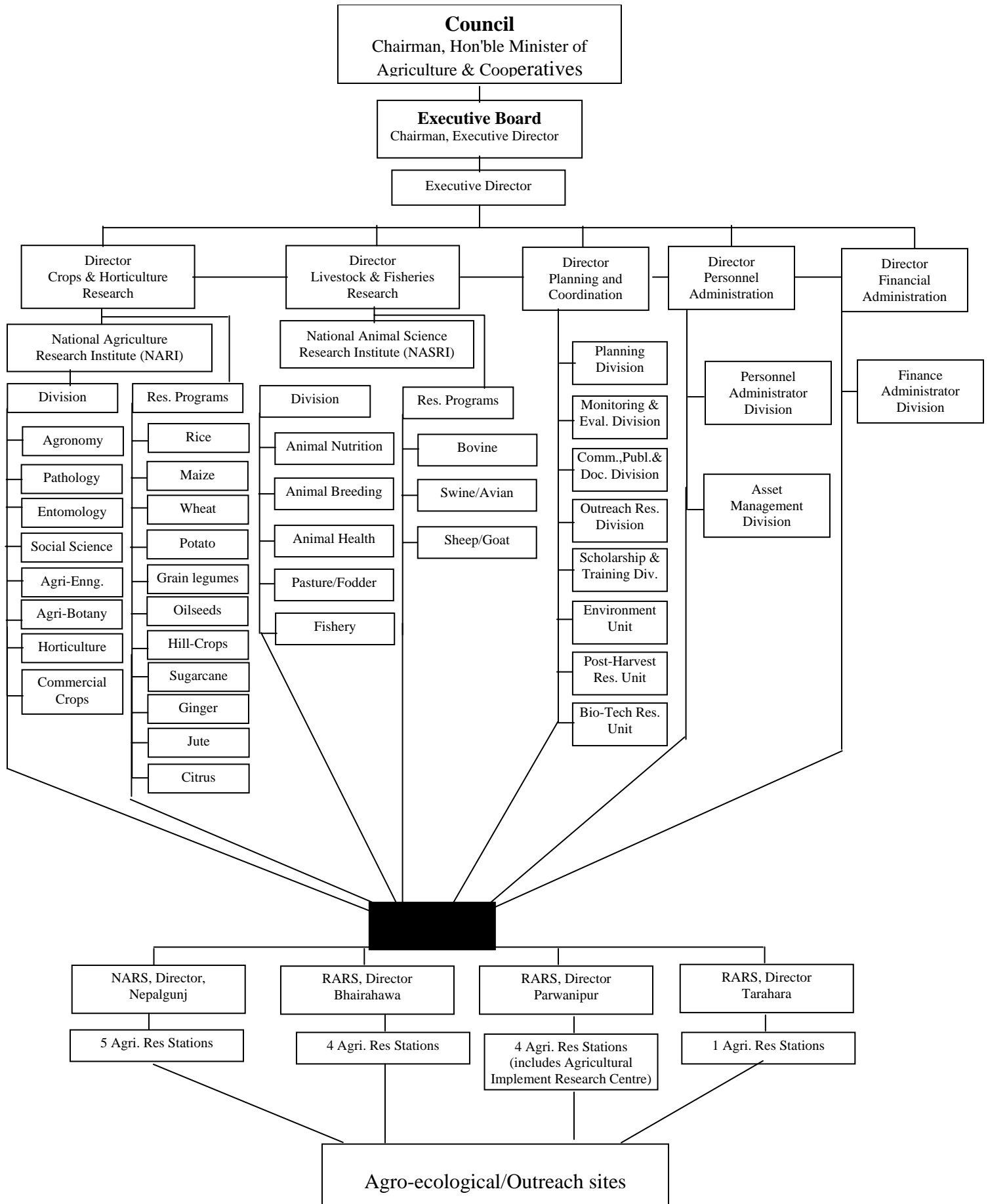
Nepal Agricultural Research Council (NARC) is the autonomous apex body at the national level, established in 1991; to undertake agricultural research activities for increasing agricultural productivity and production by generating appropriate technologies suitable to various Agro-Ecological Zones (AEZs) for the country.

The Minister for Agriculture and Cooperatives is the chairman of NARC. Agricultural Engineering Division (AED) is under the National Agriculture Research Institute (NARI) which is under the technical supervision of Director Crops and Horticulture.

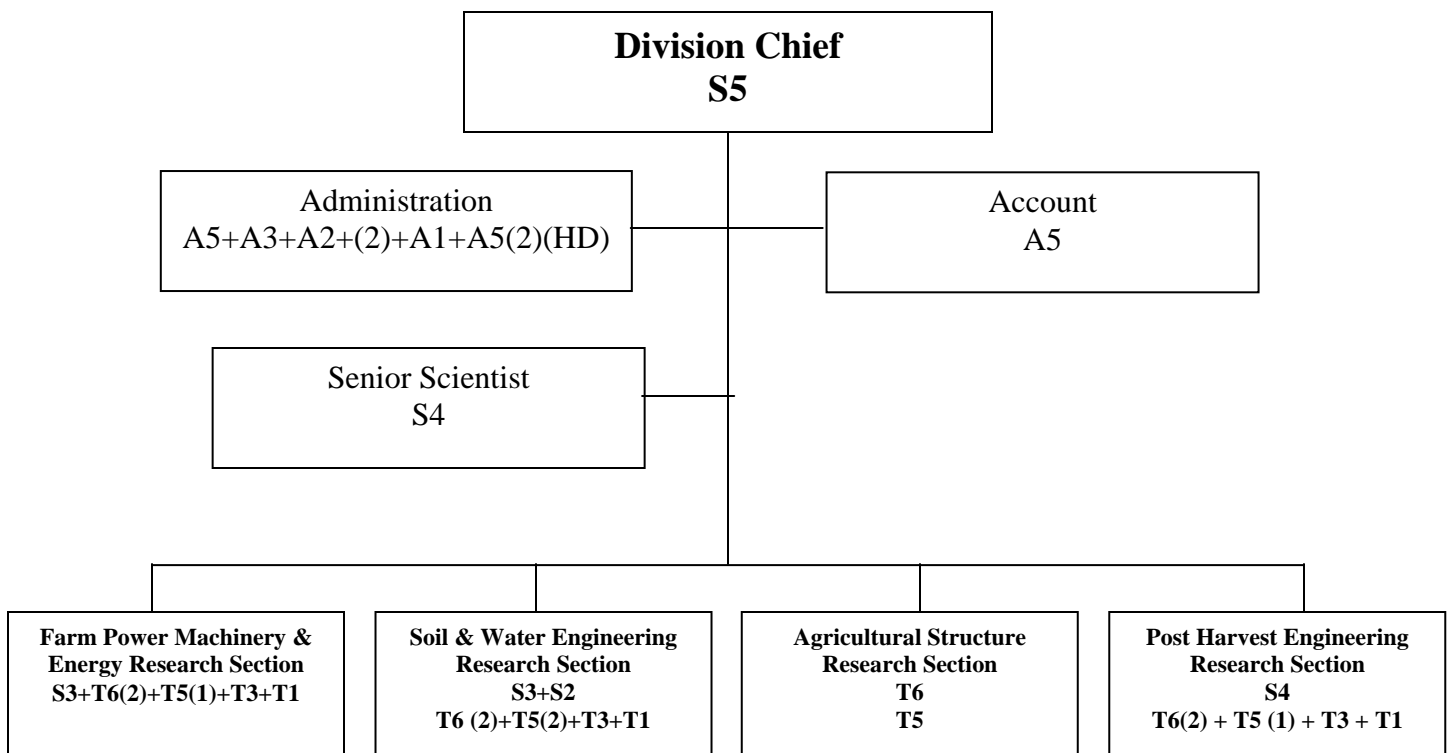
Agricultural Engineering Division is also National Institute for APCAEM/Nepal. Executive Director is the Chairman of the executive board and has 5 directors for execution of the plans and programmes . (Table...)

1. Report to be presented at APCAEM TAC/GB Meeting to be held in Beijing, china during Nov. 24-27, 2003.
2. Chief Agri. Er. And National Director
Agricultural Engineering Divison (NI/APCAEM) Nepal Agricultural Research Council.

ORGANIZATION STRUCTURE OF NARC



ORGANIZATION CHART OF AED



AGRICULTURAL MECHANIZATION POLICIES AND STRATEGIES

Due consideration to agricultural mechanization AM was not given in the past HMG's five year plans. Emphasis was given only on labour intensive techniques. There was no mention of AM even in Agricultural Prospective Plan (APP) for 20 years. In the 9th Five Year Plan (1996/97 – 2001/2002), during the budget speech for FY 1998/99, there was mention of some of the policies/measures, which help directly or indirectly in agricultural mechanization policies. The measures helped in the import of agricultural machinery such as tractors, power tillers, threshers, pumping sets sprinkler and drip irrigation equipment, solar sets and other equipment for farming operations.

10th FIVE YEAR PLAN

As in the previous plans, the core goal of the tenth plan is poverty alleviation. Four pillars considered instrumental in achieving the goal of poverty alleviation have been identified. They are broad-based economic growth, social sector development targeted programmes and good governance. In this plan too there is no mention of agricultural mechanization policy. But, it was mentioned about commercialization and modernization of agriculture for which agricultural mechanization is necessary. The objective of increasing agricultural production, productivity and incomes both to reduce poverty of rural farmers and increase food security can not be achieved without mech. policy. It was also mentioned that the growth strategies for agriculture are to modernize, diversify and commercialize crop and livestock production by expanding the case of technology and increasing the access of farmers to modern agricultural input and credit.

STATUS OF AGRICULTURAL MECHANIZATION (AM)

Human labor is the main source of power in Nepalese agriculture specially in hills where as mechanical power is increasing in Terai replacing animal power. Draught power in the country together constitute 65% of total agriculture power. The status of agricultural mechanization in Nepal is in its infancy. Moreover, major hilly regions and many rural Terai areas have no electricity. So, use of manual and animal drawn (AD) implement will be continued for few decades, also due to size & area of land holding (table 1). So, rural agriculture needs to be mechanized by using improved hand tools & AD-implement.

TABLE 1 SIZE AND AREA OF HOLDING

Size of Holding	Holding		Area of Holding	
	No ('000)	%	Area ('000)	%
<0.1-1.0 ha	1877.08	69.5	791.9	30.5
1.05-5.0 ha	786.1	29.1	1444.8	55.6
5.0 ha & over	40.2	1.5	360.6	13.9

Source: CBS, 1996

Blacksmiths are the primary suppliers of manual and AD-implement for the small and marginal farmers of the country. It is estimated that more than 85% of tools/implement used by the farmers especially in hilly areas are made/repared by the blacksmiths/rural artisans. So, blacksmiths could play an important role to help in rural mechanization of agriculture in the country.

Total mechanical power available is only about 0.22 kw/ha which is 35% of country's total farm power (Appendix 1). However, use of mechanical power for land preparation should have been increasing as number of tractors is increasing year by year, Narayani Zone having maximum of 10911 number, totaling to 29665 till June 2003 (Table 2&3). Use of tractor 63.2% for land preparation for wheat in Terai in VDC areas and inner Terai by contract hiring is also increasing. Likewise use of tractors for wheat threshing and pumping sets for irrigation is on the increase (Table 4). For wheat seeding, Chinese power tiller with seed drill is also being popular among farmers, which is the outcome of joint Agricultural Mechanization Program of Nepal Agricultural Research Council, Agricultural Engineering Division and Rice-Wheat Program funded by CIMMYT/Kathmandu. One farmer, Mr. Dan Bahadur Chaudhary, Pakadi VDC in Kapilvastu district was found to own a combine harvester also. One power Rice Transplanter (Yanmar AP 400 Model) was imported by private dealer, Joshi Auto Centre, Basundhara, Kathmandu and was demonstrated at Balkot, Bhaktapur and Basundhara, Kathmandu. The area covered during demonstrations were 5 Ropanis (0.25 ha) in Bhaktapur and 3 ropanis (0.15 ha) in Kathmandu. It is to be noted that power rice

transplanters were demonstrated few years ago by the then Janakpur Agriculture Development Office and jointly by Regional Agriculture Research Stations (RARS's); Nepal Agriculture Research Council (NARC) and CIMMYT.

TABLE 2 TOTAL NUMBER OF TRACTORS IN NEPAL

Fiscal Year	No. of Tractor	Annual Increase	Increase %	Year	2-wheel tractor
1989/90	6,166	0		1975	100
1990/91	6,954	788	12.78	1980	424
1991/92	7,502	548	7.88	1985	994
1992/93	7,764	262	3.49	1988	1050
1993/94	9,160	1,396	17.98	1989	1100
1994/95	10,974	1,814	19.80	1992/93	1300
1995/96	13,067	2,093	19.07		
1996/97	14,414	1,265	8.78		
1997/98	15,679	1,265	8.78		
1998/99	17927	2248	14.34		
1999/2000	20469	2542	14.18		
2002/2003	22954	2485	12.14	Average	828 (till 1992/93)
Total June 2060	29665				

Source: Dept. of Transport Management, Ministry of Works & Transport

TABLE 3 NUMBER OF TRACTORS IN DIFFERENT ZONES TILL JUNE 2003

Zone	Tractor	Zone	Tractor
Bagmati	1677	Bheri	1501
Narayani	10911	Mechi	1828
Lumbini	3173	Sagarmatha	583
Koshi	5639	Seti	757
Gandaki	867	Mahakali	396
Janakpur	2038	Rapti	296
		Total	29665

Source: Department of Transport Management Ministry of Works and Transport.

TABLE 4 USE OF AGRI. EQUIPMENT & MACHINERY FOR FEW CROPS (%)

Machinery Use	Wheat	Tractor Use	
VDC Areas			
Land Preparation (%)	63.2	Tilling	15.2 to 17.2
Pump Irrigation (%)	48.9		
Threshing (%)	69.2	Threshing	11.6 to 19.1
Municipality Areas %			
Land Preparation (%)	58.9	Transportation	28.8 to 29.1
Pump Irrigation (%)	42.6		
Threshing (%)	58.4		

Source: AED Annual Report

TECHNOLOGY DEVELOPMENT

Agricultural Engineering Division is the major responsible organization for the research and technology development of farm machinery and agricultural equipment in the county. Apart for R & D in farm machinery and equipments, it is responsible for the development of technologies in irrigation water management, soil conservation, post harvest engineering etc. Under the umbrella of NARC

Agricultural Implement Research Center (AIRC) is also involved in the research & development of agricultural tools and implements.

At present AED is involved in R & D of maize sheller, peanut sheller, wheat thresher, cardamom dryer, solar dryer, seed dryer, zero till seed drills, rice husk stoves etc. Where as AIRC, Ranighat is involved in R & D of manual rice, Tran planters, bed planters, zero till seed drills, reapers, drum seeder, bullock drawn seed drills etc.

Agricultural Engineering Division on going activities, 2003/04

1.	Design, development and testing of agriculture equipment. - Single bullock harnessing system. - Animal drawn zero till seed drill. - Adjustable rotary quern.
2.	Study on crop water requirement and on farm water management in rice based cropping system
3.	Applied research on design and development of micro irrigation system for efficient water application.
4.	Drying of early and summer maize in the farmer's field to minimize harvest loss
5.	Study on plastic house environment/system for off season vegetable farming
6.	Post harvest engineering study on agricultural commodity (mushroom, cardamom, apple etc.)
7.	Rain water harvesting for supplementary irrigation of wheat crop.
8.	Testing and evaluation of farm equipment and machinery.

Agricultural Implement Research Center (AIRC)

AIRC at Ranighat, Birgunj, also under NARC is also involved in the testing, design/modification of existing or imported agricultural equipment and machinery. On-station research activities are on power paddy thresher, Bullock-drawn maize planter, multicrop thresher (developed at AIRC), rice transplanter and wheat seed drills. Activities are:

Research Activities

1. Assessment of permanent bed planting methods under Rice-Wheat-Moong bean systems (NARC-Counell University Collaborative Research)
2. Study on Rice establishing methods.
3. Performance evaluation of Direct Seeded rice techniques under unpuddled conditions.
4. Crop diversification experiment.
5. Bed planting on winter maize in Rice-Maize system.

Outreach Research Activities

1. Comparative studies on mechanical wheat sowing in farmer's fields.
2. Performance evaluation of different seed drills in farmer's fields.
3. Performance evaluation of different tillage and crop establishment methods on wheat yield in farmer's fields.
4. Performance evaluation of crop establishment methods on direct seeded rice in farmer's fields.
5. Training program on operation, repair and maintenance of power tiller and inter-district farmer's visit (NARC-CIMMYT-NEWZEALAND COLLABORATIVE PROGRAM)
6. Wheat Surface/Relay sowing in low land area.
7. Rice-wheat system research activities (ADB funded RWC collaborative research) crop diversification experiment.
8. On-farm farmer's acceptance test of boro rice.
9. On farm evaluation of leaf color chart for nitrogen management in wheat.

10. Disease and insect pest situation in on farm and on station experiments.

Other rice-wheat activities carried out at AIRC, Ranighat

1. Adoption of reduced tillage technology for wheat.
2. Adoption of surface/relay wheat sowing.
3. Adoption of power tiller drill for wheat planting and soil puddling.
4. Bed wheat planting adoption.
5. Bed legume planting adoption.
6. Boro rice observation tour.

CIMMYT

CIMMYT under Rice/Wheat Project is supporting for Technology Development in agricultural Mechanization program in the country e.g. Farmer participatory Research on Use of Chinese Hand Tractor (CHT) with seed drill/tiller/leveler and rice transplanter. Possible use of this tractor for farm irrigation and winnowing purposes are also being explored. These tractors are left with the farmers after they have been trained. They operate, raise funds from wheat seeding and maintain CHT by themselves.

AGRICULTURAL MACHINERY MANUFACTURING

Blacksmiths are the primary suppliers of manual and AD-implement for the small and marginal farmers of the country. It is estimated that more than 85% of tools/implement used by the farmers especially in hilly areas are made/repared by the blacksmiths/rural artisans. So, blacksmiths could play an important role to help in rural mechanization of agriculture in the county. The blacksmiths need training, better tools/equipment and a reliable supply of high quality raw materials to improve the efficiency of their work.

LOCAL MANUFACTURING OF AGRICULTURAL MACHINERY AND EQUIPMENT

Agricultural Tools Factory (ATF estd. 1968) – ATF has been privatized with 65% private share and 35% HMG/N share. After privatization, ATF ran smoothly for about 6 months but afterwards production of equipment is not going ahead due to various constraints. Initially, it was producing power as well as animal drawn equipment & machinery along with hand tools such as threshers, corn Sheller and diesel pump sets, trailers, plough, disc harrow and cultivator, wheel exle set for animal cart and hand tools.

Development & Consulting Services (DCS estd. 1972) – It had developed appropriate technologies like Sundhara oil Expeller and apple Peeler/Corer/Slicer among the various machines developed.

Kathmandu Metal Industries – It is a privately owned mechanical workshop with 10 mechanics including 2 each with semi-skilled and unskilled. The family has a long tradition of designing, manufacturing & installation of micro hydro power plants. The workshop is well known for its innovation of MPPU & Peltric Sets. Other products are cross flow turbine, propeller turbine and induction generator.

National Structures & Engineering Pvt. Ltd. – It has 9 semi-skilled & 5 skilled mechanics with 2 supervisors. Steel fabrication and automobile parts are the main field activities. Its products are agro-processing m/c, hydram, bio mass gasifier, fuel and water storage tanks, roof trusses, electric poles, smokeless stoves of Swiss design for the mountain region (Smoke & loss of heat is minimized in this stove) and room heater.

Local Workshop – Power wheat threshers are generally made locally in Terai regions. Shakya Engineering, Bhaktapur: It fabricates power wheat thresher, pedal paddy thresher, hammer mill, paper recycling machine poultry feed grinder etc.

TESTING AND CERTIFYING

Machinery equipment whether imported or locally fabricated are tested on station in the beginning. After having satisfactory results, they are tested on farms or at outreach sites. They are further promoted provided their performances are judged good by the group of people which includes farmers, extension workers, scientists, etc.

If some modifications and adjustments are needed, they are brought to the workshop and adjusted accordingly. Then it is again tested at the site and the cycle is repeated till the machine performs well. This is usual procedure practiced by the scientists/engineers at the division/agriculture research stations/centres.

For certifying, there is a separate institution named Nepal Bureau of Standards & Meteorology (NBSM) to certify the product, which provides certification on request of industries for the product if they meet the requirement set by the institution. At present it is mainly controlling on quality control of food items.

As agricultural mechanization is very minimal in the country, dealers are free to import and sell the machinery; likewise machinery manufacturers can sell their products freely. They are not obliged for official testing and certification. It is believed that they do testing by themselves.

In other words, there is no mandatory for the manufacturers, dealers for testing and certifying the product whether locally fabricated or imported. Agri. Machinery industries/workshops are not yet registered in the NBSM.

EXTENSION ACTIVITIES

There is a separate wing for dissemination of agricultural technologies under the Ministry of Agriculture and Co-operatives as Department of Agriculture (DOA) and Department of Livestock Services (DOLS). However, these departments are not able to carry out agricultural machine related extension activities due to the low priority accorded by these departments on agricultural mechanization and also due lack of agricultural engineers at district levels.

Even though AED and AIRC are mainly responsible for R & D of the farm machinery and agricultural equipments, they are also involved in the extension of farm machinery and implements in limited areas through their outreach research activities.

Agricultural Engineering Division (AED)

The major responsibility of extension lies with the Department of Agriculture. However, AED, with its limited manpower had conducted limited extension activities, also because of research mandate, since NARC was placed as an autonomous body. The demonstrations are conducted at farmer's field, agricultural exhibitions, farmer's day etc. to get farmer's opinion for further modification. Prototypes, developed/improved or imported from other countries are tested in the division. Training on operation and repair maintenance of tractor and farm equipment to the farmers and technicians and study of agri. mechanization at national level are other related activities.

Power-operated Chinese seed drill & rice/wheat reapers received under the rice/wheat project, CIMMYT have been introduced few years back & farmers are taking keen interest in those machines. The demonstrations were held at Bhaktapur, (Table 3) AED.

Promotion of Agricultural Machinery

Efforts to popularize and promote the agricultural machinery in the country are minimal. Methods of the promotion/popularization were described as follows.

- A. Demonstration of Chinese reaper and seed drill by power tiller including training on operation.
- B. Training on operation and repair/maintenance of tractor and farm tools.
- C. TV program for popularization of technology.

The following programs are occasionally telecast by Nepal Television (NTV) for popularization of technology.

- i. Seedling broadcasting technology on rice.
- ii. Minimum tillage (Chinese seed drill) for wheat sowing.
- iii. Wheat threshing methods/machines.
- iv. Maintenance of 4-wheel tractor.

The demonstrations are conducted at farmer's field, agricultural exhibitions, farmer's day etc. to get farmer's opinion for further modification of the improved machinery and implements. AED and AIRC are also involved in the participatory action research on the dissemination of improved agricultural machinery to the economically vulnerable farmers in-group approach in Terai and in the hills. AED and AIRC are involved in following other extension activities.

- ❖ Demonstration of Chinese wheat seed drill, zero till seed drill, bed planter reaper, trans planter, peanut Sheller, rice husk stove, drum seeder, maize sheller, hammer mills etc.
- ❖ Production of information materials including leaflets, brochures, TV programs etc.
- ❖ Organization of Training on operation and maintenance of farm machinery and implements.

Institute of Agriculture and Animal Science, Rampur under Tribhuvan University (TU) is involved in the production of agricultural graduates in the country since 1972. Similarly Purbanchal Campus, Dharan under Institute of Engineering (IOE/TU) has recently initiated B.Sc. Agricultural engineering graduate program since 1999.

CIMMYT under rice wheat project is supporting to promote Agricultural Mechanization Program in the country through participatory research on the use of Chinese Power Tillers, bed planter, zero tillage seed drills etc.

The other agencies which help in the extension activities of Agricultural Mechanization are

1. Regional Agricultural Research Stations (RARS) – Some extension activities on AM are carried out at their out reach sites.
2. Nepalese society of Agricultural Engineers (NSAE) – By organizing talk programme on AM.
3. Bhajuratna Agency Pvt. Ltd. – By importing and selling agricultural machinery and equipment. (Appendix II)
4. Other agencies – Dealers of Escort, Mahindra, Fong, Eicher etc. – By selling different types of agricultural machinery and pump sets including power tillers, pump sets and Appendix II.

In Kathmandu valley alone there are more than seven dealers who import and sell power tiller and accessories.

5. Machine Manufacturer – Local machine equipment fabricator do help in extension activities while selling & advertising their products.

FINANCING

The Financing is a great problem for the promotion of agricultural Mechanization Machinery/Equipment which are found appropriate by testing on station and on farm can not be replicated due to budget constraint.

The limited resource which comes from HGM/N is not enough to buy the new machinery or equipment. In this year, there is no budget at all to buy new machinery set.

COUNTRY FARM MECHANIZATION PLANS & PROGRAMMES

Straight specific plans or programmes are not mentioned in the tenth five years plan (2002-2007). However modernization and commercialization of agriculture which includes Agricultural Mechanization too has been stressed. In the agriculture sector, the major focus has been shifted on appropriate strategies for poverty reduction.

The major objectives set for the agricultural sector are to increase agricultural production, productivity and incomes, both to reduce poverty of rural farmers and increase food security.

The growth strategies for agriculture are to modernize, diversify and commercialize crop and livestock production by expanding the use of technology and increasing the access of farmers to modern agricultural inputs and credits. Similarly, promoting the participation of private sector and NGO's / INGO's in service delivery, market promotion and infrastructure development are other major strategies.

Programmes on partial mechanization on agriculture reducing cost of cultivation of agricultural product, reduction of drudgery labor and time saving technologies, minimum tillage technologies, water saving technologies etc. are being carried out by the concerned agencies specially AED, AIRC, R-W-Programmes (CIMMYT) and RARS's.

TIME SPANS

The duration of most of the programmes ranges from one to 3 years. One year duration is for regular programme and 2-3 years is for special projects.

MAIN FOCUS AND OBJECTIVES

The main focus of the AM programmes are to increase agricultural production and productivity to reduce poverty.

The general objectives are.

- ❖ To reduce cost of cultivation of the agricultural produce.
- ❖ To carry out agricultural operations timely.
- ❖ To reduce labor and time consumed in agricultural operations.
- ❖ To reduce drudgery.
- ❖ To help partial Agricultural Mechanization.

CONSTRAINTS FOR AGRICULTURAL MECHANIZATION

The major constraints for the mechanization of agriculture in Nepal are as follows:

Physical constraints

- Rugged terrain, and narrow terraces in the hills and mountains.
- Lack of infrastructures viz. road network, electricity etc.
- Small & fragmented land holdings.

Technological Constraints

- Lack of technical know how
- Delayed availability of spare parts
- Lack of training for operation & repair maintenance of farm machinery
- Inadequate facilities for servicing & repairs.
- Lack of appropriate tools and machines

Institutional Constraints

- Lack of organizational set up for cooperative use of most farm machinery
- Lack of Govt. policy to promote investment in farm machinery manufacture
- Lack of institution to undertake machinery testing, quality control and standardization
- Lack of agricultural Mechanization policy and programme

Capital Constraints

- High cost of Agricultural machinery operation & maintenance
- Subsistence level of farming
- Farming communities dominated by small holders
- Lack of easy access to credit

Comments on Success

Machinery/equipment that are popular among farmers are mentioned below:

1. Pedal paddy thresher - Popular in Kathmandu valley and hills.

2. Power wheat thresher (modified from pedal paddy thresher)- Popular in Kathmandu valley.
3. Multi crop thresher – Popular in Terai.
4. Pumping set – Popular in rice growing areas.
5. Improved watermill – Popular in hills & higher hills.
6. Peltric set - Popular in hills & higher hills.
7. Rice Sheller - Popular in hills & Terai.
8. Oil expeller - Popular in hills & Terai.
9. Feed grinder – Popular in inner Terai.
10. Feather plucking machine – Popular in valleys and cities.
11. Beaten rice technology – Very popular in Kathmandu Valley.
12. Zero tillage technology for wheat (Zero tillage seed drill) – Getting popularity in Terai.
13. Surface seeding of wheat (Minimum tillage seed drill)- Getting popularity.
14. Minimum tillage technology for wheat – Getting popularity.
15. Bed planting (Bed planter) – Getting popularity.
16. Solar dryer, solar water heater – Solar water heater very popular in Kathmandu valley & Solar dryer in needs promotion.
17. Biogas plant – Getting popular.
18. Manual corn planter – Needs popularization.
19. Manual and Pedal corn Sheller – Needs popularization.
20. Zero energy structure for vegetable storage – Needs popularization.
21. Cellar storage – Needs Govt subsidy/support for promotion.
22. Mini SRR rice dryer (IRRI) – Needs popularization.

FUTURE NEEDS IN AGRICULTURAL MECHANIZATION AND POST HARVEST TECHNOLOGIES

- Medium capacity power rice thresher
- Sugarcane harvester

- Portable ginger peeler
- Portable oil expeller
- Tea leaves plucking machine
- Sunflower seed decorticator (de husker)
- Aerator for fish ponds
- Small milking machine

RECOMMENDATION/SUGGESTIONS FOR PROMOTION OF AM PROGRAMS

1. Agricultural Mechanization Policy should be emphasized and clearly mentioned in the coming Five Year Plan.
2. Establishment of National Agricultural Mechanization Research and Extension Centre (NAMREC) to strengthen national mechanization programme.
3. Establishment of Agricultural Machinery Testing and Evaluation Centre (AMTEC) to test the quality and performance of agri. machinery equipment manufactured locally or imported from other countries to upgrade the standard of agri. machinery before it is used by the farmer.
4. Activation of Agricultural Mechanization Committee already formed in MOAC.
5. Formulation of National Agricultural Machinery policy as early as possible.
6. Revolving fund for replication of tested prototype machinery/equipment should be made available to Nepal Agricultural Research Council.
7. Implementation of incentive programs to support the collective use of costly machinery and custom hiring system for AME specially in the Terai should also be encouraged.
8. Establishment of mechanization promotion cell headed by agricultural engineers/mechanization engineers within potential District Agriculture Offices.

9. Mobilization of Agricultural Tools Factory, Birgunj and other private workshop for the partial assembling and manufacturing of some easily replaceable parts of Chinese power tiller with seed drill, reaper, hammer mill etc.
10. Encourage domestic fabrication of agricultural machinery and equipment with bank loans at low interest rate to the interested factory/workshop and duty on raw materials for the production of AME should also be reduced.
11. Interest rate on bank loans for farmers to purchase AME should be reduced.
12. Special program of land consolidation of parcels should be launched.
13. Reduction on custom duty on spare parts that are used for tractors.
14. For blacksmiths (having no fixed capital for collateral) to expand their activity, a sum of about Rs. 10,000.00 should be sanctioned by ADB/N with the approval of VDC Chairman/agricultural Mechanization Officer.

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Appendix – I**Farm Power Availability**

Source of Power	Units (No.)	Power rating, Kw/unit	Available Power (Kw)	% of Total
Human Labor (Agriculturally Active Population 15-59 yrs.	12310968 x 0.81 = 9971885	0.07	698031.95	36.7
Draught Animals				
Cattle Oxen	1496384*	0.30	448915.2	
He-Buffer	201660 *	0.44	88730.40	
Total Draft Power			537645.60	28.3
Mechanical Power 2 & 4 Wheel Tractor (June 2003)	29665	14.9	442008.5	
Stationary Engines Estimated 2002/2003	60000	3.73	223800	
Total Mechanical Power			665808.5	35
All Total			1901486.05	100.00

Mechanical Power = 0.22 kw/ha = 0.29 hp/ha

* Estimated Value from CBS Publications.

Appendix II
Machinery and equipment imported by different agencies/dealers in 2002/2003

SN	Dealers/Agencies	Machineries	Imported, No.	Sale (No.)
1.	Bhajuratna Agency*	Tractor	450	350
		Pump Set		100
		Cultivator	200	
		Harrow	50	
2.	HMT	Tractor	88	
		Chinese Powertiller	59	
		Field Marshal Pump Set	175	
3.	Sonalika	Tractor		65 (2002/2003)
		Reaper	9 (Parsa) running	
			1 (Bara) running	
4.	Bhudev Trading Ford	Tractor	94	
5.	Eicher	Power Tiller DF 12	114	
		DF 12L	20	
		DF 15 L	10	
6.	Bajra Enterprises	Powertiller (Zongshen); 6.5 hp	20	
		Tractor	121	

Source: *Er L.P. Sahani, Bhajuratna Agency
 Personal Communication with G. Shah, Ranighat

Appendix III

DUTY ON IMPORT OF AGRICULTURE MACHINERY

Description	Import Duty
Agricultural, horticultural or forestry machinery for soil preparation or cultivation (Plough, harrows, seeders, planters, translators etc.)	5%
Harvesting and threshing machinery	
Milking machines and dairy machinery	
Poultry machinery	
Machinery for cleaning, sorting, grading etc.	
Machinery for fruits, vegetables seeds etc.	

Appendix IV

Foreign Investment Policy

To promote foreign investment and technology transfer, the foreign investment and technology transfer Act was enforced in 1992. According to the act, foreign investment could be in the form of equity share, reinvestment of the earnings or in the form of loan or loan facilities. According to the act, the facilities and concessions, provisions relating to visa and the list of national priority industries are mentioned below.

DETAILS OF INCENTIVES AND FACILITIES

- a. Corporate tax shall not exceed 20 percent of profit for industries other than manufacturing cigarettes, bidi, cigar, tobacco, alcohol and beer.
- b. 50 percent of income tax is exempted in the case of national priority industries.
- c. Industries (other than cigarette, bidi and alcohol industries) established in remote, undevelopment and underdeveloped areas, are entitled to a tax exemption of 30, 25 and 20 percent respectively.

- d. Industries are permitted to deduct one-third of the value of the fixed assets investment as depreciation in addition to the normal depreciation allowed under the income tax law.
- e. Industries in operation which diversify production through re-investment or expand installed capacity by 25 percent or more or modernize technology or develop ancillary industries are entitled to a deduction of 40 percent of the value of new fixed investment in computing taxable income. Such deduction may be made in lump sum or in installments within a maximum period of 3 years.
- f. Industries which invest in modern plant, machinery and equipment which will control environmental pollution are entitled to deduct 50 percent of the investment so made as deductible expenses in computing taxable income.
- g. Pre-operating expenses incurred in connection with skill development and training will be allowed to be capitalized.
- h. 10 percent of the gross profit is allowed as a deduction against net income on account of expenses connected with technology or product development and skill enhancement.
- i. Dividends declared from investments made in industry are taxed at a nominal rate of 5 percent.
- j. 5 percent of the gross income would be allowed as a deduction in computing net income on account of donations made for the improvement of schools, colleges, universities, hospitals, religious places and other social welfare activities.
- k. 5 percent of the gross income will be allowed as deduction in computing net income as expenses on account of expenditure incurred on advertisements for the promotion of products or services, hospitality and for similar miscellaneous.
- l. Industries (other than cigarettes, bidi, alcohol, saw mill and catechu) using 80 percent or more domestic raw materials in production and employing all local manpower are exempted income tax at the rate of 10 percent.
- m. Industries which provide direct employment to 600 persons or more than 600 Nepali citizens round the year shall be entitled to an additional income tax exemption at the rate of 10 percent for that year.
- n. Royalties, technical and management fees earned by a non-resident person will be taxed at 15 percent.
- o. Export oriented industries receiving duty drawback facilities under the Industrial Enterprises Act and Industries manufacturing intermediate goods to be used for the production of exportable commodities will be refunded the amount of premium, customs duty, excise and sales tax paid on such intermediate goods on the basis of the

actual volume of the export of the commodities manufactured by using them. For this purpose transferable tax credit system will be used.

- p. Priority will be given to arrange infrastructures required for the establishment of industries.
- q. Industries will be given priority for government land and land in industrial districts for the establishment of industries.

Provisions Relating to Visa:

- a. A foreign national visiting the Kingdom of Nepal in connection with undertaking any study or carrying out any research with the objective of making investment in the Kingdom of Nepal shall be provided a non-tourist visa for up to six month on recommendation of DOI.
- b. A foreign investor or dependent family or authorized representative of such a foreign investor and dependent family of such authorized representative shall for the purpose of stay in the Kingdom of Nepal be provided a business visa on the recommendation of DOI.

National Priority Industries

1. Agro and Forestry-based industries.
2. Engineering Industry (Producing Agricultural and Industrial Machine).
3. Industry Manufacturing Fuel Saving or Pollution Control Devices.
4. Solid Waste Processing Industry.
5. Road, Bridge, Tunnel, Ropeway, and Flying Bridge constructing and Operating Industry, and Trolley Bus and Tram Manufacturing and Operating Industry.
6. Hospital and Nursing Home (Only outside the Kathmandu Valley).
7. Industries Producing Ayurvedic, Homeopathic, and other Traditional Medicine, and Industries Producing Crutch, Seat Belt, wheel chair, Stretcher and Stick, and so on to be used in aid of the disabled and orthopedic.

Cold Storage installed for the storage of Fruits and Vegetables.