Country Report

Agricultural Mechanization Development in the Philippines

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INTRODUCTION

The Philippines is an archipelago without river deltas (Figure 1). It is basically an agricultural-based economy with 13 million hectares devoted to crops. The harvested area for rice is 4.27M ha at 3.8 mt/ha ave. yield. The current population is 88 million with a growth rate of about 2% annually.

In 2007, the Philippines yielded 7.96 percent growth in Gross National Product (GNP), while the Gross Domestic Product (GDP) expanded by 7.19 percent. The Gross Value Added (GVA) in agriculture and fishery, which accounted for about 18.26% of GDP, grew by 5.01 percent during the year.

Farming condition in the country can be described by a mixture of small, medium and large farms. Majority of the farms are small with an average of 2has/farm.

Figure 1. Map of the Philippines (Source: www.maps.com)

CHALLENGES OF THE AGRICULTURAL SECTOR

There are two basic challenges being faced by the agricultural sector in the Philippines and Asia in general. First, the agricultural sector must be able to meet the growing demand for food, agricultural production in Asia must increase significantly in the face of less labor, less land, and less water, along with greater concern for the climate change. Second, profitability of the agricultural production system must be increased amidst global free trade. Farmers' agricultural products must be able to meet quality standards and cost of production must be reduced to be able to compete in the global free trade.

The need for mechanization

Despite considerable advances in agriculture and agricultural technologies, most farmers are still using inefficient manual tools. Many farms operations are predominantly done manually. This is particularly true for the rice and corn crops which had been given high priority by the government as far as research and development efforts by many R&D institutions.

There is disparity in productivity among the different agricultural systems. This could be explained by the different socio-economic, cultural, farming systems and agricultural ecosystems associated to agricultural crops. As such, location specificity of agricultural machines is an important consideration in their design and development and technology transfer.

The utilization of agricultural equipment must take advantage of the economies of scale to gain profit. This can be illustrated by the experience of farmers' cooperative in Isabela which operate and manage custom hiring services for large machines such as tractors, planters and harvesters. Their experience shows that farmers owning small farms may take advantage of the use of large machines through clustering/consolidating corn farms. In this scheme farmers may organize themselves for the efficient use of farm machines for synchronized land preparation, planting and fertilizer application, and to some extent harvesting. The farmers' cooperative was able to reduce custom hiring rates if they could increase the service area. Moreover, some of the documented benefits of clustering/consolidation include:

- Reduced fuel consumption in clustered/consolidated farms
- Savings is incurred in corn seeds since with the use of planter, precisely one seed is planted per hill
- Increased in service area in clustered/consolidated farms because of the removal of boundaries between farms
- Increased in crop production for farms which used mechanical planter since corn plants are evenly spaced and since the extra area which are formerly used as boundaries are also being planted

Thus, in small to medium scale farms, farmer could utilize farm machines through machinery pooling and custom hiring services. Custom hiring services could be a viable farm enterprise

since it enables farmers to utilize machines without actually owning high-investment machines.

STATUS OF AGRICULTURAL MACHINERY APPLICATION

The level of agricultural mechanization in the Philippines is relatively low. This is reflected in Table 1 which indicates predominance of manual technology in planting, weeding, fertilizer application, spraying and harvesting in rice and corn farm operations. The operations which have high level of machinery utilization are limited to land preparation, shelling, threshing and drying.

Table 2 also reflects the low level of mechanization in rice and corn farms through the total available horsepower per hectare for major farm operations (1.68 hp/ha).

Table 1. Level of mechanization in rice and corn farms, 2005

OPERATION	POWER SOURCE		
	Manual	Man-Animal	Mechanical
Land Preparation	3.2	64.7	13.2
Planting	98.7	1.2	0.2
Weeding	85.2	14.8	0
Fertilizer Application	98.7	1.7	0
Spraying	100	0	0
Harvesting	99.8	0	nil
Threshing/Shelling	31	0	69
Drying (Farm Level)	100	0	0
Milling	0	0	100
AVERAGE	56.5	19.2	21.7

Table 2. Level of mechanization in rice and corn farms in hp/ha, 2005

SOURCE OF POWER	hp/ha
1. Human Labor	0.24
2. Draft Animal	0.08
3. Four-wheel Tractor	0.24
4. Engines	
a. Power Tiller	0.56
b. Thresher	0.34
c. Irrigation Pump	0.07
d. Harvesting, drying & shelling equipment	0.15
TOTAL	1.68

The level of rice postproduction technology utilization is shown in Table 3. It confirms the low level of mechanization for harvesting and drying operations as shown in Table 1.

Table 3. Rice Postproduction Operation and Technologies

Operation	Technology	Capacity	Usage (%)
Harvesting	Manual Reaper Combine	240 man-h/ha 2.4-3.8 ha/d 4.5-8.0 ha/d	99.8 Nil nil
Threshing	Manual Axial Flow	0.05-0.1 t/h/person 0.5-5.0 t/h	31.0 69.0
Drying	Sundrying Flatbed Recirculating Continuous	24 kg/m2 1-6 t/batch 6-10 t/batch 2-10 t/h	86.0 14.0 nil
Milling	Kiskisan Cono Rubber Roll	0.1-0.3 t/h 0.5-2.0 t/h 0.5-2.5 t/h	10.5 33.2 56.1
Storage	Bag Bulk	14 m2/t 1.5-1.7 m2/t	99.0 1.0

AGRICULTURAL MACHINERY INDUSTRY PROBLEMS AND CONCERNS

The adoption of agricultural machinery in the Philippines is beset with major problems as listed in Table 4, where possible solutions are also indicated.

Table 4. Problems and possible solutions of the agricultural machinery sector.

	PROBLEMS	SUGGESTED SOLUTIONS
1.	Technical – High acquisition cost – Inappropriate Technology – Low Reasearch & Extension capability of appropriate farm machinery	– Collective machinery ownership / machinery pooling / custom hiring – Needs assesment of AM suitability – Capacity/capability enhancement/training
2.	Socio-economic – Low Income/lack of capital – Small & fragmented land holdings – Unfavourable market price for the farmer – Cheap & abundant labour (in some areas) and seasonal labour shortage	– Provision of credit facilities, Clustering farmers into groups – Farm Clustering & custom services – Floor price, train farmers into entrepreneurs (processing & business) – Absorbing unemployed into other jobs, retooling – Encourage farm business enterprises – Creating new jobs in agricultural activities (processing, waste handling, food processing, etc.)
	Environment / infrastructure – Lack of infrastructure – Diversity in Agroecosystem – Weak agricultural manufacturing industry – Environmental degradation	– Put in place irrigation, processing facilities, farm roads, access to market – Adjust the AM to the local-specific conditions – Select the most promising machines to produce locally – Support local manufacturers, through R&D, training, financial asistance – Introduce the business of service and maintenance of AM – Promote joint ventures with foreign manufacturers – Control the utilization of chemical materials – Promote sustainable farming systems
4.	**Political / Institutional** – Lack/inconsistant Political-will to support AM	– Educate the political leaders on the importance of AM – Put AM into strategic long-term programs – Promote AM through International Networking & Cooperation

GOVERNMENT PROGRAMS AND INIATIVES ON AGRICULTURAL MECHANIZATION

Agriculture and Fisheries Modernization Act of 1997

The Philippines enacted the Agriculture and Fisheries Modernization Act (AFMA) to promote agricultural modernization. The law addressed issues and constraints of the agricultural and fisheries sector which has made the country less competitive in the world market. AFMA focuses on five (5) major concerns, namely poverty alleviation and social

equity, food security, global competitiveness, sustainable development, and income profitability for farmers and fisher folks. To modernize the Philippine agriculture AFMA addresses concerns related to:

- Credit
- Irrigation
- Information and marketing support service
- Other infrastructure
- Product standardization and consumer safety
- Human resource development
- Research development and extension
- Trade and fiscal incentives
- Research, extension and human resource development
- Local assembly, manufacture, supply and after-sales service
- Registration, licensing and standardization

National Agricultural Engineering RDE Network

The Philippine Council on Agriculture, Forestry, and Natural Resources Research and Development (PCARRD) of the Department of Science and Technology (DOST) established the National Agricultural Engineering RDE Network to:

1. Strengthen RDE Network
2. Conduct benchmark and needs surveys
3. Adaptation of technologies to local conditions
4. Development of technologies for machinery pooling
5. Establishment of technical standards and improvement of test facilities
6. Piloting system integrated technologies
7. Conduct of training on technical and business aspects of technologies
8. Establishment of centralized information service

Committee on Agricultural and Fisheries Mechanization (AFMech)

The National Agricultural and Fishery Council (NAFC) of the Department of Agriculture implements AFMech and perform the following functions:

1. Serve as consultative/feedback mechanism on the policies, plans and programs of the Department of Agriculture.
2. Monitor agriculture and fishery mechanization programs of all government agencies.
3. Assist DA in advocacy work in agriculture and fishery mechanization activities among concerned government agencies.Assist DA in mobilizing and evaluating the contributions of government agencies to agriculture and fishery modernization.
4. Promote consensus on, and support for, national and local budgets for agriculture and fisheries.

Agricultural Mechanization Development Program (AMDP)

AMDP was created in 1979 by the College of Engineering and Agro-Industrial Technology (CEAT), U.P. Los Baños to serve as the research and extension arm of the college and as the Philippine National Institute representative to the Regional Network of Agricultural Machinery (now UN-APCAEM). Its mandate focuses on the development and promotion of agricultural mechanization research development and extension efforts. Through the years, AMDP has developed and promoted technologies/technology packages for various commodities. It has assisted decision makers in drafting policies in agricultural mechanization and has published refereed and non refereed journals for the dissemination of agricultural mechanization research and extension outputs.

AMDP's current research and development (R&D) and extension activities are listed below:

R&D

	Research Thrust	Projects
1	Corn	Anthropometric survey of farmers agricultural machinery design Integrated corn mechanization technologies (planter, fertilizer applicator, irrigation, combine, dryer, mill)
2	High-value Crops	Soil sterilization Hot water treatment of mango Multi-crop washer
3	Renewable Energy	Integrated Jatropha biodiesel production Micro-hydro development

Technology Dissemination and Extension

1. Maintain Agricultural Machinery Display Area
2. Conduct and Participate in Technology Exhibitions/Fairs
3. Conduct of Technology Demonstration
4. Provide Technical Services and Assistance
5. Disseminate Machinery Design and Blueprints
6. Collaborate with agricultural machinery manufacturers
7. Conduct Mechanization Congress /Conference/Workshop
8. Produce Bi-annual and Annual Publications/Information Dissemination Materials
   - ✓ Philippine Journal of Agricultural and Biosystems Engineering (refereed journal)
   - ✓ Philippine Agricultural Mechanization Journal
   - ✓ Posters/Technology Flyers

Agricultural Machinery Testing and Evaluation Center (AMTEC)

AMTEC based at U.P. Los Baños was created in 1977 to perform the following activities:

1. Establish standard specifications, test procedures and performance indices for agricultural and fisheries machinery

2. Test and evaluation of agricultural and fisheries machinery
3. Train students, technicians and engineers on standards development, test and evaluation of agricultural and fisheries machinery
4. Publish and disseminate standards and test results
5. Philippine Agricultural Engineering Standards
6. Training of regional and provincial engineers on testing and evaluation procedures
7. Information dissemination

SUMMARY AND RECOMMENDATIONS

The basic challenges being faced by the agricultural sector are:

1. The agriculture sector must be able to meet the growing demand for food, agricultural production in Asia must increase significantly in the face of less labor, less land, and less water, along with greater concern for the climate change.

2. Profitability of the agricultural production system must be increased amidst global free trade. Farmers' agricultural products must be able to meet quality standards and cost of production must be reduced to be able to compete in the global free trade.

Such challenges could be aided with agricultural mechanization of farm operations. However, there is still much to be done in agricultural mechanization because despite considerable advances in agriculture and agricultural technologies, most farmers are still using inefficient manual tools. Many farms operations are predominantly done manually. This is translated into low level of mechanization for major farm operations.

Concerned government research & development agencies must continue to work together and collaborate to address the problems and issues being faced by the agricultural mechanization sector.

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