

# **NEPAL COUNTRY PAPER**

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

Nepal, a hilly country with total 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 where cereal production is mainly concentrated. Hilly region is emphasized for fruit production where as mountains for livestock production. Agriculture growth in Nepal is not coping with its population growth. Total farming population is 65.6% and is 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.

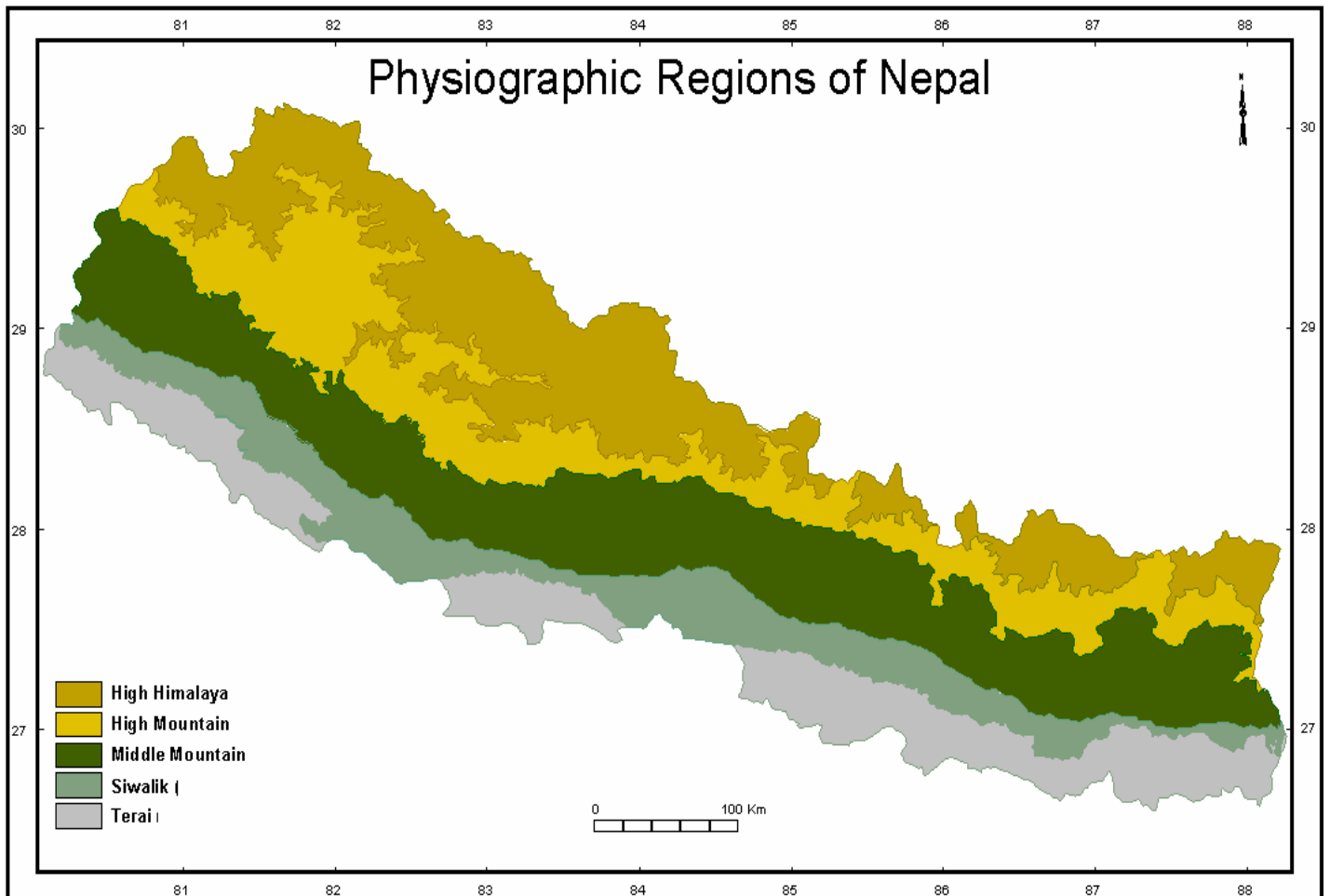
Though Govt. has not stressed on agricultural mechanization in the 10<sup>th</sup> plan, Cabinet has, recently, approved new agricultural policy incorporating the main spirits of the Agricultural Perspective Plan (APP) and also includes programs to comply with the commitments made at the WTO and BIMSTEC. In a significant step towards commercializing the traditionally managed agricultural sector, the government is going to begin commercial farming in eleven districts in the eastern region of the country. 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 and 900 units of 4- & 2-wheel tractors have been added by June 2004. 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 28.1%, human power to 36.4% and mechanical power increased to 35.5%. Use of combine harvester and power rice transplanter needs to be promoted in the country.

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 sugarcane harvester/stripper (leaf sheath), portable oil expeller, tea plucking m/c, portable ginger peeler and sunflower decorticator. 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.

Expected supports from APCAEM are technology transfer, human resource development, strengthening APCAEM National Institute and joint action research project development.



## 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

<b><u>Population Estimates</u></b> (millions)	23.1 (2001), male: 11.5, Female: 11.6
a) Total rural population	85.8%
b) Farming population	65.6% (2001)
c) Unemployed population	4.9% (10 years and above)
d) Literacy rate	53.7% (2001)
e) Life expectancy at birth rate	59.7 (2001)

<b><u>Total Land Area (sq.Km)</u></b>	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 (000 ha)

a) Agriculture Cultivated land	3091	(21%)
b) Agriculture Uncultivated land	1030	(7%)
c) Forest	4268	(29%)
d) Shrubland	1560	(10.6%)
e) Grassland and Pasture	1766	(12%)
f) Water	383	(2.6%)
g) Others	2620	(17.8%)

Irrigated Land (Million Ha)	0.986 (2002/03)	33.2%
GDP (Million Rs.) 2003/04	472424	
a) Agriculture Sector	183357	38.8% (2003/04)
b) Non-agriculture sector	289067	61.2%
Per Capita GDP (2003/04)	US\$ 269	
Per Capita GNP (2003/04)	US\$ 276	

**Major Cereals 2003/04**

	<b>Cereal Crop</b>	<b>Area (000 HA)</b>	<b>Production (000 M.T.)</b>	<b>Productivity (MT/ha)</b>
a.	Rice	1559	4456	2.86
b.	Maize	834	1590	1.9
c.	Wheat	665	1387	2.09
d.	Millet	259	283	1.09
e.	Barley	27	28	1.04
	<b>Total</b>	<b>3344</b>	<b>7744</b>	

**Cash Crop**

Sugarcane	59	2304	39.07
Potato	143	1643	11.49

Others : Oil seeds, Tobacco, Jute, Vegetable, Fruits, Tea, Coffee, Honey

Source: MOA, Agri. Business, Promotion and Statistics Division, 2004

**Population of Livestock & Other Animals for Cultivation/Transport (in Million, 2002/03)**

a. Cattle	6.95
b. Buffaloes	3.84
c. Sheep	0.82
d. Goat	6.79

**AGRICULTURAL POWER****Land Holding Using**

No. of 2-&4- wheel tractor	30565 (June 2004)
Animal Power	28.1 %
Human labor	36.4%
Mechanical Power	35.5 %

# NEPAL COUNTRY REPORT<sup>1</sup>

**S.K. Adhikary<sup>2</sup>**

## INTRODUCTION

Nepal, a mountainous and hilly country, has total land area of about 147,181 sq.km of which only about 21% 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 86.1% population is concentrated in rural areas and the farming population is about 65.6 percent. Share of industrial sector to total gross domestic production (Agriculture, Fishery & Forestry) is 38.81 percent (2003/04).

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. Other cash crops are tea, coffee, cardamom, ginger etc.

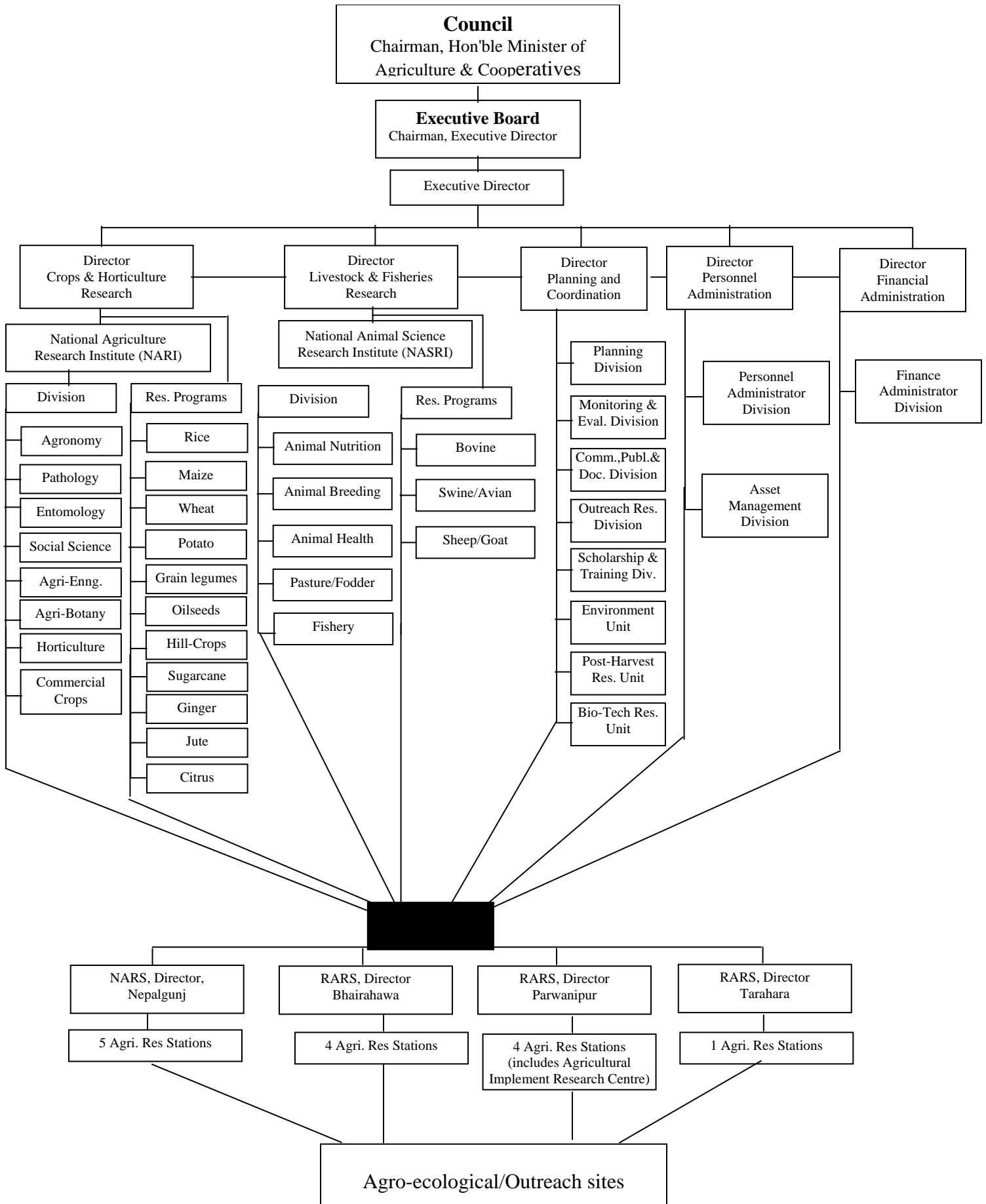
## ORGANIZATIONAL STRUCTURE

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), the National Institute for APCAEM/Nepal is under the National Agriculture Research Institute (NARI), which is under the technical supervision of Director (Crops and Horticulture).

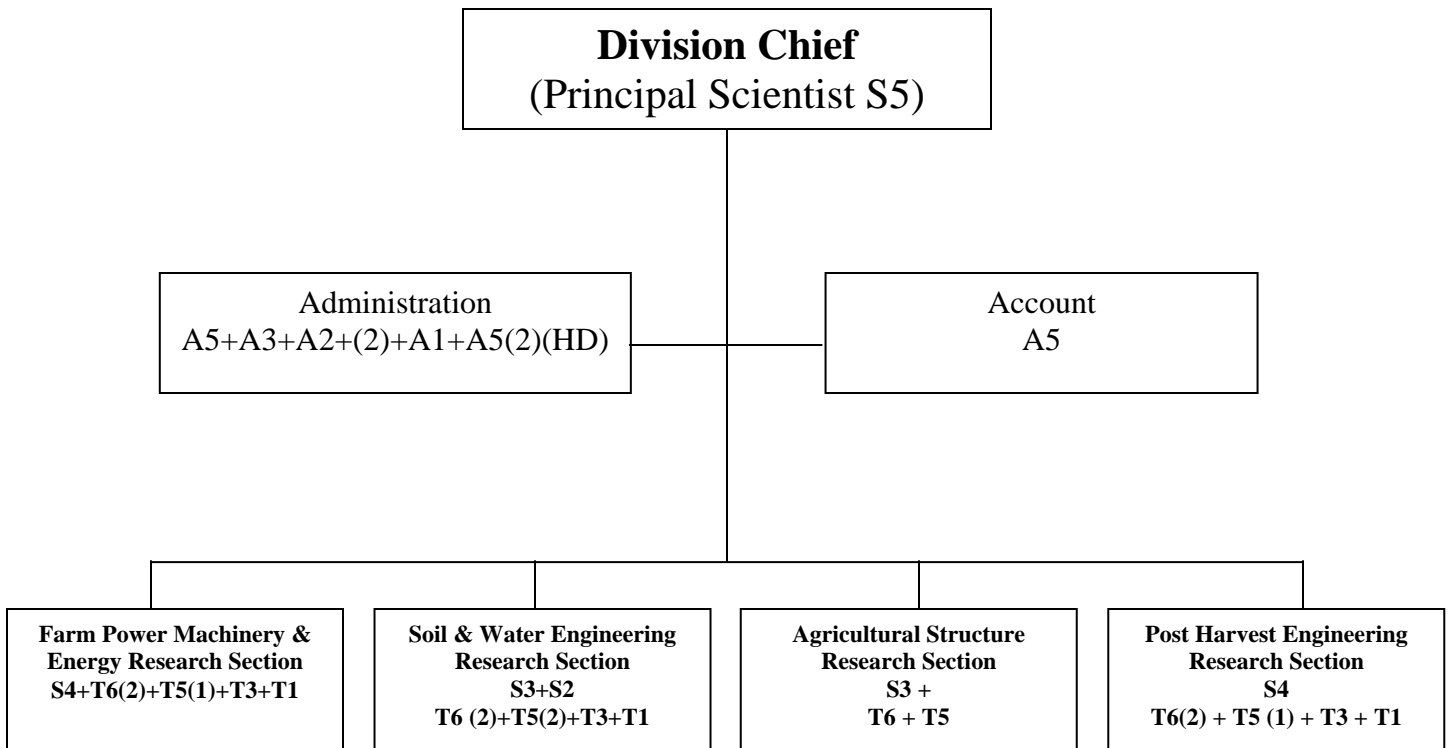
Executive Director is the Chairman of the executive board and has 5 directors for execution of the plans and programmes (Organization Chart of NARC).

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1. Report to be presented at APCAEM TAC/GB Meeting to be held in Hanoi, Vietnam during Dec13-16, 2004.
  2. Chief Agri. E r. (Principal Scientist) 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 9<sup>th</sup> 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.

### **10<sup>th</sup> 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 cannot be achieved without mechanization 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.

### **NEW AGRICULTURAL POLICY**

Recently, cabinet has approved new agricultural policy incorporating the main spirits of the Agricultural Perspective Plan (APP) and also includes programs to comply with the commitments made at the WTO and BIMSTEC, which are as follows:

- Enhanced competitiveness of agricultural sector and encourage farmers to go for commercial production
- Increasing productivity rate and protecting & promoting natural resources to utilize them in the interest of the farmers
- Farmers were divided into small & big in order to provide more supporting resources to the small farmers (owning less than 4 hectares)
- Establishment of the land bank to provide long term loans for farmers to purchase land
- Farmers were put in the target group for agro-processing company
- Agro-processing company recognized as key players to promote agriculture and has incorporated provisions to facilitate and provide support ranging from technology to tariff concessions

- Special attention to nurture investment of private sector on contract farming and leasehold farming

It also mentioned that the government would introduce new Acts as soon as possible to promote agriculture and meet the objectives of the policy.

### **STATUS OF AGRICULTURAL MECHANIZATION (AM)**

The status of agricultural mechanization in Nepal is in its infancy. Human labor is the main source of power in Nepalese agriculture especially in hills where as mechanical power is increasing in Terai replacing animal power. Draught power in the country together with labour constitutes 64.5% of total agriculture power. 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

The trend of farm mechanization is in positive direction as the loan investment of ADB/Nepal has increased from 419836 000 (1994/95) to 743777000 (2002/03)<sup>1</sup>.

<sup>1</sup> Selercted Indicators of Nepalese Agriculture and Population, Published on the Occasion of World Environment Day – June 5 and World Population Day – July 11. His Majesty's Government, Ministry of Agriculture and Cooperatives, Agri-business Promotion and Statistics Division, Singh Durbar, Katmandu, Nepal. 2004.

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 0.23 kw/ha, which is 35.5% 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 30565 till June 2004 (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 and Pantanagar Zero till drill are also being popular among farmers. Tractor operated reaper is also becoming popular. The farmers in Narayani Zone have already purchased ten sets of reaper. Likewise the farmers in Parsa have procured 2 sets of seed drill. Rice area harvested by the reaper was 188 ha and the rental charge for the reaper was Rs400-500/hr. The capacity of the reaper ranged from 0.6 to 0.75ha/hr.

Combine harvester has already been introduced. It has been reported that the number of combine harvesters that are purchased by the farmers are 1 set in Kapilvastu, 4 sets in Rupandehi and 1 set in Nawalparasi district.

The farmers are also practicing lentil cultivation by minimum tillage. The rental charge of minimum seed drill is Rs 150to 250/hr and the capacity is 0.3 to 0.4ha/hr

One power rice transplanter (Yanmar AP 400 model) which was imported last year by private dealer (Joshi Automobiles, Gongabun, Chakrapath, Kathmandu) was demonstrated in Gouradaha village, Jhapa district. The transplanted area was about 20 Bigha (13 Ha). According to the Chief, Agriculture Development Office, Mr. Shakya informed that farmers were very much interested and the impact was very positive. Rice area that would be transplanted by transplanter could be increased tremendously in the coming years. The rental charge of the transplanter was Rs. 600 per hour.

**TABLE 2 TOTAL NUMBER OF TRACTORS IN NEPAL**

<b>Fiscal Year</b>	<b>No. of Tractor</b>	<b>Annual Increase</b>	<b>Increase %</b>	<b>Year</b>	<b>2-wheel tractor</b>
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 2003	29665				
Total tractor & power tiller registered during 2003/2004(June,2004)	900				

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

**TABLE 3 NUMBER OF TRACTORS IN DIFFERENT ZONES TILL JUNE 2003**

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

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

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

<b>Machinery Use</b>	<b>Wheat</b>	<b>Tractor Use</b>	
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*

### **MAJOR ISSUES & CONSTRAINTS FOR AGRICULTURAL MECHANIZATION**

There are many problems in Nepal for agricultural mechanization. However, major issues and constraints for the mechanization of agriculture in Nepal are listed as follows:

### **Labour Shortage**

- Labor shortage during peak crop season like rice transplanting and weeding; harvesting of rice and wheat etc.
- Young generation are not willing to work in the agricultural farms due to tedious and laborious operations
- Attraction of young generation for jobs in non-agriculture sector
- Attraction of young generation for jobs in foreign countries

### ***Physical constraints***

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

### ***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

### ***Financial Constraints***

- High cost of Agricultural machinery operation & maintenance
- Subsistence level of farming
- Lack of easy access to credit

## 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 from R & D of 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, wheat thresher, cardamom dryer, solar dryer, rice/seed dryer, zero till seed drills etc. Where as AIRC, Ranighat is involved in R & D of manual rice transplanters, bed planters, zero till seed drills, reapers, drum seeder, bullock drawn seed drills etc.

### On-Going Activities of Agricultural Engineering Division, 2004/05

1.	Estimation of crop water requirement of rice and wheat based on 30 years of meteorological data of hills (Katmandu valley) and terai (Banke district) of Nepal
2.	Testing and modification of micro-tiller, mills and power threshers
3.	Design, development and testing of agriculture equipment. <ul style="list-style-type: none"> <li>- Single bullock harnessing system.</li> <li>- Animal drawn zero till seed drill.</li> <li>- Adjustable rotary quern.</li> </ul>
4.	Study on crop water requirement and on farm water management in rice based cropping system
5.	Applied research on design and development of micro irrigation system for efficient water application.
6.	Drying of early and summer maize in the farmer's field to minimize harvest loss
7.	Study on plastic house environment/system for off season vegetable farming
8.	Post harvest engineering study on agricultural commodity (mushroom, cardamom, apple etc.)
9.	Rain water harvesting for supplementary irrigation of wheat crop.

### Modification & on-farm testing

SN	Activities	Location	Area/Unit	Remarks
1.	Under Rice-Wheat Project- Naldung <ul style="list-style-type: none"> <li>• Demonstration of minimum till seed drill</li> <li>• Demonstration of modular power tiller with strip till seed drill</li> </ul>	Katunje  Duwakot VDC, Katunje VDC	2 ha  5 ha	
2.	Modification of millet pearling machine	Khumaltar	1	Millet pearling machine
3.	Prototype replication of modified millet pearling machine	Khumaltar	10 pcs.	
4.	Rolling type bed former replication	Khumaltar	3 pcs.	
5.	Modification of power tiller drawn zero till seed drill	Khumaltar	2 pcs	
6.	Modification of power tiller drawn potato planter	Khumaltar	1	
7.	Modification and testing of animal drawn zero till seed drill	Kavre	1	
8.	Popularization of power tiller operated Chinese wheat seed drill	Katunje VDC	1.075 ha	19 farmers

### 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 as follows:

- Agricultural Farm Machinery Improvement Programme
- Modification and testing of Animal-drawn seed drill and power paddy thresher
- .Development & modification of manual weeder and sickle
- .Modification and testing of 4 row –transplanter and rice drum seeder for women farmers
- Evaluation of planting methods in rice wheat systems

## **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; rice transplanter, rice dryer etc. 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. It is also exploring on use of Chinese water pump for irrigation.

## **AGRICULTURAL MACHINERY MANUFACTURING**

As blacksmiths are the primary suppliers of manual and AD-implement for the small and marginal farmers of the country, they 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**

### **Katmandu Valley Local Workshops**

**Nepal Yantrashala Energy** - It is a privately owned mechanical workshop situated inside Patan Industrial Estate, Lalitpur district. The family has a long tradition of designing, manufacturing & installation of micro hydro power plants, paper pulper, stoves etc.

**Shakya Engineering Works** - It is also a privately owned mechanical workshop situated in Bhaktapur district. It fabricates power wheat thresher, pedal paddy thresher, hammer mill, paper recycling machine poultry feed grinder etc.

**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.

### **Luv-Kush Engineering Metal Works (Pvt) Ltd, Kapan, Katmandu**

It has initiated manufacturing different dairy equipment such as automatic liquid sealing feeding machine, homogenizer, automatic pouch packing machine, pasteurizer, cheese and paneer pressing machine, automatic liquid wrapping machine and tankers for fresh milk and food stuffs, boilers etc.

### **Local Workshops Outside Katmandu Valley**

Power wheat threshers are generally made locally in Terai regions. Likewise, some other workshops established in Rupandehi district were Agro Engineering Works (P) Ltd for rice mills, threshers etc.; Appropriate Engineering (P) Ltd. on pumps, turbines, corn sheller, apple peeler; Universal Equipment Industries (P) Ltd. on apple juice extractor /pasteurizer, electrical dryer, oil expeller etc.; Godar Engineering Works (P) Ltd for tractor parts, beaten rice machines, roller and mud mixture m/c, briquetting m/c etc.; Nepal Machine & Steel Structure (P) Ltd., on husking & polishing m/c, micro-hydro; Shrestha Industries, on treadle pump, sprinkler, bio-gas, smokeless stove; North Consult (P) Ltd on complete set of microhydro and OSHIN Power Service on oil expeller, electrical dryer and microhydro.

### **TESTING AND CERTIFYING**

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 to lack of agricultural engineers at district levels. Recently, Agricultural Engineering Directorate under DOA had been structured.

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.

### **Promotion of Agricultural Machinery by Agricultural Engineering Division (AED)**

AED, with its limited manpower had conducted limited extension activities. The demonstrations are conducted at farmer's field, agricultural exhibitions, farmer's day etc. to get farmer's opinion for further modification. The following are some of the efforts to popularize and promote the agricultural machinery in the country:

- 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.

### **Promotion of Agricultural Machinery by Agricultural Implement Research Center**

AIRC is also involved in the participatory action research on the dissemination of improved agricultural machinery to the economically vulnerable farmers in-group approach in Terai. AIRC are involved in following 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, etc.
- ❖ Production of information materials including leaflets, brochures, TV programs etc.

- ❖ Organization of Training on operation and maintenance of farm machinery and implements.

**Other Resource Conservation Technology Adoption activities carried out by AIRC, Ranighat during winter season(2003/04)**

Activities	Area, ha
<i>Winter season (Wheat)</i>	
1. Minimum tillage with power tiller drill	98
2. Seed broadcasting mixing with power drill	5
3. Zero tillage with zero till drill	25
4. Minimum tillage with animal drawn harrow	184
5. Farmers; practices.	
<i>Summer season(Rice)</i>	
6; Direct seeded rice by zero till drill	5
7 Direct seeded rice by power tiller drill	6
8. Direct seeder rice by drum seeder	3
9 Farmers practice	

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 village seed drills etc. This year, CIMMYT/NMRP has replicated 20 sets, each of manual and pedal operated maize shellers and distributed to the research organizations at Kaski and Dhankuta, farmers groups/NGO's at Arghakhanchi, Gulmi, Palpa, Okhaldhunga, Solokhumbu, Lalitpur, Gorkha, Lamjung, Bhojpur, Khotang and Dadeldhura districts. Likewise, ten sets of millet trashers have been ordered for replication with the support of Rice-Wheat Project.

Purbanchal Campus, Dharan under Institute of Engineering (IOE/TU) has recently initiated B.Sc. Agricultural engineering graduate program since 1999.and new graduates are coming in 2005 after few months.

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, Ford, 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**

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 and also to modernize, diversify and commercialize crop and livestock production by expanding the case of technology and increasing the acts 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. Programs on partial mechanization on agriculture; reducing cost of cultivation of agricultural product, reduction of drudgery in agricultural works and time saving technologies, minimum tillage technologies, water saving technologies etc. are being carried out by the concerned agencies specially AED, AIRC, R-W Programs (CIMMYT) and RARS's.

In a significant step towards commercializing the traditionally managed agricultural sector, the government is going to begin commercial farming in eleven districts in the eastern region of the country.

### ***Comments on Popular Equipment***

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. Power rice thresher – Popular in Eastern Terai region
4. Multi crop thresher – Popular in Terai.
5. Pumping set – Popular in rice growing areas.
6. Improved watermill – Popular in hills & higher hills.
7. Peltric set - Popular in hills & higher hills.
8. Rice Sheller - Popular in hills & Terai.
9. Oil expeller - Popular in hills & Terai.
10. Feed grinder – Popular in inner Terai.
11. Feather plucking machine – Popular in valleys and cities.
12. Beaten rice technology – Popular in Kathmandu Valley and terai.
13. Zero tillage technology for wheat (Zero tillage seed drill) – Popular in few districts of Central & Western Terai.
14. Surface seeding of wheat (Minimum tillage seed drill)- Getting popularity.
15. Minimum tillage technology for wheat – Getting popularity.
16. Bed planting (Bed planter) – Getting popularity.
17. Solar dryer, solar water heater – Solar water heater very popular in Kathmandu valley & Solar dryer is in need of promotion.
18. Biogas plant – Popular.
19. Manual corn planter – Needs popularization.
20. Manual and Pedal corn Sheller – Needs popularization.

21. Zero energy structure for vegetable storage – Needs popularization.
22. Cellar storage – Needs Govt subsidy/support for promotion.
23. Mini SRR rice dryer (IRRI) – Needs popularization.
24. Mandarin grading machine-----Needs popularization
25. coffe pulping machine-----Getting popular
26. Manual winnower-----Getting popular in Terai

## **EXPECTED SUPPORT FROM APCAEM**

### ***Research/studies***

- Concrete policy on agricultural mechanization is lacking in Nepal and hence policy research studies specially related to agricultural mechanization is required.
- There is a need of studies to identify specific interventions by HMG/N for the motivation of the private sector to come forward in the manufacture of agricultural machinery at different commercial scale of production.

### **Technical and financial assistance from APCAEM is expected for such type of research studies**

### ***Capacity building of agro related metal working industries***

To attract the national and multinational investment on the establishment of agro related metal working industries the support from APCAEM is expected in the following areas:

- Technology transfer
- Capacity building of the industrialists through exposure visit, expo etc.
- Linkage development for the establishment of national and multinational agro related metal working industries.

### ***Human Resource Development***

As there is lack of trained human resource in research, development, extension and training, external support from APCAEM is expected to strengthen the research, training, extension and educational institutes of Nepal in the field of agricultural engineering.

### ***Strengthening the APCAEM National Institute:***

AED, NARC as a APCAEM National Institute is networking among the agricultural engineering related institutes in Nepal to the extent possible. However due to the lack

of resources, it could not play active role to the expected level. Hence the support from APCAEM is expected in following areas to strengthen networking activities in the country.

- Exchange of experts
- Study visits for planners/scientists/technical officers in regional countries
- Exchange of prototypes
- Exchange of information and publications
- Establishment of Farm machinery testing laboratory at AED/NARC
- Skill development training for existing man power

***Joint action research project development***

APCAEM could play facilitating role in the development of joint action research projects in the participating countries and seeking donors for financial support. Some of the possible areas for the joint action research and development projects are listed below:

- Mechanization of hill agriculture
- Small scale post harvest technology in fruits and vegetables
- Cottage scale processing of herbs and medicines
- Rain water harvesting
- Integrated watershed management
- Rural transport in hilly areas etc.

***FUTURE NEEDS IN AGRICULTURAL MECHANIZATION AND POST HARVEST TECHNOLOGIES***

- Sugarcane harvester
- Sugarcane stripper
- Portable ginger peeler
- Portable oil expeller
- Tea leaves plucking machine
- Sunflower seed decorticator (de husker)

## **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 & verification 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 power tiller with seed drill, reaper, pumping sets 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.

#### REFERENCE:

- Adhikary S.K. (2003). Nepal Country Paper. Paper Presented at TAC & GB Meeting of APCAEM, Beijing, China. November, 24-27, 2003.
- AED. Annual Report 2002, Agricultural Engineering Division, Khumaltar, Lalitpur, Nepal.
- Department of Customs (2003/04). Customs Tariff. Department of Customs Ministry of Finance, Tripureshor, Katmandu (2003-2004).
- Kathmandu Post. Daily English Newspaper. November 23, 2004
- Manandhar, G.B. and S.K. Adhikary (1999). Role of Blacksmiths in Agricultural Mechanization in Nepal. National Workshop on Agricultural Mechanization in Nepal. June 10-11, 1999, Kathmandu.
- Manandhar, G.B. (2002). Nepal country paper presented at the 23rd TAC/GB meeting of APCAEM of Beijing, China, Nov 25-27, 2002
- Ministry of Agriculture and co-operatives: Statistical Information on Nepalese Agriculture 2002/03 (2059/060). Ministry of Agriculture and co-operatives, Agri-Business promotion and statistics Division, Kathmandu, Nepal.
- National planning commission (2003). The tenth plan (Poverty Reduction Strategy paper) Summary 2002-2007. National Planning commission Kathmandu, Nepal July 2003.
- Statistical year. Book of Nepal 2003,
- Shakya, Personnal communication Chief,DADO, JHAPA
- Sah,G Personnal communicartion. AIRC, Ranighat, Birgunj.
- Sherchan, D.P. Personnal communicartion. NMRP, Rampur, Chitwan. .
- Shrestha, K.B. Post-Harvest Technology for Major crops in Nepal. A country paper presented at the Asian and pacific center for Agricultural Engineering and Machinery (APCAEM). Regional Seminar on "Post Harvest Technology" held at Kunming, Yunan province of Chin. China, 3-5, Nov., 2003.
- Selercted Indicators of Nepalese Agriculture and Population, Published on the Occasion of World Environment Day – June 5 and World Population Day – July 11. His Majesty's Government, Ministry of Agriculture and Cooperatives, Agri-business Promotion and Statistics Division, Singh Durbar, Katmandu, Nepal. 2004.

**Appendix – I**  
**Farm Power Availability**

<b>Source of Power</b>	<b>Units (No.)</b>	<b>Power rating, Kw/unit</b>	<b>Available Power (Kw)</b>	<b>% of Total</b>
Human Labor (Agriculturally Active Population 15-59 yrs)	12310968 x 0.81 = 9971885	0.07	698031.95	36.4
Draught Animals				
Cattle Oxen	1496384*	0.30	448915.2	
He-Buffer	201660 *	0.44	88730.40	
Total Draft Power			537645.60	28.1
Mechanical Power 2 & 4 Wheel Tractor (June 2003)	30565	14.9	455418.5	
Stationary Engines Estimated 2002/2003	60000	3.73	223800	
Total Mechanical Power			679218.5	35.5
All Total			1914896	100.00

Mechanical Power = 0.23 kw/ha = 0.3 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.	