

COUNTRY REPORT

INDONESIA

**The Fifth Session of the Technical Committee (TC) of UNAPCAEM and
Expert Group Meeting**

Los Banos, the Philippines
14-16 October 2009

Dr. Agung Hendriadi, M.Eng
Head of Research Program Division and GM for Testing Laboratory
Indonesia Center for Agricultural Engineering Research and Development
(ICAERD)
Ministry of Agriculture
Indonesia
Email: ahendriadi@yahoo.com

I. Introduction

Increase productivity through intensification, reduce post harvest losses, increase added value and maintain the quality of farm product are the multiple objectives farm mechanization in Indonesia. In addition to that works, the ultimate goals of farm mechanization are also include increase the welfare of farm households, and create employment opportunity in the rural area. All of these may not be completed by a single strategy e.g. increasing the number of machinery use for farm production. It will include the long strategy to re-energize rural development as a whole, which enable farmers to adjust and improve their own capacity to adopt the suitable technology for their farm business efficiently. Farm mechanization is not only the use of physical machines like tractor, irrigation pump, thresher, or rice milling machinery, but it include the changes of culture, process of invention, innovation, adoption and commercialization of technology.

Small farm mechanization system development in Indonesia started with material transfer in the era of 1950, followed by the design transfer in the year 1970 and then move to capacity transfer beginning in 1980 (Handaka, 2003). It was in line with the development stages of rice cultivation in Indonesia (Ananto et al, 2003) which called period before the green revolution (1950-1970) and after the green revolution (1970- 1990) A number of fails and successes has been experienced that resulted to the new orientation for sustainable development.

II. Agricultural Mechanization Development

2.1 Farm Mechanization and Evolutionary Process

A historical evidence of farming system development in Indonesia has guided to the need of analysis of the evolutionary process with regards to farm mechanization technology. Figure 1 shows the evolutionary process of mechanization technology in the country. A farm system moves from the

subsistence to the commercial farm along the certain path called a sustainable path. The development stages illustrates the technology adoption capacity that moves from one stage to other stages affected by the existence of variables such as infrastructure, institutional arrangement, cultural endowment, resources endowment, economy, technology innovation, and cultural behavior. The capacity of the farm system to improve their productivity is depended upon their capacity to adopt, adapt and manage technology, institution, resource and capital either form internal or external resources. Government intervention in this case could participate in facilitating the change or providing the good condition for accelerating the move. However, the intervention could also make a premature mechanization if it was not properly plan (non-sustainable path). For example; the subsidy for low price machinery, the huge number of machinery aids for the farmers with minimal assistant or social institutional will create the problem of sustainability.

Accordingly, at the first stage, called as subsistence level, farm mechanization is in the beginning phase. No machinery needed at any kind of farm work. It is exist in the remote and less developed area when technology, infrastructure, institution, information and culture are isolated. It is happened if communication between the villages to the market is closed or limited, e.g. transmigration area. . Situation will change if the isolation is opened, and communication is step by step developed and when the market worked.

Not only the land preparation will be adopted by the farms, but also post harvest will gradually improve if the feel any profit or additional income is made from it. Through innovation process technology would be adopted if it could provide benefit for the farms. And it will be spread, adopted and utilized from the individual, community, region and national level by market.

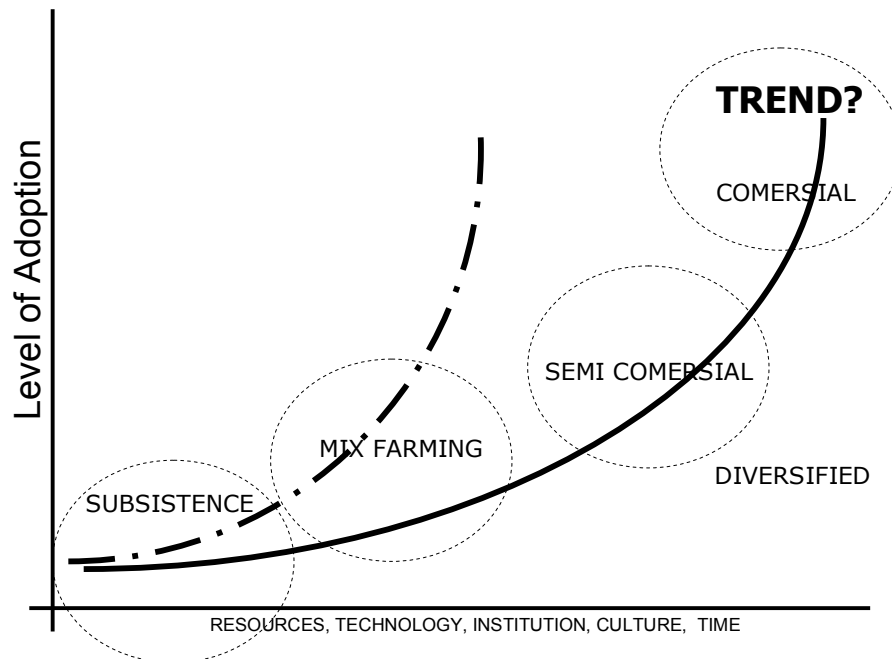


Figure 1. An Evolutionary Process of Farming System and Farm Mechanization
 Source: Handaka.. 2003. Sustainable Farm Mechanization Development. An Alternative Solution for Techonology Development. Indonesian Center for Agricultural Engineering Research and Development.

The changes will bring the subsistence system to the mixed, diversified, and commercial farming system and then farm mechanization will follow this development. Moving from the solid line to the dot line indicates the rapid development of the changes. If it is needed, then consequently the changes should be encouraged to facilitate. In this evolutionary process the government could also encourage the development by enhancing mechanization development, but this policy must design without any distortion of market mechanism to avoid so called *premature mechanization* (Hayami Y and T Kawagoe. 1989).

2.2 Development Policy and Strategy for Agricultural Mechanization Development

It was stated indirectly in the previous chapter that there were constraints, challenges and opportunities of agricultural mechanization for supporting development of

agriculture in Indonesia. Based on these experiences, it is also indicated that up till now the contribution and status of agricultural mechanization in supporting agricultural development has not sufficient yet. In order to have sustainability development of agricultural mechanization, all respective aspects have to work closely and all components in these aspects should get beneficiaries in developing of agricultural mechanization.

Policy for agricultural mechanization development should be an integrated policy in the frame work of national policy for agricultural revitalization. It is, therefore, as supporting agen, position of agricultural mechanization should be strong enough with respect of helping farmers. Therefore, policy for agricultural mechanization development in Indonesia have been setup directed to be able to create (a) the increase of productivity and efficiency of agricultural resources, (b) the increase quality and added value of the agricultural products and its by products, (c) oppportunity development of local agricultural machinery industry to produce better quality of the machines which are suitable to local conditions and purchase ability of farmers, (d) oppportunity collaboration among small, medium and big sclae of agricultural machinery industry.

For current situation, relationship among agricultural mechanization institutions and farmers has not been harmonize yet. In the most cases, the goverment policies on agricultural development have not accomodate farmer's need. The same thing also occured to local agriculcural machinery producers. It is therefore some machineries needed by the farmers could not be provided by the local producers. The goverment institutions and the local producers have not worked closely yet, especialy in research and development of agricultural machinery. Those are the reasons of relatively slow development of agricultural mechanization in Indonesia compared to others developing countries.

Based on these conditions it is needed to develop appropriate strategy in promoting agricultural mechanization in Indonesia. Strategy development of agricultural mechanization should be able to support development of agroindustry in village areas as well as local agricultural machinery industry it self.

Currently, appropriate strategy has been established in promoting agricultural mechanization development are **selective**, **progressive** and **participative**. Selective strategy meant that technology level and type of mechanization which would be implemented should be suited to the local or region conditions. The local conditions which have to be considered in this strategy are physical, socio-economic-culture, farming system and farm infrastructure aspects. Progressive meant that the level of technology should be implemented and always gradually improved from low level into higher level. These changes of technology level are respect to agricultural development from traditional into modern agriculture. Participative strategy meant that the implementation of agricultural mechanization development have to be done by involving the active participation of agribusiness society, including consumers/farmers, related industry and producers and financial institutions. Therefore, this development could not be handled by single institute.

III. Development of Agricultural Machinery Testing Institution/Laboratory

3.1 National Legislations and Standardization of Agricultural Machinery

Testing and evaluation is one important aspect in the development of agricultural machinery. Through testing and evaluation, research and development technically can be carried out systematically. In Indonesia the objectives of testing and evaluation of agricultural machinery are directed to

- (1) Protect the consumers need (farmers and other users) through quality control for standardization, which refers to the Indonesian National Standard of the testing procedures, test methods and minimum technical requirements for certification.
- (2) Guarantee quality agricultural machinery used by the farmers/other users to meet the requirement of global trade.

- (3) Strengthen research and development agricultural machinery more systematic and leads to what the national needs.
- (4) Strengthen the growth of local agricultural machinery industry through developing and adopting National Standard of Agricultural Machinery (SNI) used for technical barrier to trade.

As the National regulation on testing and evaluation of agricultural machinery, Government of Indonesia (GOI) Decree no 81/2001 (PP 81/2001) stated that all agricultural machinery either locally made or imported used in Indonesia must be tested before release to the market. Further statement in the Decree is that the test should be conducted by competent institutions/testing laboratory which have been accredited. The Decree indicates that the GOI pay big attention in protecting consumers of agricultural machinery.

In order to fulfill the implementation of the decree, testing institutions/laboratory of agricultural machinery should seriously be able to improve their competency to guarantee the quality of testing results and gain mutual recognition through the National and International accreditation process. Indonesian Center of Agricultural Engineering Research and Development (ICAERD) as National Center for agricultural Machinery development, since 1987 has started to establish and develop National Agricultural Machinery Testing Laboratory as National Testing Center. Through gradual improvement of testing facility, human resource and establishing National Standard of Agricultural Machinery, since October 2003 Testing Laboratory of ICAERD has been recognized as competent testing laboratory through accreditation based on ISO/IEC 17025: 1999.

National Standard of Agricultural Machinery which has been developed for the references in conducting testing and evaluation of agricultural machinery are includes Test Codes-Procedures-Methods, and Minimum Technical Performance Requirement of Agricultural Machinery. Currently, those standards are available and used for almost food crops and horticultures machinery.

3.2 Agricultural Machinery Testing Laboratory of ICAERD

Through gradually improvement and establishing national dan international collaboration, capacity building of Agricultural Machinery Testing are most directed to test small scale agricultural machinery commonly used in Indonesia. The capacity builing are listed bellow :

Table 1: Testing laboratory facility of ICAERD

No	Testing Laboratory	Capacity
1	Testing Laboratory for 4 Wheeled and 2 Wheeled Tractors	Max 100 kW
2	Testing Laboratory for Irrigation Centrifugal Pumps	Max 250 mm discharge pipe
3	Outdoor Testing Laboratory for grain post harvest machinery.	Var.
4	Testing Facilities for sprikler irrigation and hand sprayer	Var.

IV. Constraints and Challenges of Agricultural Mechanization Development

The success and fails of the agricultural mechanization development process in Indonesia provide some experiences and lesson learned. Slow development process indicates that there are some constraints are which include socio economic, technical and institutional constraints.

The reasons for slow adoption of agricultural mechanization technology are high price of machine, small size of land holding, limited of capital, low return due to low productivity and low price of product, back up support of the dealership. The price of machine may be the major problem of the technology adoption rate. A power tiller with local body and equipped with Japanese engine will cost more than double of Chinese type power tiller (US 2500 compare to US

1200). The local industry prefers to produce only the body of power tiller, and let the buyer to select the engine based on their preferences. Beside those reasons, less management knowledge and less capability to assess resources of farmers/farmer groups are also contribute to slow adoption of agricultural mechanization technology. Another constraint related to the agricultural mechanization institution is less coordination among agricultural institutions in establishing policy.

Size of land holding and the fragmented land are also problem in adopting suitable machinery. High efficiency for machinery fieldwork would not be achieved if the field is not match to the design of machinery. A minimum of 1000 m² per plot of field is required, but normally the land is fragmented. A flat land, considered as 0-8% slopes is the most suitable land for every farm machinery. According to Hendriadi (2003), the percentage of wet land which is potentially suitable for mechanization at any technology level is about 6 million hectares (20%). This has guided us to plan the appropriate rice mechanization for the country.

Limited capital and low return capability is also a critical factor among the socio economic aspects. Since their average land holding is too small, there is a limitation to increase productivity. Utilization of input such as high quality seed, proper amount of fertilizer, and application of proper pesticides are among the constraint to increase yield. Farmers prefer to secure the production first by giving the priority to production input, then followed by machinery utilization. Therefore, hiring or leasing of farm machinery is the most acceptable for them instead of owning.

Based on the current socio-economic characteristics, the existing growth of machinery production, and the speed of technology adoption, farm mechanization development in Indonesia will still follow the process of national economic development. Small land holding size will still dominated the process of farm production. Rice and other secondary food is still the strategic crop to be maintained in the food security system in the country. Java and Bali islands as the most fertile land will still produce high portion of rice with very intensive

technology, however, it will need to move to high quality rice, which need more advance rice processing technology. Outer Islands such as Sumatera, Sulawesi and Kalimantan need to be put in the priority for intensification, the potential swampy and tidal land need to be explored for food availability. Application agricultural machinery technology which is not suit to the local specific conditions is other main technology constraint in using agricultural machinery.

Some challenges identified for development of agricultural mechanization in Indonesia are:

- (1) There are possibilities to increase agriculture area through extensification program in which agricultural mechanization will play an important role.
- (2) There are possibilities to increase cropping intensity through intensification program. For this case, adoption of agricultural mechanization technology will help in achieving objective of the intensification program.
- (3) High losses, low quality and low added value of agricultural products are some cases which could be handled by implementing agricultural mechanization technology.
- (4) Prospect in the development of renewable bio-energy is one of challenges in agricultural engineering development.
- (5) Application of agricultural mechanization technology in the concept of crop livestock systems it may help to achieve their economic feasibility.

V. Priority Area of Technical Cooperation and Assistance for Capacity Building.

Based on the constraints and challenges in agricultural mechanization development, priority area of technical cooperation and assistance among APCAEM member countries are:

1. Strengthening collaboration among agricultural mechanization institutions in the field of research and development, especially in the areas of agricultural machinery for food crops, horticultures and utilization of agricultural mechanization for crop livestock systems.

2. Establishing testing network in terms of the development of methods, procedures and standardization of agricultural machinery in order to establish Mutual Recognition Agreement (MRA) of agricultural machinery certification among APCAEM member countries.
3. Strengthening collaboration on dissemination and technology transfer.
4. Strengthening capacity building (facilities and human resource) of agricultural mechanization institutions for research and testing of agricultural machinery.

VI. Recommendations and Ways To Promote and Address Challenges for Agricultural Mechanization Development

Agricultural mechanization development programs in Indonesia must be designed and implemented comprehensively which are well integrated and coordinated with programs of other sectors. National development programs in agriculture, industry, trade, infrastructures, education sectors and regional development programs have to be taken into considerations in developing agricultural mechanization programs.

Based on 50 years experiences in the development of agricultural mechanization in Indonesia, agricultural mechanization development programs should be directed to: (a) develop a model systems technology transfer (adoption) from research institutions to local industries and end users, (b) strengthen agricultural mechanization institutions which included national level, provincial level as well as farm level, government and private institutions, (c) strengthen research and development program, (d) develop good communication and strengthen collaboration among agricultural engineering institutions, (e) provide adequate technical knowledge and number of human resource, (f) develop financial support systems which are accessible by the farmers/farmer groups.

In order to achieve the objectives and targets in the development of agricultural mechanization in Indonesia, the following some action programs are strongly recommended, those are:

- (1) Supporting infrastructures development such as rehabilitation and construction of irrigation scheme and farm road for improvement transportation systems of input and output of agriculture.
- (2) Improving accesibility credit schemes available for farmers, including credit of agricultural machinery for farmers and small and medium scale of agricultural machinery industry.
- (3) Strengthening capacity building of agricultural mechanization institutions, national and provincial level, goverment and private institutions, research, development and extention.
- (4) Strenghtening the use of locally made agricultural machinery. By this policy, while subjected to support development of priority commodities, simultaneously, it is also strenghten the growth of local agricultural machinery industry and provide job opportunity.
- (5) Improving procurement, testing and evaluation procedures and National Standard development in order to insure quality of agricultural machinery used.
- (6) Training and extention which cover operation, repair and maintainance of agricultural machinery should be conducted for farmers as well as agricultural machinery hiring services (UPJA) in order to optimalize the use of agricultural machinery in farm level.
- (7) Development of human resources related to development of agricultural engineering especially in research and extension.
- (8) Strengthening collaboration among agricultural mechanization institutions in the field of research, development and dissemination of technology.
- (9) Strengthening collaboration with others respective institutions in the development and adaptation of technology.

VII. Conclusions

Modern Agricultural is characterized by high productivity, efficient use of natural and technological resources produce quality and sufficient amount of

product as market demanded with reasonable price. Modernize agriculture is a continuous process that required to improve the performance of farming system, facilitated the transformation from the subsistence to commercial farms.

Farm mechanization in Indonesia is a process of technological evolution. It guides to a strategic role in the dynamic transformation from the subsistence to modern farm. That role are: (a) increase production and productivity, (b) increase efficiency of the process and natural resource utilization, (c) improve quality and added value of the agricultural produce, and finally (d) increase income of the farm households.

The future prospect of farm mechanization in Indonesia for the next five to ten years (2010-2015) will still be dominated by small to medium mechanization. The development of agricultural machinery should be directed to increase productivity and efficiency, preserving product quality and creating added value product and its waste, and developing renewable bio-energy.

Mainly in order to guarantee quality of agricultural machinery (local and import machinery), testing and evaluation become important aspect in development of agricultural mechanization in Indonesia. It is, therefore, testing systems, networking, facilities and human resource of the testing center in the APCAEM member countries have to be improved for better accuracy of testing results and national as well as international recognition.

Shortly, for agricultural mechanization development in general, some priority areas need to be taken into action in the frame of APCAEM is strengthening collaboration among agricultural mechanization institutions for (1) research development and testing of agricultural machinery, (2) dissemination and transfer technology, and (3) improving capacity building.

References

Ananto Eko, Handaka and Sutrisno. 2003. Economic of Rice in Indonesia. Edited by Effendi Pasandaran, Faisal Kasryno, Agency of Agricultural Research and Development.

- Handaka.. 2003. Sustainable Farm Mechanization Development. An Alternative Solution for Technology Development. Indonesian Center for Agricultural Engineering Research and Development.
- Hayami Y and T Kawagoe. 1989. *Farm Mechanization, Scale of Economies and Polarization*. Journal of Development Economic, 31 (1989) p. 221–239. North Holland. Elsevier Science Publication B.V.
- Hendriadi A. 2003. Mechanization Suitability for Wet Land in Indonesia. Research Report. Indonesian Center for Agricultural Engineering and Research Development.
- Park J and R.A.F Seaton. 1996. *Integrative Research and Sustainable Agricultural Systems*. Elsevier Applied Science.
- Sayogya, 2003. Public Policy in Agricultural and Rural Development. Not Published
- Vernon W Ruttan and Hayami Y. 1984. Induce Innovation Model of Agricultural Development in Agricultural Development in the Third World. Edited by Calr K. Eicher & John M. Staatz.