STATUS AND PROSPECTS OF AGRICULTURAL MECHANIZATION IN THE PHILIPPINES[1]

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ABSTRACT

The Philippines had been experiencing a declining agricultural production and self-sufficiency in major food commodities. This is due to a number of factors, which include the lack of incentives and support mechanisms to sustain agricultural development in the predominantly small-farm sector, and inadequate adaptations of known technologies to suit the needs of the Filipino farmer. Agricultural mechanization, for example, is one technology that can increase land and labor productivity.

The level of mechanization in the Philippines is considered low at 0.52 hp/ha. Generally, agricultural machinery is used mainly in the production of rice, sugarcane, banana, pineapple and other plantation crops. In an intensely cultivated rice farm, mechanization level is about 2.6 hp/ha where the mechanically powered machines are highly adopted in land preparation, threshing and rice milling operations. Attention must also be focused in field operations that need precision and proper timing such as seed sowing and transplanting, and the combined harvesting-threshing operations.

The Agriculture and Fisheries Modernization Act (AFMA) of 1997 modernizes the agriculture sector to become globally competitive. Through the AFMA, the Department of Agriculture had created a National Agriculture and Fisheries Mechanization Program, an integrated mechanization program that is implemented by a Committee on Agriculture and Fisheries Mechanization. This program when fully implemented aims to develop agricultural mechanization. A big component of the program is R&D that will not only develop technologies that will match the farming and mechanization but will also develop the agricultural machinery manufacturing industry sector.

Key words: farm mechanization, agricultural machinery industry, research and development, policies, Philippines

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INTRODUCTION

Food security had become an increasingly important agenda especially in developing countries. In the Philippines, the Agriculture and Fisheries Modernization Act (AFMA) of 1997, also known as Republic Act 8435, was enacted to enhance the development of agriculture. It has provisions for the modernization of the agriculture and fisheries sectors, greater participation of small farmers and fisher folks, food security and self-sufficiency, private sector and people empowerment.

Modernizing the Philippine agriculture and fishery sectors requires infusion of the needed agricultural infrastructures, development of agricultural enterprises in the countryside, mechanization, and promotion of agricultural industrialization. As in the experience of other advanced countries, agricultural mechanization played a key role in raising production and market efficiencies. Of all the modern agricultural technologies introduced however, mechanization is probably one of the most controversial. Mechanization is usually blamed for escalating rural unemployment. The trend however, that most of the younger generations is now more inclined to "urbanization" will make mechanization a very important agenda to help attain food security.

The importance of using the appropriate tools and machines in farm operations cannot be overemphasized, as mechanization increases labor efficiency, eases-up the drudgery of farm work, saves time and promotes technical accuracy. Moreover, the level of mechanization technology increases as the source of power shifts from human to animal to mechanical power. As a measure of mechanization level, the amount of horsepower per hectare of arable land was adopted since the 1960s (PCARRD, 2002). Furthermore, AMMDA (2005) defined the level of mechanization into three (3) categories: 1) lowly mechanized (low level) when manual power utilization exceeds 33 percent; 2) fairly mechanized (medium level) when animal power utilization ranges from 34 to 100 percent; and 3) highly mechanized (high level) when mechanical power utilization ranges from 67 to 100 per cent.

STATUS OF AGRICULTURAL MECHANIZATION

Generally, the level of mechanization in the Philippines remains low compared to other Asian countries. From 1968 to 1990, Japan's mechanization level had increased from 3 to 7 hp/ha, Korea from 0.435 to 4.11 hp/ha while the Philippines had increased only from 0.198 to 0.52 hp/ha. It was also estimated that in 1968, of the total available power per unit area for Philippines, contributions from human, animal and mechanical power were 36%, 52% and 12%, respectively. In 1990, human power accounts for 50% of the total available power per unit area, while animal power decreased to 14% and mechanical power increased to 35% (Ozaki and McColly, 1968 and Rahman 1994 as cited in PCARRD, 2002).

Looking back at the history of agricultural mechanization in the Philippines, AMMDA (2005) had reported the following:

1. The Filipino farmers had been using simple agricultural tools and machines prior to the Spanish era. New farm machines were introduced in the country during the successive colonial regimes of Spain and the United States of America. However, use of these machines failed to take off because they were not appropriate and adaptable to local conditions.
2. After World War II, the country was introduced to four-wheel tractors from the US, United Kingdom, Japan and Germany. Use of these machines was concentrated in the sugar industry, which enjoyed assured market in the US. Of the 8,500 tractors in 1960, 50 per cent were owned by sugar farmers, 35 per cent by rice farmers and 15 per cent for general purpose.
3. Use of farm machines in the country, however, stayed insignificant up to the 1960s. But during the year, power tillers were introduced in rice growing areas, and mechanization started its roller-coaster development. The sugar boom from 1962 to 1964 increased tractor sales from 800 to 1,200 units per year. Availability of credit and financing for power tillers increased sales of the product significantly.
4. In 1970, the value of the peso was floated, and sales of tractors declined. There was a resurgence from 1971-1975 as a result of a number of factors like the land reform programs; introduction of locally-made, low-cost power tiller models; availability of credit support; and outbreak of foot and mouth disease that affected draft animals.

Likewise, PCARRD (2002) also reported that with the introduction of the Central Bank- International Bank for Reconstruction and Development (CB-IBRD) loan program, mechanization of Philippine agriculture shifted towards rice. While the program was geared more on the use of four-wheel tractors during its first phase in 1966, the demand for small power tillers grew, as rice farmers preferred the smaller and low-cost machines. In the 1970s, the development and adoption of machines for rice production became more attractive which can also be attributed to the growth of the local agricultural machinery manufacturing industry, introduction of modern rice varieties, availability of financial assistance and other factors. In fact, agricultural mechanization is now heavily biased on rice along with sugar, pineapple and banana.

The level of mechanization of rice and corn farms (Table 1) had improved considerably to an estimated 1.68 hp/ha (Rodulfo et al. 1998 as cited in PCARRD 2002). From this table, Canapi and Follosco (2002) gave their observations that:

1. Human labor is abundant which explains the predominant use of human power in rice and corn farms.
2. The use of mechanical power in land preparation and threshing are being adapted as indicated by high hp/ha of power tillers and threshers.
3. Irrigation, harvesting, and drying have low hp/ha levels.

Table 1. Level of mechanization in rice and corn farms

Source of Power	hp/ha
1. Human labor	0.24
2. Draft animal	0.08
3. Four-wheel tractor	0.56
4. Engines	0.56
a. power tiller	0.34
b. thresher	0.07
c. irrigation pump	0.15
d. harvesting, drying, shelling equipment	1.68
TOTAL	

Source: Rodulfo et al 1998 as cited in PCARRD 2002

Likewise, Bautista (2003) stated that in rice production in the country, the present pool of implements and machines is mainly used for land preparation; pump irrigation (for nonirrigated areas), spraying, threshing, milling and transport (Table 2). Custom hiring of land preparation and threshing is widely practiced in large rice-growing areas but village drying remains on the paved roads and basketball courts.

The most popular farm equipment are those that are locally developed and manufactured (i.e. hand tractors, threshers). Major reasons include adaptability to local conditions, ease of repair and maintenance, availability of service and parts with manufacturers and cheaper costs

Table 2. Present areas of rice mechanization by operation in the Philippines, 1999.

Operation	**Equipment locally adopted**	**Level of R&D/equipment adoption**
Land preparation	Power tiller + attachments Four-wheel tractor + rotavator	Highly adopted in favorable areas; for custom hiring in irrigated areas For custom service near sugar estates Reconditioned minitractors becoming popular in Luzon for custom land preparation
Transplanting	None (done manually)	IRRI manual transplanter introduced but was not widely accepted
Direct seeding	Mostly by hand broadcast)	Slow but continuing adoption of drum seeder
Crop protection	Lever-operated knapsack sprayer Manual rotary weeder	Highly adopted (imported from China, Taiwan and other countries) Adopted in Laguna, Cotabato and Nueva Vizcaya
Harvesting	None (still done mostly by sickle)	IRRI reaper introduced but not popular; PhilRice reaper released for commercial manufacture Improved reaper-windrower highly adopted in Bataan and nearby provinces

Operation	Equipment locally adopted	Level of R&D/equipment adoption
Threshing	Axial-flow design Pedal thresher	IRRI thresher design highly adopted in irrigated and rainfed areas with many models/sizes Widely adopted in northern Luzon, Bohol, and other small islands in Visayas
Drying	None (mostly sun drying in concrete pavements)	Flatbed/continuous flow, other imported designs adopted by big rice millers/traders PhilRice flatbed dryer slowly being adopted with some 150 units installed since 1994 Flash dryer, in-bin drying systems (high capacity) introduced by BPRE through DA programs
Milling	Rubber-roll/cono steel hullers	Highly mechanized except in upland remote areas but low quality of output from locally manufactured mills
Irrigation	Centrifugal pumps Axial-flow pump	Highly adopted in Ilocos, Central Luzon, and few rainfed areas Less adoption in rice farms; more adoption by fishpond operators
Transport	Power tiller + trailer	Highly adopted in irrigated/rainfed areas

Source: Bautista 2003

The three levels of mechanization, which include manual, animal and mechanical power technology, characterize the farming system in the Philippines. In Table 3, Canapi and Follosco (2002), showed the country's mechanization level in terms of percentage of farms using the three sources of power from which they observed that:

1. Farm operations are predominantly utilizing human power.
2. Only threshing, milling and land preparation apply mechanical power to accomplish the job.
3. Land preparation is still dominantly using animal power. However, the use of powered machines is gaining acceptability.
4. Due to the availability of solar energy and unaffordable cost and mismatched capacities of mechanical dryers, sun drying is still preferred by farmers.

Table 3. Percentage of rice and corn farms using the three sources of power.

Operation	Manual	Man-animal	Mechanical
Land preparation	3.15	64.71	23.17
Planting	98.67	1.15	0.16
Weeding	85.20	14.80	0.00
Fertilizer application	98.69	1.31	0.00
Spraying	100.00	0.00	0.00
Harvesting	98.79	0.00	1.21
Threshing/shelling	31.01	0.00	68.99
Drying	100.00	0.00	0.00
Milling	0.00	0.00	100.00
Average	56.53	19.25	21.70

Legend:
Lowly mechanized = manual power exceeds 33%
Fairly mechanized = animal power utilization ranged from 34-100%
Highly mechanized = mechanical power utilization ranged from 67-100%

Bautista (2003) compared the labor utilization in rice production in the Philippines and Japan. Table 4 shows the notable difference of labor utilization in producing rice between the two countries. For instance, the Philippines needs 784-man-hours as compared to Japan's 624 for a cycle of farming operations in transplanted ecosystem to produce more than 4 t/ha. The same trend is seen in direct seeding.

Table 4. Labor utilization in rice production (Bautista 2003).

Operation	Philippines		Japan	
	Transplanted (> 4t/ha)	Direct seeded (> 4t/ha)	Transplanted (> 4t/ha)	Direct seeded (> 4t/ha)
Land preparation	104	112	80	53
Seedbed preparation	8	-	-	110
Pulling/bundling/ planting/ broadcasting	112	16	24	-
Crop care and maintenance	24	40	64	157
Harvesting and threshing	480	288	408	80
Drying/storage	56	24	48	30
Total	784	480	624	430

In Nueva Ecija, Bermudez et al. (2004) stated that the average level of rice mechanization is 2.6 hp/ha, which is considered moderate[3]. Of the total power inputs, majority were supplied by machines, 7% from draft animals and only 0.1% for manually operated equipment. Also, about 56% of the rice area is moderately mechanized, 38% are highly mechanized and 6% is considered low.

An inventory of postharvest facilities (Table 5) was conducted by the Bureau of Postharvest Research and Extension (BPRE). Based on this inventory, the projected requirement for palay drying was estimated to need about 1,700 units of mechanical dryers and 2,550 multipurpose drying pavements (MTDP), while for corn drying, about 474 units of mechanical dryer and 711 units of MTDP are needed (BPRE, 2005).

Bermudez et al. (2004) level of mechanization was categorized into three levels: low mechanization, 0.1~0.9 hp/ha; moderate mechanization, 0.9~3.0 hp/ha; and high mechanization, 3.0-5.5 hp/ha.

Table 5. Inventory of postharvest facilities (BPRE, 2005)

Postharvest facility	Capacity		No. of Units
	Unit	Amount	
Thresher/Shellers			
Rice Thresher	MT/hr	1.0	78,097
Multipurpose sheller/thresher	MT/hr	1.0	5,751
Pedal thresher (manual)	MT/hr	0.25	23,010
Pedal thresher (motorized)	MT/hr	0.5	1,198
Corn sheller	MT/hr	1.0	4,941
Drying facilities			
Flat bed dryer	MT/batch	2.0	380
Flat bed dryer	MT/batch	6.0	47
Electric grain dryer	MT/batch	4.0	970
Mobile flash dryer	MT/batch	0.5	1,345
LSU type	MT/batch	6.0	5
MPDP	MT/batch	4.0	47,845
Warehouse/storage facilities			
Warehouse	MT/batch	25.0	14,019
Outdoor storage	MT/batch	10.0	70
Corn crib	MT/batch	5.0	41
Milling facilities			
Rice Mill –single pass	MT/hr	0.54	29,959
Rice mill – multipass	MT/hr	1.45	477
Micromill	MT/hr	0.2	17
Cornmill	MT/hr	0.5	3,040

The social acceptability of mechanizing farming operations is spreading significantly. For instance, in a survey conducted by the Philippine-Sino Center for Agricultural Technology (PhilSCAT) in 2002, majority of the respondents in Central Luzon gave a high priority in mechanizing land preparation activities such as plowing, harrowing, field leveling and rotovating (Table 6).

It is also apparent from this table that majority of the farmer-respondents consider mechanizing seed sowing, seeding and transplanting as low priority. Reason given is because most of them cannot figure out how it can be possible because most of them have not seen any machine for this purpose. It is in this regard that on-farm

demonstration of farm machineries in crop establishment including other farm operations should be done.

When it comes to crop care and maintenance, mechanizing the field operations by Central Luzon farmer-respondents has a low priority. About half of the respondents mentioned that mechanizing the irrigation operation is a high priority while the others regard it as a low priority. The respondents who considered it high are those in areas that cannot be serviced by national or communal irrigation systems.

Table 6. Response of Central Luzon farmers in the priority of mechanizing field operation in the rice production system.

Field operation	Response (%)			
	High priority	Medium priority	Low priority	Total
Land preparation				
Plowing	203 (81.2)	10 (4.0)	37 (14.8)	250 (100)
Harrowing	200 (80.0)	11 (4.4)	39 (15.6)	250 (100)
Field leveling	190 (76.0)	14 (5.6)	46 (18.4)	250 (100)
Rotovator	167 (66.8)	19 (7.6)	64 (25.6)	250 (100)
Crop Establishment				
Seed sowing	45 (18.0)	27 (10.8)	178 (71.2)	250 (100)
Pulling and bundling	39 (15.6)	38 (15.2)	173 (69.2)	250 (100)
Transplanting	84 (33.6)	27 (10.8)	139 (55.6)	250 (100)
Direct seeding	50 (20.0)	29 (11.6)	171 (68.4)	250 (100)
Crop and Care Maintenance				
Fertilizer Application	49 (19.6)	34 (13.6)	167 (66.8)	250 (100)
Spraying	64 (25.6)	30 (12.0)	156 (62.4)	250 (100)
Weeding	44 (17.6)	38 (15.2)	168 (67.2)	250 (100)
Irrigation	118 (47.2)	22 (8.8)	110 (44.0)	250 (100)
Harvesting				
Harvesting	160 (64.0)	24 (9.6)	66 (26.4)	250 (100)
Threshing	200 (80.0)	13 (5.2)	37 (14.8)	250 (100)
Post Harvest				
Hauling	70 (28.0)	35 (14.0)	145 (58.0)	250 (100)
Drying	110 (44.0)	25 (10.0)	115 (46.0)	250 (100)
Milling	150 (60.0)	10 (4.0)	90 (36.0)	250 (100)

Majority of the respondents in Central Luzon are amenable to mechanize harvesting and threshing, which is considered the most critical stage as far as the farmers are concerned because this is the time when the result of their season-long working will reap yields

The mechanization priorities in postharvest operations by the Central Luzon respondents indicate high priority in milling operations. On the other hand, some of the respondents regarded drying operation as high, while 46% consider it as low priority. As noted by Canapi and Follosco (2002), sun drying is still preferred by farmers due to the availability of solar energy and unaffordable cost and mismatched capacities of mechanical dryers.

Moreover, in the rural rapid appraisal conducted in Nueva Ecija by the PhilSCAT in February 2005, it revealed that 54% of the respondents have no clear idea how mechanization would help their farming activities more efficient and productive. Some 34% are afraid that farm mechanization would displace farm workers (Table 7).

Table 7. Perception of farmers on agricultural mechanization in Nueva Ecija.

Problems	Percentage
No clear idea	54
Mechanization is not applicable to the farm location	6
Hesitant to mechanization	3
Labor displacement	34
Lack of technical know-how in operation	3
Total	100

THE AGRICULTURAL MACHINERY INDUSTRY IN THE PHILIPPINES

AMMDA (2005) stated that there are currently 400 registered manufacturers and dealers of agricultural machinery in the country. Based on the survey of the Agricultural Machinery Testing and Evaluation Center (AMTEC) as cited by PCARRD (2002), the data on the distribution of the agricultural machinery enterprises showed that about 56% is in Luzon, 8% in the Visayas and 36% in Mindanao. While the industry is a mix of imported and local manufacturers of tools, implements, machines and equipment, the various enterprises are organized into a single organization – the Agricultural Machinery Manufacturers and Distributors Association (AMMDA). Further, AMMDA (2005) mentioned that the following characterizes the agricultural machinery industry

1. Ninety one (91) per cent are single proprietorship; seven (7) percent are corporations and the others are partnerships;
2. About 81% operate on a made-to-order basis; 12% engages in mass production and 7% produce by batch;
3. Almost all industry players have the capacity for cut-and- weld manufacturing;
4. Those engages in mass production can afford presses and stamping machines;
5. Majority of industry workers were not formally trained but got their skills through experience;
6. Only 20% of manufacturers are connected to dealers, others are sole suppliers;

7. Most common form of promotion is farm demonstration practiced by about 30% of the manufacturers; radio and TV ads are engaged in by 21%; print media by 12% and sales promotion (person-person) by 14%.
8. Manufacturers provide repair and maintenance services and training of operators.

Table 8 shows the sales data of the AMMDA in 1994 to 2000. PCARRD (2002) noted that the locally manufactured machines have high-import content because their prime movers and other important component parts are imported.

Based on a study, AMMDA (2005) had cited that the agriculture sector needs about 188,000 units of agricultural machinery and farm engines over the next few years. This projections can be supported by the following trends:

1. Over the past few years, about 50,000 units of gasoline engines and 15,000 units of diesel engines had been sold annually. The growth rate stands at about 30 per cent.
2. The demand for power tillers was estimated at 15,000 to 20,000 unit per year.
3. The demand for rice threshers is about 8,000 to 10,000 units.
4. Irrigation pump requirement is about 10,000 units annually.
5. About 4,000 units of rice mill is required per year.
6. Demand for grain dryers is currently on downtrend, leveling at 500 units per year. Manufacturers are trying to find ways to match appropriate type to complement other postharvest operations like rice milling.
7. The market for planters and reapers are in the development stages.

Imports of agricultural machinery have been substantial. This includes four-wheel tractors, engines, electric motors and speed reducers while locally manufactured ones are the power tillers, water pumps, weeders, sprayers, threshers, dryers and shellers (AMMDA, 2003). PCARRD (2002) had cited a report from the National Statistics Office (NSO) that total imports of wheeled tractors in 1999 have significantly grown to more than ten times the 1992 level. This can be attributed to the entry of used tractors from Japan and the United Kingdom.

This importation trend is expected to continue due to the relaxation of import duties on agricultural tractors and engines pursuant to the AFMA

Table 8. Sales of agricultural machinery by AMMDA members (no. of units sold)

Machine	Year						
	1994	1995	1996	1997	1998	1999	2000
Tractor							
Compact (32 hp and less)	16	6	12	11	14	3	8
Standard (greater than 32 hp)	140	140	235	172	100	119	128
Power tillers	417	456	1,812	1,556	529	1,393	NYA
Prime movers							
Gasoline engine	62,428	77,037	92,073	98,123	60,598	59,584	67,931
Diesel engine	17,922	15,789	15,604	14,849	20,033	16,436	11,320
Irrigation pumps	6,493	6,013	7,595	5,015	10,137	1,374	NYA
Production equipment							
Seeders/planters		-			25		NYA
Reapers/harvesters	142	191	119	70	117	70	NYA
Postharvest equipment							
Threshers	267	317	504	431	538	440	NYA
Shellers	17	35	30	24	20	24	NYA
Dryers	2	231	183	284	17	284	NYA
Rice mills	405	373	163	276	38	276	NYA
Feed mixers	33	5	5	11	12	NYA	
TOTAL	88,282	100,593	118,335	120,822	92,178	80,003	79,387

AMMDA Sales Data as cited in PCARRD 2002
NYA – not yet available

ISSUES AND CONSTRAINTS IN THE ADOPTION OF AGRICULTURAL MECHANIZATION

The current status and trends of agricultural mechanization in the Philippines can be attributed to the following:

1. High cost of machines
2. Lack of promotion - lack of farmers' awareness of new mechanization technologies and the unfavorable attitudes and orientation of farmers caused by risks in adapting locally manufactured equipment.
3. Poor quality of machines due to low capability of the local manufacturing industry
4. Lack of access to formal credit facilities
5. Low income of farmers/ decreasing farm sizes - Landholding distribution in the country also affects the pace of farm mechanization. Most of the Filipino rice farmers have farm size within one to five hectares only and this continue to become smaller with time. This essentially explains why rice mechanization has been concentrated on small equipment with engine sizes seldom exceeding 15kW. Most operations in rice production are done manually, except for the use of local power tillers, threshers and imported knapsack sprayers (Bautista 2003).

POLICIES AND PROGRAMS FOR AGRICULTURAL MECHANIZATION

Agricultural mechanization had been receiving support from the Philippine government since the late 1940s. As PCARRD (2002) had reported, the various government efforts encouraging agricultural mechanization are as follows:

1. Exempting agricultural farm machinery from custom duties and taxes since the late 1940s.

2. The CB-IBRD mechanization program introduced in 1966 to 1980. This is a loan program for the purchase of different agricultural machinery that ranges from four-wheel tractors to smaller and low-cost machines.

3. The enactment of the Agriculture and Fisheries Modernization Act (AFMA) of 1977 where the role of agricultural mechanization was recognized for the development of agriculture and industrialization of the country. Concrete set of policies and strategies has been included in the Implementing Rules and Regulations (IRR) of this law with the Department of Agriculture as the lead implementing agency.

4. Through the AFMA, a DA Administrative Order No. 11 provides for the implementation of the National Agriculture and Fisheries Mechanization Program (AgFiMech). This aims to coordinate the planning, implementation, monitoring and evaluation of an integrated agriculture and fisheries mechanization program. To implement this, a National Agriculture and Fisheries Mechanization Program Committee (CAFMech) was created.

5. Other programs and policies that are directly or indirectly affecting agricultural mechanization are:

    a. Republic Act 8559 in 1998 – Philippine Agricultural Engineering Act;
    b. R&D programs of various agencies: government or non-government, state colleges and universities, and other research institutions;
    c. Development of the Philippine Agricultural Engineering Standards (PAES) spearheaded by the Agricultural Machinery and Testing Center (AMTEC)
    d. As a member of the World Trade Organization (WTO) the country commits itself to the policy of globalization and liberalization of trade.
    e. Through a government loan from China, the Bureau of Postharvest Research and Extension (BPRE) will spearhead a postharvest facilities dispersal program in various areas of the country.
    f. Through a bilateral program, the governments of Philippines (GOP) and Peoples Republic of China (PROC) established the Philippine Sino Center for Agricultural Technology (PhilSCAT) in 2003. The center is doing R&D activities for the adoption and promotion of hybrid rice and agricultural mechanization technologies.

POTENTIALS AND PROSPECTS OF AGRICULTURAL MECHANIZATION DEVELOPMENT

In a recent consultation workshop on the status and directions of agricultural mechanization in the Philippines, the discussions led to the following:

1. While there were several policies, programs and other interventions done to raise the level of mechanization in the Philippines, there seems to be insufficient support for the implementation of a sound agricultural mechanization program. With AFMA and DA Administrative Order No. 11, the AgFiMech program was clearly defined and a CAFMech was created to spearhead its implementation. Problems on funding support however, hamper its full implementation. Hence, should the necessary support be given for the implementation of the AgFiMech, a lot of opportunities will be created to develop agricultural mechanization that will eventually lead to agriculture and fisheries modernization.

2. R&D efforts in agricultural mechanization are fragmented and the low capability of the manufacturing industry somehow contributes to the growing technological gap between the Philippines and other countries. This led to the growing reliance on imported agricultural machinery. While adaptation of foreign technology offers some advantages like savings on the R&D of new technologies, efforts must be done to strengthen the manufacturing industry to develop quality machines (from R&D outputs of new or modified machines adapted from foreign technology) that are really fitted to Philippine conditions. This will somehow solve some of the issues that hinders mechanization e.g., high investment cost of agricultural machinery, availability of spare parts, mismatch of mechanization and farming technologies. Likewise, with the development of the manufacturing industry, the fear of labor displacement due to mechanization can also be addressed as they can be trained to be employed in the manufacturing industry.

3. The Philippines is endowed with many resources that support agricultural mechanization. It has a large and highly trained manpower base, consisting of agricultural and mechanical engineers, manufacturers and craftsmen. It has more than adequate supply of mineral resources that can serve as raw materials for steel and other products needed in the manufacture of agricultural machinery. Through R&D efforts, development of farming, appropriate mechanization and manufacturing technologies must be continuing.

4. Other government support on infrastructures, marketing and service facilities, and funding are being sought to support further the promotion of agricultural mechanization. This includes among others the enforcement of existing standards and development of necessary standards, and provision of easy credit.

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