Contributed Papers

PRELIMINARY RESULTS OF IMPLEMENTATION OF PRIMA TANI IN IRRIGATED RICE FIELD: CASE STUDY IN SIPAERE-PARE VILLAGE, AIR PUTIH DISTRICT, ASAHAN REGENCY , NORTH SUMATRA

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ABSTRACT

Initial implementation of Prima Tani's technology has been conducted at Sipaere-pare village, Air Putih district, Asahan Regency one year ago. The village development planning which was formulated mutually with the society using PRA approach has been implemented through: (1) Integrated Plant Cultivation (IPC) of rice field paddy, (2) Integration System of Paddy and Cattle (ISPC), and (3) Improvement of farmers organizations, quality of farmer's human resources, expansion and guidance of industrial potential, the supply of supportive facilities and infrastructures, and others. The results show that trust to the government performance and technology started to grow, the society is establishing a cooperative as a vehicle for unity in implementation and innovation of the technology, farmers have started to diversify businesses, application of technology paddy and vegetables productivity and income of the farmers; farming cooperative groups has established partnership with the local entrepreneurs; the government of the Regency is responsive and willing to share funds with the farmers for implementation and expansion of the technology.

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INTRODUCTION

Prima Tani is a pilot program of agricultural innovation using the principle of BOP (Build, Operate and Transfer) which means that the model of innovation introduced and socialized is a new thing but it is still an initial introduction to be delivered to the technical agricultural institution which will implement the program massively or adopted by the farming groups independently and adopted by private agribusiness agents. Prima Tani aims to introduce and socialize the results of agricultural innovation from Badan Litbang Pertanian to communities as the end-users (farmers and other agribusiness agents) through disseminating media in the form of agribusiness laboratory. The meaning of Prima Tani itself is a reliable agricultural extension, while its expected output is a model of agribusiness innovation that technically proper, economically feasible, socially acceptable, environmentally friendly, administratively transparences, legally accountable and politically conducive so that are also properly adopted by farmers and agribusiness agents.

METHODOLOGY

Prima Tani is implemented at Sipaere-pare village, Air Putih district, Asahan Regency. This region is famously known as rice production center, with the area of 360 ha, located just beside the trans-Sumatra highway, about 103 kilometers from Medan. It is occupied by 5,778 people consists of 2,751 males and 3,027 women belong to 1,375 families. The average income of the population is Rp 2,806,667/household/month which is mostly earned from agricultural sector, trade, service, and others. The living expenses is about Rp 1,741,395/household/month, thus there is saving amounting to Rp 1,065,272/household/month. The rice field area is 180 ha and technically irrigated from Bahbolon Irrigation.

The village development planning is performed mutually with the society using PRA approach. The planned is implemented through: (1) Integrated Plant Cultivation (IPC) of rice field paddy i.e. application of farming technology of vegetables and house yard cultivation, (2) Integration System of Paddy and Cattle (ISPC), and (3) Institutional improvement and guidance, improvement of the quality of farmer's human resources, expansion and guidance of industrial potential (household, paced rice, high quality seed), the supply of supportive facilities and infrastructures, and others.

Technological improvements which have been applied are: (1) rice field IPC (about 80 ha, ISPC: 2 groups); (2) vegetable technology from Research Institute of Vegetables Production (Balitsa); (3) guidance of high quality paddy seeding; (4) gurami fish farming extension and training, (5) improvement of the quality of management of group of farmers/cooperative; (6) training in making cow compos and agricultural waste; (7) training in making and using of natural agensia, and (8) facility of partnership with entrepreneurs. In addition, the cooperatives are also giving financial aid to manage productive businesses groups to be professional. In 2006, these activities will be continued intensively by expanding some new adaptive commodities that potential for increasing incomes through optimal use of the areas.

RESULTS

Institutional renovation is an initial phase of the activities that carried out right after development planning is agreed. This activity is conducted phase by phase using SAGA (Social Economic and Gender Analysis) participatory approach. It is started with socialization, program clarification, how to

use and system to be applied. Principally, farmer groups are established based on the farmers' wish and need. There is not any intimidation or intervention in formation of the groups. The researchers, agricultural extension workers and related regional apparatus only facilitate meetings and gives comment and suggestion if the farmers asking for. Process of formation and selection of management are performed entirely by the farmers. The groups consist of growing groups, vegetable farming group (partnership with entrepreneurs), domestic industry group, gurami fish farming group (partnership with entrepreneurs), and combination of farming group and farming cooperative group.

Contractual bases partnership with the owner of RM.100 Restaurant for marketing of gurami-fish, high quality of paddy seed, vegetables and domestic industry is still being negotiated. The Restaurant has agreed to buy as much as 50 – 100 kilograms of fish a day. The contract agreement is facilitated by Koperasi Kelompok Tani and the entrepreneur. Currently negotiation with some big companies around the location, such as PT. Inalum, PT. Perkebunan dan governmental offices for marketing rice is still in a process. The cooperation is predicted will have more opportunities to increase quantity and quality of the business that in turn will also influence expansion of agribusiness and increase of incomes of the society as well.

CONCLUSION

*A*fter one year implementation of Prima Tani in the field, there are some essential preliminary changes, as follows:

- Gradually changing the society's perception and respond to the government official and technology innovation, respectively. Trust crisis to the government official which has been occurred significantly is gradually reduced. The society who previously did not interest to new introduced innovated technology, now beginning show their interest and enthusiasm. It seems that they started looking for appropriate technology and sustainable guidance.
- Gradually, the society is establishing a system to be used as a vehicle for unity in implementation and innovation of the technology.
- Farmers have started to diversify businesses, in which integration is not only within sub-sectors, but also expand to other sectors such as home industry and services.
- The application of specific location technology for paddy and vegetable commodities has increased their productivity and income of the farmers. Productivity of paddy increased about 0.75 tons/ha and vegetable about 1 – 1.5 tons/ha. Farmer income is much more higher resulted from business efficiency.
- Farming cooperative groups has established partnership with the local entrepreneurs. This partnership plays an important role in triggering farmer's motivation to apply and expand their business.
- The government of the Regency is responsive to the application of Prima Tani's technology and willing to share funds with the farmers for implementation and expansion of the technology.

A MODEL OF TECHNOLOGICAL TRANSFER OF INTEGRATED CROP-LIVESTOCK SYSTEM IN IRRIGATED WET LAND IN LEBAK DISTRICT, BANTEN PROVINCE, INDONESIA

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ABSTRACT

In order to accelerate innovative transfer of technology, a model of adopted technology of the crop livestock system (CLS) of cattle-rice to increase income of farmers has been developed. Three technological package components of the CLS of cattle-rice: (1) integrated rice farming management, (2) cattle raising management, and (3) fermentation technology for rice straw and cattle dung, have been introduced and then adopted by a farmers' group in the irrigated wet land of Panancangan Village of Cibadak Sub District, Lebak District, Banten Province. In addition, considering a role of local institutional organization, the farmers' group has established a cooperative organization namely "KUAT" to support the management activities of CLS. The results of the study indicated that the local government has given considerable attention to the system and willing to continue and introduce the model to be adopted by farmers in the others wet land of Lebak District area.

Key words : CLS, cattle, rice, technology

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INTRODUCTION

Rice demand increases along with population growth, so that the Indonesia government tries hard to sustain rice self-sufficiency. Rice production can be increased by intensify cropping intensity and open new planting area. In 2004, the national rice production was 54 million ton. Java is still an Indonesia's main rice producer that contributed about 60% of the total rice production in about half of the national rice area. One of the 33 provinces in Indonesia is Banten located in western part of Java and occupied area of 8.800 km^2 The total wetland area of Banten is 335.029 ha with the average rice production of 1.8 million ton per year (Anonymous 2002; Setiawan, 2005) that is lower than the national average of 4.7 ton/ha.

Currently, most of Indonesia's rice farmer is living under standard; because of the average wet land ownership is less than 0.3 ha. One of the efforts to increase farmers' income is to apply the integrated farming management. The government of Indonesia through AARD (Agency for Agricultural Research and Development) has developed a technology package of crop livestock system (CLS) that integrate rice production with livestock farming. The technology of cattle - rice integration has been introduced widely in many places of Indonesia since 1995. The technology has been updated to synchronize with special condition area and to increase its applicability. The integrated system of cattle and rice is a mutual benefit relationship, in which rice provide rice straw for cattle feeding and cattle dung used as bio-organic fertilizer for rice. Rice straw has low nutrient quality and fewer digestibilities. Technology of fermentation using some microbes could improve quality and digestibility of rice straw. The productivity of fermented rice straw per ha per season was 5-8 ton that enough for feeding 2 – 3 heads of cattle annually, while production of cattle dung is 4-5 kg/head/day. (Haryanto *et al*, 2002)

Applying integrated cattle-ricw farming system on individual bases will not able to get profit. It needs an institutional approach as "a *grouped quotient*" in which land and cattle are owned individually, but farming activities such as collecting rice straw, cleaning barn and stocking needed materials and marketing are conducted together. To support funding for these activities, a cooperative organization of farmers namely "Integrated Agribusiness Work Group (*KUAT*)" is established. The cooperative seeks for soft loan to finance the activities. The credit should have lower rate of interest, easy procedure and small collateral and affordable. In addition, collaboration with private husbandry is important in marketing and stocking of young cattle/breeder. The ideal institutional organization chat is presented in Fig.1

In this management system, farmer could gain income from sold cattle, either seed cattle or fattened cattle.

The government has continued to promote the model of livestock and crops integration through establishment of pilot project, provision of capital, dissemination of information, seminar, and others. The government stem for alternative integrated system models by incorporating indigenous technologies into the systems in regard to sustainability, environmental tolerance, social acceptance, economic feasibility, and political desirable aspects for further development in the future.

There are three integrated technology components in the CLS of cattle rice: (i) rice farming management, (ii) cattle farming management and (iii) technology of fermentation for rice straw and cattle dung. This paper reported an adopted technology of CLS components to accelerate technology transfer for farmers' group. The study located in a farmer's group in Panancangan Vilage, Cibadak Sub-district, Lebak District of Banten Province.

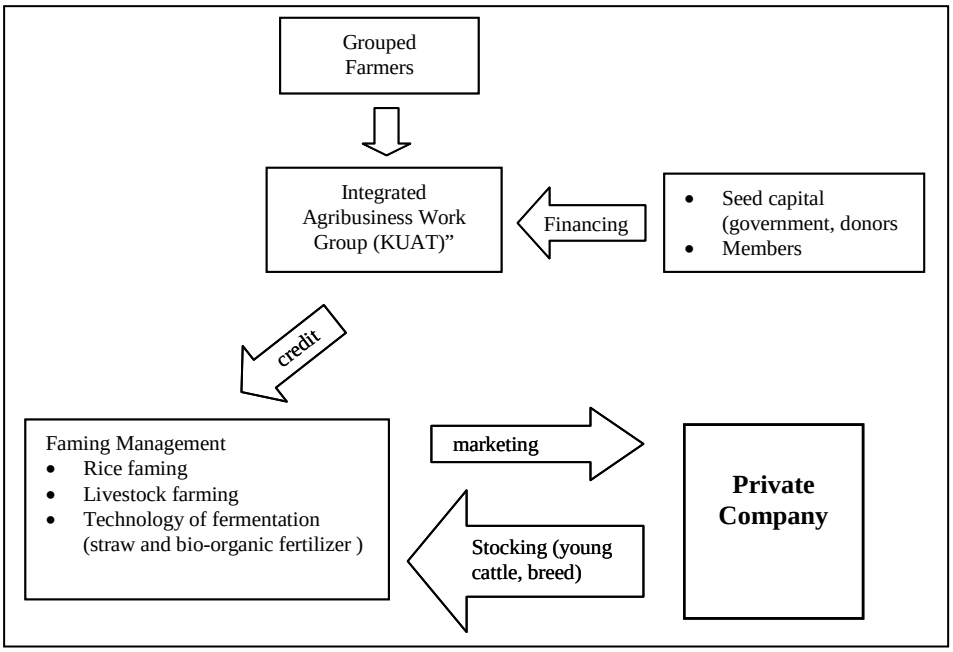


Figure1. Institutional organization scheme

METHODOLOGY

Location of study

This study was conducted by involving the farmers who own irrigated-land. A survey has been carried out in the agro-ecological zone of irrigated wet land in Lebak district of Banten province to select a suitable site for the pilot project. Farmers whose involved in this study are the member of farmer‘s groups of Panancangan Village-Cibadak Sub-district, Lebak District of Banten Province. As much as 125 farmers with total area of irrigated land of 25 ha were interviewed.

Materials

- 25 ha of irrigated land owned by 125 cooperative farmer groups;
- 10 heifers of Ongole-Crossbreed (200-210kg of live weight);
- 1 unit 6 x 8 m cattle’s stable with cement floor;
- 1 unit 3 x 9 m roof room to ferment rice straw;
- 1 unit 3 x 6 m roof room of in size to ferment cattle dung;

- 1 package of concentrate feed, drugs and starter (probiotic) culture equipments.

Package Technology

a) Integrated Rice Farming Management

One way in the rice farming is *jajar legowo* system that recommended for member's farmers as a substitution of common local way. Commonly, the local planting system are used to using *tegel* system with irregular distances ranged 20—22 cm in square. The *jajar legowo* system is planted at specific distance without reducing the number of plants per-hectare. Spacing is closer within the row but wider between the rows and provide adequate space to plant management. The *jajar legowo* plantation system of 4:1 was applied (Fig. 2). Each four rows of plantation after one row is sacrificed for space The completely component applied of integrated management for rice farming is presented in Table 1.

Table 1. Technological components applied in the integrated rice farming

No	Technological component	system
1.	Land management	Used Tractor 1
2.	Pest management of snails	Collecting, killing
3.	Seed used	Labelled seed, immerged with salin solution 3%
4.	Variety	Memberamo
5.	Treatment of seedling	Used Carbofuran
6.	Number of seed stocking	20 kg/ha
7.	System of planting	Legowo 4:1
8.	Age stocking of seed	15 days
9.	Number of seed stocking	1-2 individu /hill
10.	Irrigated management	Local management
11.	Fertilizer dosage: Urea SP-36 KCl	 Base on Leaf Color Chart/LCC 100 kg/ha KCl 50/ha

The integrated farming system started in the second planting season of 2003 that covered of 11.5 ha of irrigated-land, and then continued in the first planting season of 2004 with total land area of 25 ha. Both activities were conducted by 125 cooperator farmers.

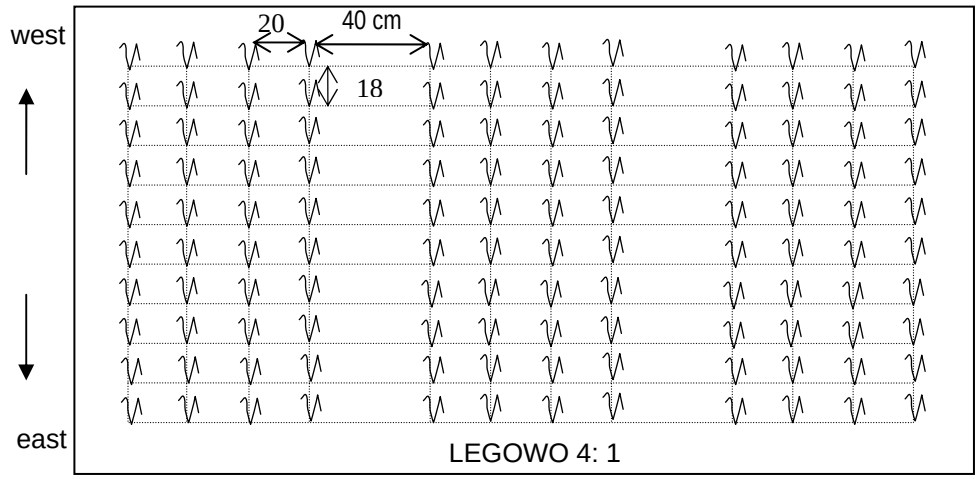


Figure 2. Jajar Legowo plantation system of 4:1

b) Cattle Management Technology

The cattle management technology applied started on the end of rice harvesting season of the first season of 2004. Ten Ongole-Crossbreed (OC) heifers (200-210 kg) were confined in a stable at all times. The stable floor is covered with saw dust at height of 15-20 cm. Five members of "*Sri Mukti*" group were selected to manage the cattle. Cattle fed daily with 5 – 8 kg fermented rice straw plus 1 – 1.5 kg concentrate feed per head. Fermented straw was given twice a day at 09.00 and 17.00, while concentrate feed was given two hours before fermented straw feeding at 07.00 a.m. Water was provided *ad-libitum.* At the end of every month, the mixed cattle dung (consist of faces, urine and saw dust) is removed and transferred to fermentation place and then it is changed with new saw-dust.

c) Technologies of fermented straw and animal dung (bio-organic fertilizer made)

After harvesting of rice, straw collected in a room of fermentation and it arranged and piled up of 1.5 – 2.0 m in height. Every 20 cm of height of heap straw is sprayed by commercial starter (called "probiotic") at dosage of one liter per ton wet-straw. To make needed ingredients of starter and equipments is presented in Table 2. The ingredients are mixed in a tank of 100 *liters* volume with a pipe (0.5") and a pump (20 watt) under continuous current electric (Figure 3). After three days of culture, probiotic ready to used for fermentation of straw.

Bio-organic fertilizer is made by blending mixed cattle dung (faces, urine and saw dust) homogenously with a commercial probiotic (*orgadec)*, lime, TSP at dosage of 2.5 kg/ton and piled of 1.0 m in height. The mixed dung must always turning back four times a week for three weeks to complete decomposition process. Finally, bio-organic fertilizer is placed sun dried at ground.

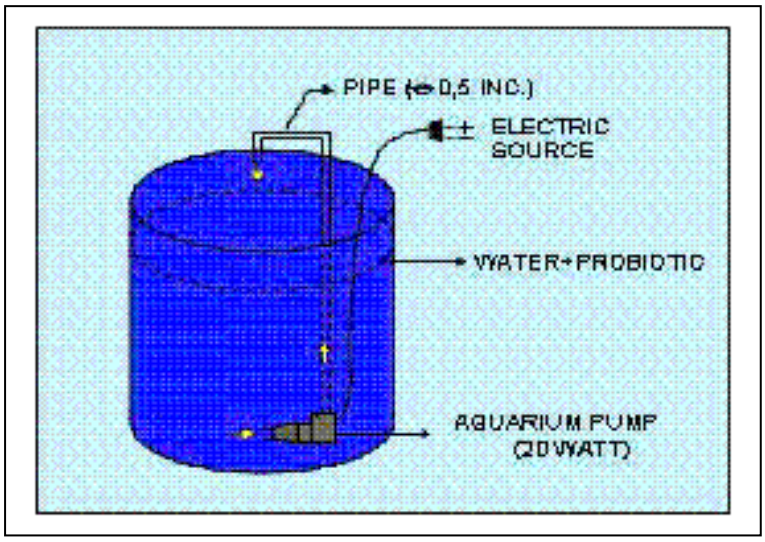


Fig. 3. Culture of probiotic

Table 2. Ingredient and equipment used for culture starter (probiotic)

No	Material/equipment	Number
1.	Water	40 liters
2.	Rice flour	2 kg
3.	Urea	1.5 kg
4.	TSP	1.5
5.	ZA	1.5 kg
6.	KCl	1.0 kg
7.	Mineral mix	2.0 kg
8.	Molasses (sugar)	2.0 kg
9.	Commercial starter	20 liters
10.	Aquarium pump (20 watt) + pipe (0.5”)	1 unit
11.	Pail volume of 100 l	1 unit

d) Short training course and field contact

A number of 25 selective participants consist of cooperative cattle farmers, extension workers and involved institution staff have been trained on CLS management for two days. The topics were technologies of fermented straw and bio-organic fertilizer, biology of cattle, and cattle management. In addition, a field contact among participants to discuss the showcase technology completely has been conducted where 75 persons participated in.

Results

Application of the integrated rice farming management technology has improved average rice production to 7.2 ton/ha as proven by 125 farmers who adopted the technology. Meanwhile, non cooperative farmers only achieved 3.9 ton/ha in average. The cooperative farmers enjoy increased 85 % rice productivity and increased of 164% profit. The difference between integrated and non integrated managements is presented in Table 3.

Table 3. Difference of integrated vs. non integrated managements

Technological components	**Integrated management**	**Non-integrated management**
Variety	Membramo	IR-64
Number of seed stocking	30 kg/ha	50 kg
Sistem of planting	*Legowo 4:1*	*Tegel*
Age stocking of seed	15 -18days	21-25 days
Number of population stocking /hill	1-2 individu	5-7 individu
Fertilizing		
Urea	Base on BWD (leaf color)= 75 kg	100 kg
SP-36	100 kg	-
KCl	50 kg	-

Eight farmer groups in Panancangan village have established a cooperative which is called Integrated Agribusiness Working Group (KUAT). The organizational structure of KUAT is sketched in Fig 4. Five KUAT members were decided to manage the integrated cattle rice farming. Considering that most of the farmers in the study location only experience on raising buffalo only, their knowledge's in biology and management aspects of cattle was lack.

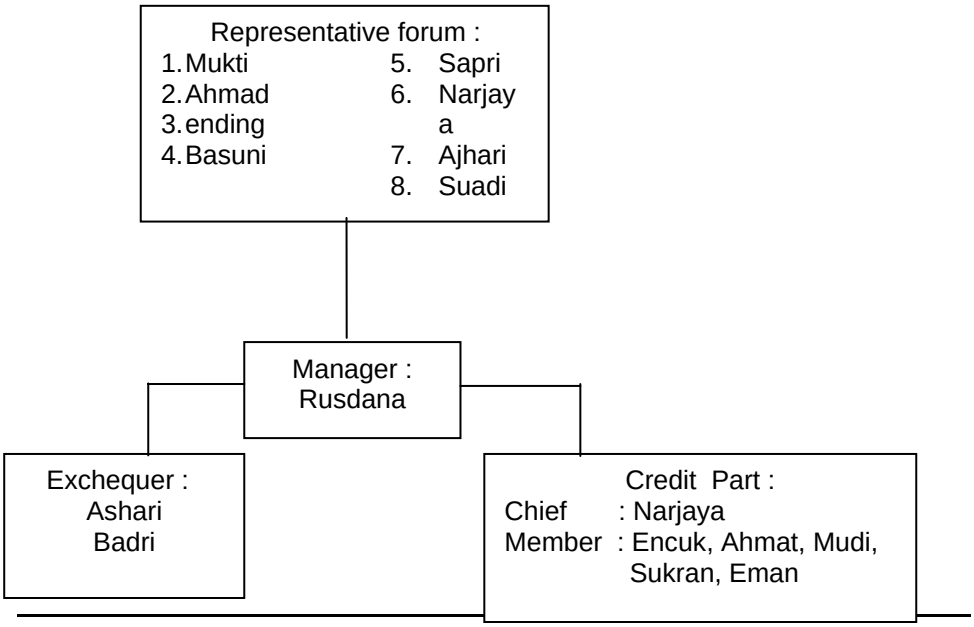
In the early stage, both farmers and the local extension workers did not believe that dried rice-straw could be fed to cattle. Even though the local government has distributed cattle to farmers in the rural area, but no farmer has applied the fermented straw technology. They just believed after participated in the training course and show the results in the field. Base on the requirement criteria of feed formulation; feed ingredients for concentrate feed for cattle feeding are locally available, therefore the price of locally made concentrate feed was about Rp 708,-/kg that is lower than the price of commercial feed Rp 825,- The criteria used for feed formulation are economically applicable, locally available and appropriate nutritive value. The ingredients for concentrate feed are presented in Table

4. The daily gain of cattle fattened for three months was 0.36 kg up to 0.80 kg a day and reached live weight of 256 - 267 kg, even three cows show the first mating weight. Average daily weight gain of fattened beef cattle in Garut, West Jawa Province, was more than 1 kg after consumed concentrate feed of 3 kg/*day/head* for 3 months (Bachrein *et al*., 2002). However, excessive fat in the body of fattened cow could reduce fertility. Therefore if cattle is look after for reproduction purpose, concentrate ration should be restricted to less than 3 kg a day.

Table 4. The composition of concentrate feed formulation

No	Feedstuff	Amount (%)	Protein Content (%)	Total Protein (%)
1.	Rice brain	60	10 - 12	6.0 -7.2
2.	Corn brain	11	9	0.99
3.	Coconut meal	10	22	2.2
4.	Palm kennel cake	15	24	3.8
5.	Mineral mix	1	-	-
6.	Salt	1	-	-
7.	Calcium	2	-	-
T o t a l		**100**		**12.8-14.0**

The study on applying bio-organic fertilizer for rice farming has not been conducted. Nevertheless, Syam dan Sariubang (2004) reported that used of bio-organic fertilizer 2 ton/ha plus 105,6 kg urea + 100 kg ZA + 33,3 would able to substitute a part of the plant nutrients requirement and to improve the soil structure.



Les *Figure. 4. Organizational structure of Integrated Agribusiness Work Group/KUAT*

The study became a pilot project of CLS implementaion especially for Lebak district and generally for Banten Province area. The technology package of rice cattle CLS could be transfered and adopted by farmers. The transfered technology components are:

Improvement of rice farming system. Components of technology transfer in this system covered seed variety used, stocking and seed age, planting system, integrated pest management and fertilizer dosage used.

1. Livestock Management that consists of cattle management technology (i.e. fattening, reproduction, concentrate feed ration formulation), rice straw fermentation and bio-organic fertilizer technology, and probiotic *(starter*) culture technology.
2. The study found out that: (1) the roles of institutional organization need to be intensified and established in which the local goverment could actively partisipate in; (2) Farmers become aware and realized that rice straw is needed for cattle feed so they will not burn it; (3) Extention workers should visit farmers more often to facilitate them; (4) Skill and knowledge of farmers and extension workers should be up graded through training programs and workshop; (5) The local goverment should be more focus on irigated water management to fulfill requirements for rice farming. Unfortunately there is no private company involved in this study. Roles of livestock company is very important to assist in marketing and stocking of livestock under a mutual collaborative.

CONSTRAINS

The most constraining factor in applying rice-cattle CLS technology is changing farmer behavior. E.g. previously farmers used to plant seed with 5-7 seeds per-hill, while the technology component system should plant 1-2 seeds per-hill. It needs more time to train farmers (commonly women) to plant recommended number of rice seeds per hill.

In developing institution organization, establishment KUAT was not running well, because of lack of human resources capability and limitation of provided financial.

CONCLUSION

The technology package of integrated rice farming management have been adopted by 125 farmers, while CLS technology have been adopted by 5 farmers. Nevertheless, the local government would continue to develop the model of adopted technology of CLS in the irrigated wet land of Lebak district area.

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INPUT DELIVERY SYSTEM TO PROMOTE GOAT AND SHEEP ENTREPRISES IN THE VILLAGE

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ABSTRACT

Goat and sheep production in Indonesia is typically smallholder in nature and become an integral part of complex farming activities. Technologies including breeding, feeding and animal health have been generated from many research programs, but the adoptions by the small holder producers have been minimal. It is considered that the undeveloped delivery system of the production inputs associated with the technologies is an important constraint to the slow adoption. Alternative delivery systems for production inputs such as drugs to control internal and external parasites, improved breed as seed stock and alternative and in conventional feeds are proposed. Delivery system using key farmer or individual, functioning to link the drug or feed supplement producer or distributor with the smallholder producer could be developed and has been shown to work well. It is shown that 4-5 key farmer or individuals are sufficient to serve smallholder farmer in a sub district. The delivery system for improved breed generated by the research institution could be developed by promoting several key farmers functioning as multiplication unit that produce and sell the seed stock directly to the farmer. It is shown that 3-4 multiplication units are sufficient to serve the need of small holder farmer in one sub district. Delivering of agro-industrial by products or wastes as in conventional feedstuff for small holder farmers is relatively difficult due to additional cost for transportation and processing, particularly for those classified as wet by-products. It suggested that feeding system for smallholder farmers should be based on the maximum utilization of locally available feeds. Priority should be given to maximum development and use of tree legumes as protein sources and maximum selection on the forages offered to the animal (young forages and high leaf/stem ratio) to increase intake, digestibility and animal productivity.

Key words: Production, input, delivery system

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INTRODUCTION

The population of goats and sheep in Indonesia is approximately 22 million, and most of them (98%) are reared in small-scale operation by rural households with the size of ownership of 5-8 head/ household (Diwyanto *et al*, 2005). These small ruminant animals are dispersed across the many households in the villages, and become an integral part of the complex farming activities. Most of the goat and sheep production is still in its undeveloped stages, and use whatever resources are available on the farm, such as forages from communal land, crop-residues and crop by-products. Expectedly, the productive performances of the animals under such situation are relatively poor, but it also suggests that there is ample room for improvement even within the context of the smallholder system by introducing improved technologies to the system.

Results form research activities on small ruminants from various institutions have accumulated, and some technologies have been generated. Examples include improved breeds, alternative feedstuffs either as feed supplements or basal feeds and veterinary products. They might be technically and economically sound, but they have not been widely adopted by most of the smallholders, and so the goat and sheep farming developed very slowly. The sporadic, and in most cases, minimal adoption of the technology is due to a lack of accelerators of the technology adoption which is for livestock sector include lack of production incentives based upon quality and price and uneconomical size of enterprises (de Boer *et al*, 1992). The delivering system of the production inputs associated with the technologies from the producer to the farmers in the remote and rural areas could also be important constraint resulting in the less developed goat and sheep rearing. This paper aim to present and discuss experiences in development of the delivery system of some physical inputs to the goat and sheep smallholders in the rural areas.

RECENT TECHNOLOGY DEVELOPMENT AND DELIVERY FOR GOATS AND SHEEP IN INDONESIA

There have been research programs conducted by government-funded research institutes to improve the productivity, efficiency and marketing system on small ruminants. These technologies include: 1) new crossbreeds of local and imported breeds, 2) utilization of economically feasible agro-industrial by-products as supplements, 3) application of anthelmintics to grazing animals to control internal parasites and 4) application of patent drugs or non-conventional medications to eliminate external parasites (scabies). These improved technologies have been introduced and promoted to farmers in many types of farming systems in various programs using different approaches such as Outreach Research Project and Outreach Pilot Project developed by the Small Ruminant-Collaborative Research Support Program, USAID (Knipscheer *et al*., 1996). These programs aimed to extend the technologies to outreach farmers, but the persistence of technology introduced varied, some were successful and some were not (Merkel *et al*., 1996).

The use of such technologies depends on the availability of the inputs that are associated with these technologies. The provision of inputs and services for smallholder goat and sheep producers has been mostly in the hands of governments and to a lesser extend the private sector that produce and market the inputs. The delivery system of inputs by governmental agencies are usually insufficient or even erratic. The role of the private sector should be encouraged more intensively, since the

privatization of some of the animal services and production inputs is likely to improve the delivery system (de Haan and Bekure, 1991).

ANIMAL HEALTH DELIVERY SYSTEM FOR SMALLHOLDER PRODUCERS

It is essential to have effective and efficient linkages among all parties involved in livestock production and development. However, the typically small size of goat and sheep rearing must required a unique delivery system of production inputs. It was found that smallholders were able to recognize the benefits of inputs (in this case drugs) and were willing to pay for them (Kartamulia *et al*., 1995). The most required drugs by the goat and sheep smallholders are anthelmintics to control the internal parasites and drugs to control the external parasites, mainly the *Sarcoptic scabei*. However, these drugs are rarely available in the rural area and when they are available they are usually packed in a relatively large volume. Due to the very small amount of drugs required for their small herd size, as well as their limited cash allocated for drugs, it is not always encouraging for the farmer to buy drugs directly from the distributor or from the animal shop. Thus, the main challenge is how to deliver drugs to smallholders in packages that are practical and acceptable to them. It is, therefore important to promote the existence of individual person or key farmer who are willing to practice as a professional middleman to repack the drug into a smaller volume as required by most of the smallholder farmers or serve the farmer in a 'door to door' visit and directly treat the animals in the field. Although the cost of the drug will become more expensive per unit or volume due to the presence of the middleman, it is observed that this system have been sustainable.

A case study is observed in the Sub District of Galang, North Sumatra where there are 3-5 active individual middlemen that serve as drug distributors for the smallholders living around the region. Those practicing as middleman for the drug distribution are generally those who are interested or associated with animal production, such as progressive farmers and government employees associated with livestock services, extension workers, and even young scientist trying to get additional income from such activities.

The main danger of the use of anthelmintics is drug resistance (Carmichael, 1993). It is important to ensure that the anthelmintics being used should be rotated at least once in every year, used in correct dosing and application in order to prevent drug resistance. In relation to this, there should be several main groups of anthelmintic chemicals traded in such market so that farmers have choice to buy the correct anthelmintics in accordance with the rotation program they developed for their flock. There are five main groups of anthelmintic chemicals based on their chemical structure (Wilson et al., 1996) namely: 1) Benzimidazols (e.g. Panacur, Valbazen, Systamex, Fasinex), 2) Salicylanalides (e.g. Trodax, Ancylol), 3) Levamisol and Morantel (e.g. Nilverm, Ripercol), 4) Organophosphates (e.g. Loxon, Neguvon) and 5) Avermectins/Milbemicyn (e.g. Ivomec, Cydectin). Maximum result from rotationing of anthelmintic used would be achieved when it is based on the anthelmintics' chemical structures.

DEVELOPING 'MULTIPLICATION UNIT' AS SOURCES OF SEEDSTOCKS FOR GOAT AND SHEEP SMALLHOLDER PRODUCERS

Using genetically improved breed in goat and sheep rearing is promising since it could increase productivity by more than 30% (Bradford *et al*., 1996). Generating a newly improved breed of goat and sheep by crossing local with exotic breed have been conducted. For example, the breeding

program has been conducted by crossing local Sumatra sheep with St Croix and Barbados Blackbelly to yield the Sungai Putih sheep (50% S; 25%SC; 25%BB). A similar breeding program is in progress aimed to generate an improved goat breed by crossing local breed (*Kacang*) with Boer goat to yield Boerka breed (50%K; 50%B). While the creation of these new breeds have been successful at the research system, the challenge of how to ensure a continuous supply of seed stock to farmer fields remained.

It is considered that from economics point of view, the breeding activities to produce seed stock, like producing improved breed of goat or sheep required longer period to be break event. Therefore, such activities should be initiated and conducted by the Government until the targeted genotype has been achieved. The multiplication of such newly-improved breed should be extended into private sectors such as progressive farmers, farmer groups or commercial farms. An approach has been adopted to make the seed stocks are becoming available for the smallholders. This was conducted by promoting several (4-5) key farmers in a sub-district as multiplication units for the improved breeds. In this model, 25-30 ewes or does were given to each key farmer with a better resource base and were used as foundation stock. The key farmers, then have obligation to return the same amount of females in no more than three years. The multiplier unit has the function of multiplying in numbers the new genetic material made available from the seed stock producer for further delivering to the smallholders. This scheme is likely to be success since most of the key farmers are able to fulfill their obligation in less than three years, and the population of sheep in these multiplication units have increased progressively. Ideally, each multiplication unit has at least 150-200 ewes steadily to be functioning effectively as source of seed stock for their neighboring smallholders. However, this is much depend on the availability of other inputs, mainly forages and labor. This also suggests that the key farmers should be economically more established in order to be able to afford purchasing production inputs in particularly, feeds, barn and labor.

OPTIMUM FEEDING SYSTEM FOR GOAT AND SHEEP SMALLHOLDER PRODUCERS

Researches on feed and feeding system have been focused on the utilization of non-conventional feeds, in particular ago-industrial by-products or wastes used as feed supplement or basal feed. While technically and economically these products are feasible, the rate of adoption of the feeds by goat and sheep smallholders are very limited. Merkel *et al*. (1996) observed that in a project developed in North Sumatra in which technologies and production recommendations were extended to farmers cooperating in the project, the use of concentrate based on agro-industrial by products were not well adopted. Several factors could be blamed for this limited adoption. The undeveloped-delivery system of the feedstuff from the producers or sources to the farmer as users could be an important constraint. However, the cause for the undeveloped-delivery system may stem from the typically uneconomic scale of goat and sheep rearing practiced by the smallholders.

The agro-industrial by-products or wastes are generally produced in urban or peri-urban area, and so in a large distance from the rural area where most of smallholders live. More over, many of the by-products or wastes are classified as wet by products, and further processing such as drying, or grinding is required before could be used as animal feeds. Therefore, these materials might be mosly effective when used in high input production system such as commercial enterprises. However, there are by products such as palm kernel meal and molasses that have potential for use in smallholders due to its competitive prices and continuous availability. The delivery system of these products need to be established. The producers, either private or state-owned palm oil or sugar plantation do not release these by-products into free market, so special ordered is required. The minimum volume for purchasing would be to large for smallholders. In this case, the delivery system should include

individual person or farmer group with economic capability purchase the by-products and distribute them to smallholders in smaller volume.

Other approach for developing feeding system for smallholders is by basing on the locally available and easy to use, so that no need cost for the transportation or processing is required. The most practical way of developing feeding system for goat and sheep smallholder producers is through the utilization of tree legumes as high quality feed. These crops (*Leucaena leucocephala*, *Gliricidia sepium*, *Sesbania grandiflora* and *Calliandra calothyrsus)* could be planted on marginal land or backyard and could be harvested at daily basis to meet the animal needs. To make maximum use of these feeds, it is recommended to give priority for those animals in highly productive state such as lactating ewes or does or growing animals. Other practical way is by intensifying the selection on the forages offered to the animal. A typical scene in goat and sheep smallholder enterprises is a bike or motorcycle carrying unselected forages (mostly mature forages) to housed animals. If the animals are exposed to mature forages the feed intake and digestibility will be lower and animal production limited. A better approach would be to select and cut younger, higher quality forages so that feed intake, digestibility animal performances increase.

CONCLUSION

The delivery system of various production inputs play an important role for transferring technologies to goat and sheep smallholder producers. The farmers have been observed to willing to pay for certain inputs that could increase the animal productivity such as drugs, improved animal breed or feed supplement. It is therefore suggested that low adoption of technological innovation might be limited by inappropriate delivery system of inputs. Due to the typically small size of animal ownerships of the smallholder the delivery system of inputs required the involvement of middleman that acts as input distributor to the smallholders.

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THE USE OF WATER RESERVOIR (EMBUNG) TO INCREASE FOOD AND NUTRITION AVAILABILITY AND FARMER'S INCOME IN UPLAND

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ABSTRACT

The main problem in upland is limited irrigation water that obtained only from rainfall. This condition resulted high risk of harvesting, low intensity of planting and low activity of farming labor. Conservation farming system using farm reservoir is an alternative solution to solve this problem, where the rainfall during rainy season is collected in such collector or water reservoir (embung) and be used in dry season. The use of water from water reservoir for vegetable farming could increase the availability of food and nutrition throughout the year and farmers' income. Study on then role of water reservoir on farmer's food and nutrition availability and income in upland has been assessed by introducing cropping patterns with some vegetables in upland area of Tulungagung Regency. In general, water reservoirs which have been built in some places in East Java including in Tulungagung regency have not been used optimally. Farmers don't grow any plant in dry season. The existing farming pattern in rainy season is (maize-soy bean). Two cropping patterns a year consisted of combination between farmer farming in rainy season and introducing farming of vegetables in dry season using water reservoir, i. e.: 1)(maize-soy bean-pechay+young maize) and 2)(maize-soy bean-kangkong+yard long bean), were compared to the old farmer cropping pattern a year, i. e. (maize-soy bean). It proved, that the introducing vegetables farming of (pechay+young maize) and (kangkong+ yard long bean) can increase farmer's income and fulfill the need of food and nutrition availability for farmers in upland. Farming of (pechay+young maize) needs 710 m3 of water, while (kangkong+yard long bean) needs 921 m3 water per ha for plants watering. Recommended cropping pattern during a year in upland is (maize-soy bean-pechay+young maize) with total income as much as Rp. 3,912,850.- per 2.500 m2 land used.

Key words : Upland, Water reservoir, Food and Nutrition, Income, Vegetable.

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INTRODUCTION

Agriculture One of the government's programs to fight against poverty is increasing the people's food and nutrition in the areas which lack of food. In general, those areas are located in the marginal lands that are not productive in the dry season and only produce rice in the rainy season with low planting intensity. Short rainfall causes high risks of harvesting failure, low planting intensity and less production and also reducing the activities of farming labor. To support the application of the program in increasing the food and nutrition availability for the people in upland, technique of harvesting water using water reservoir *(embung)* is considered as suitable alternative technology to reserve water in the rainy season and use it to water plant in the dry season (Arifin *et al.*, 1996; Arifin *et al*., 2005).

The water reservoir system has been developed successfully in the regency of Pati, Central Java and the farmers have made 100 water reservoirs (Wardana *et al.*, 1989). The system could increase planting intensity, planting area and land productivity in the rain fed areas (Moya *et al*, 1986; Waston *et al.*, 1987; Syamsiah *et al.*, 1989; Arifin *et al*., 1999; Endang *et al*., 2005). The existing of water reservoir could increase the income of the farmer's farming via increasing of the planting intensity. The high income of the farmers can be measured by the family consumption of better nutrition's content food (Arifin *et al*, 1996; Wardana *et al*., 1997). The net-income of the farmers who own water reservoir was higher than the income of the farmers who do not have any water reservoir. It was Rp. 1,285,655.- and Rp. 714,145.- per ha per year, respectively (Arifin *et al*., 1996).

According to Fagi *et al.*, 1987, suitable farming is complementary combination of some components of farming technology that give maximum benefit. Used of mixed-farming with complete and proper dosage of fertilizer can increase land fertility and production per wide and time unity (Arifin and Toha, 1996), which in turn increase availability of the food and nutrition for the whole family that enough for all year long. Increasing of family nutrition can be done by providing the plants which have highly protein, vitamins and minerals contents.

Study on the role of water reservoir on increasing of food and nutrition availability in upland areas has been assessed through introducing cropping patterns with some vegetables in upland area of Tulungagung Regency, i.e. in the village of Kates, Kauman district, with the agro ecology including Oxi 3131 (Legowo *et. al*., 1996), during the dry season of 1999.

INTRODUCING CROPPING PATTERNS

In general, the cropping pattern applied by the farmers during rainy season in the studied location is (maize-soy bean). Maize usually planting at the beginning of the rainy season in the month of October, while the soybean in February. The harvesting age of the maize and soybean are 3 months. The most variety used by farmer for maize is Local, while soy bean is Galunggung.

In the dry season after harvesting soy bean, farmers do not plant anything (fallow), because there is no water. Meanwhile, some water from the reservoir is not used. In this study, during the dry season,

water of the reservoir was used to water plants of introduction farming with mixed cropping pattern of vegetables, i. e. (pechay + young maize) and (kangkong + yard long bean). By the existence of water reservoir, farmers could plant 2 kinds of cropping pattern alternatives per year in the dry-season right after old cropping pattern (maize - soy bean) in the rainy season, as follows:

1. (maize-soy bean-pechay+young maize);
2. (maize-soy bean-kangkong+yard long bean).

Comparation of those 2 kinds of cropping pattern alternatives with the old farmer's cropping pattern (maize-soy bean) shown in (Table 1).

Table 1. Farmer's cropping pattern and (farmer + introduction) cropping pattern using water reservoir irrigation a year in upland

Cropping pattern	**Variety**	**Planting space (cm x cm)**	**Harvesting age (d. a. p. = days after planting)**	**Irrigation**	**Pests and diseases control**
Farmer's cropping pattern					
1. Maize-soy bean					
Maize	Lokal	60x60	80	None*	None
Soy bean	Galunggung	25x25	90	None*	None
(Farmer + introduction) cropping pattern					
1. Maize-soy bean–pechay+young maize					
Maize	Lokal	60x60	80	None*	None
Soy bean	Galunggung	25x25	90	None*	None
Pechay	Cai Sim	25x25	30	Water reservoir	Optimum
Young maize	Pioner 4	100x25	62	Water reservoir	Optimum
2. Maize-soy bean-kangkong+yard long bean					
Maize	Lokal	60x60	80	None*	None
Soy bean	Galunggung	25x25	90	None*	None
Kangkong	Chia Tai	10x10	23	Water reservoir	Optimum
Yard long bean	Usus Hijau	50x30	83	Water reservoir	Optimum

*During rainy season.

The need of fertilizer for each cropping pattern are presented in Table 2.

Table 2. The need of fertilizer for each commodity

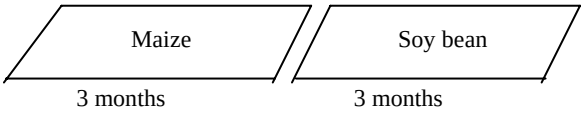
Cropping pattern	**Manure (ton/ha)***	**Urea (kg/ha)**	**SP36 (kg/ha)**	**KCl (kg/ha)**
1. Farmer's cropping pattern:				
Maize-soy bean				
Maize	2	100	50	-

Soy bean	2	25	25	-
1. (Farmer+introduction) cropping pattern:				
Maize-soy bean-pechay+young maize				
Maize	2	100	50	-
Soy bean	2	25	25	-
Pechay	10	120**	-	-
Young maize	10	300***	100*	100*
2. Maize-soy bean-kangkong+yard long bean				
	2	100	50	-
Maizeg	2	25	25	-
Soy bean	10	100****	50****	5****
Kangkong	10	100*****	100*	100*
Yard long bean				

* Given during land cultivation
** Given 2 times, ½ during land cultivation and ½ on the14 d. a. p (days after planting)
*** Given 2 times, 1/3 during land cultivation and 2/3 on the 30 d. a. p (days after planting)
**** Given on the 10 d. a. p (days after planting)
***** Given 2 times, ½ during land cultivation and ½ on the 21 d. a. p (days after planting).

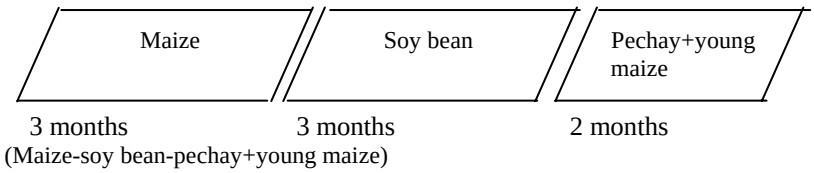
A picture of the comparison between the farmer's planting pattern and (farmer + introduction) cropping pattern in one year is presented in Figure 1.

Farmer's cropping pattern:

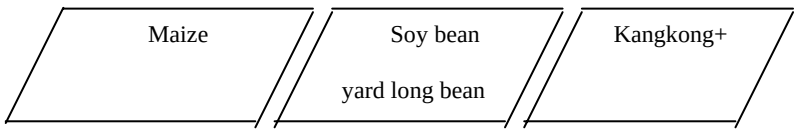


(Maize-soy bean)

(Farmer+introduction) cropping pattern:



(Maize-soy bean-pechay+young maize)



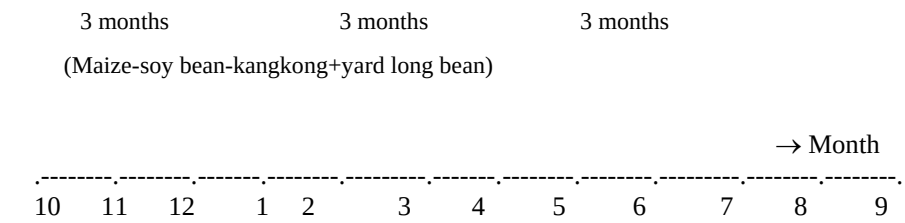


Figure 1. Cropping pattern of farmer and (farmer+introduction) during a year.

QUALITY OF HARVESTING VEGETABLES

Compared to the quality of the harvesting yield samples of the same commodity taken from the public market, the weight of the harvesting yield from the introduction cropping pattern was higher, while the length was also accepted by the public market, since there was a small difference only (Table 3).

*Table 3. Weight and length per unit and degree of the freshness (water content) of harvesting yield**

Commodity	Weight (g)	Length (cm)	Water content (%)**	Standard of water content (%)***
Pechay	9,8-17,6 (13)	21,7-29,5 (23)	90,8-92,2	92,2
Young maize	164-238 (167)	17-22 (20)	88,6-89,5	-
Kangkong	11,5-20 (11)	18-34 (28)	89,6	89,7
Yard long bean	30-120 (11)	21-66,5 (45)	87,5-88,5	88,5

* Numbers in the brackets show the average weight or length of the harvesting yield samples taken from the public market.
** Was measured by Rangana, 1979 method.
*** According to the Directorate of Nutrition, the Health Department of Republic Indonesia, 1972.

PRODUCTION

The production yield gained from farmer's cropping pattern and the (farmer+introduction) cropping pattern was presented in Table 4. In that table, it is clearly seen that the harvesting yield of the cropping pattern that the farmers use the water from the water reservoir is higher. Similarly the yield of the cropping pattern of (farmer+introduction) is higher than the farmer's cropping pattern (Table 4). The highest increasing of the total yield is gained by the cropping pattern of (maize-soy bean-pechay+young maize) as much as 719% (Table 4).

Table 4. Production yield of farmer's planting pattern and (farmer+introduction) cropping pattern

Commodity	Variety	Planting space (cm2)	Yield (kg/ha)	Total yield equal with maize yield (kg/ha)**	Increasing of total yield compare to yield of farmer's farming pattern (%)***
Farmer's farming pattern:					
1. Maize-soy bean				3.308	124
Maize	Lokal	60x60	1.900*		
Soy bean	Galunggung	25x25	800*		
(Farmer+introduction) farming pattern:					
1. Maize-soy bean-				19.194	719
pechay+young maize	Lokal	60x60	1.900*		
Maize	Galunggung	25x25	800*		
Soy bean	Cai Sim	25x25	11.600		
Pechay	Pioner 4	100x25	6.600		
Young maize					
2.Maize-soy bean-					
kangkong+yard long bean	Lokal	60x60	1.900*	16.961	636
Maize	Galunggung	25x25	800*		
Soy bean	Chia Tai	10x10	9.000		
Kangkong	Usus Hijau	50x30	5.750		
Yard long bean					

* = Seed/dried seed.

** = $\frac{\text{Price of the commodity (x1, …xn) /kgxTotal yield of the commodity (x1,…xn) kg /ha}}{\text{Price of the local maize/kg}}$

*** = $\frac{\text{Price of the commodity (x1,…xn) /kgxTotal yield of the commodity (x1,…xn) kg/ha}}{\text{Price of the local maize/kg}}$: Total yield of farmer's farming pattern equals to the maize yield

X 100%.

FOOD AND NUTRITION AVAILABILITY

The nutrition value gained from the cropping pattern in the dry season with the introduction of farming pattern (pechay+young maize) or (kangkong+yard long bean) is much higher than the farmer's

cropping pattern in rainy season (maize-soy bean) as shown in Table 5. Obviously, the application of introduced cropping pattern could highly increase vitamin C, especially with the one of (pechay-young maize).

Table 5. Comparison between nutrition value gained from the farmer's cropping pattern and (farmer+introduction) cropping pattern as wide as 2,500 m^2 in one year

Nutrient Components	Cropping pattern		
	Farmer	(Farmer+introduction)	
	Maize-soy bean	Maize-soy bean-pechay+young maize	Maize-soy bean-kangkong+yard long bean
Protein (g)	109.130	234.800	185.499
Fat (g)	52.872	96.741	60.832
Carbohydrate (g)	384.667	607.687	553.840
Calcium (mg)	496.750	6.162.850	2.174.965
Phosphor (mg)	2.264.400	4.873.140	6.794.295
Iron (mg)	26.260	107.677	73.184
Vitamin A (IU)	2.400.250	121.686.050	105.238.225
Vitamin B (mg))	3.764	7.354	6.268
Vitamin C (mg)	0	2.705.460	1.076.985
Water (g)	66.300	3.869.256	2.438.272
Calorie (cal.)	2.179.625	3.279.185	3.110.915

If the whole harvesting yield gained by the cropping pattern of the 2,500 m^2 is consumed by the farmer's family themselves, with the average of the family members is 4 adults (men or women), nutrition availability per day for each person in one year can be calculated as in the Table 6. In order to know whether the number of that nutrition is enough to care the healthy life, it is compared with the sufficient nutrition per person per day according to Winarno, 1993.

Table 6. Comparison of nutrition availability/person/day between cropping pattern of (farmer) and (farmer+introduction) on 2,500 $m^{2\ of\ land}$

Nutrition components	The need of nutrition /person/day	The availability of nutrition/person/day		
		Farmer's cropping pattern	(Farmer+introduction) cropping pattern	
		Maize-soy bean	Maize-soybean-pechay+young maize	Maize-soybean-kangkong+yard long bean
Protein (g)	45	75	161	127
Calcium (mg)	500	340	4.221	1.490

Phosphor (mg)	475	1.551	3.338	4.654
Iron (mg)	18	18	74	50
Vitamin A (IU)	3.750	1.644	83.347	72.081
Vitamin C (mg)	30	0	1.853	738
Calorie (cal.)	2.090	1.493	2.246	2.131

There was a deficiency on calcium, vitamin A and C from the farmer's cropping pattern of (maize-soy bean). Meanwhile, the introduced cropping pattern of (maize-soy bean-pechay+young maize) is a good source of vitamin A, while (maize-soy bean-kangkong+yard long bean) is a good source of phosphor. From the value of the nutrition components available per person per day, the cropping pattern of (maize-soy bean-pechay+young maize) and (maize-soy bean-kangkong+yard long bean) can suffice the needs of healthy life.

THE NEED OF WATER FOR FARMING IRRIGATION

The need of water for farming irrigation is presented in Table 10. Watering was done in the afternoon when it was necessary by spraying sufficient water around the root of the plants. The need of water for irrigation of the introduced cropping pattern is presented in Table 7.

*Table 7. The need of water for farming irrigation of introduced cropping pattern**

Cropping pattern	**Variety**	**Planting space (cmxcm)**	**Harvesting age (days)**	**The need of water (m^3/planting season/ha)**		
				Land cultivation	**Plant cultivation**	**Total need of water**
1.(Pechay+young maize)				303	710	1.013
Pechay	Cai Sim	25x25	30	-	-	-
Young maize	Pioner 4	100x25	62	-	-	-
2.(Kangkong+yard long bean)				303	921	1.224
Kangkong	Chia Tai	10x10	23	-	-	-
Yard long bean	Usus Hijau	50x30	83	-	-	-

* Was done during dry season.

ECONOMIC ANALYSIS

Production cost per year of the (farmer+introduction) cropping pattern of (maize-soy bean-pechay-young maize) and (maize-soy bean-kangkong+yard long bean) is higher than farmer's cropping pattern of (maize-soy bean). This is because of the existence of water reservoir, so that in dry season the farmers can plant vegetables. With the existence of water reservoir, the planting intensity increases from 200% to 300%. The highest additional expenses of the (farmer+introduction) cropping pattern is for the input-expenses in dry season. However, this additional expenses can be trade-off by gaining production value.

In reality, the expenses of both cropping pattern of (farmer+introduction) is not quite different, but the income gained from each cropping pattern shows the big difference (Table 8). This is because of the difference between the production value gained in each cropping pattern. Highest income and efficiency of the farming is gained by the cropping pattern of (maize-soy bean-pechay+young maize) as shown by R/C ratio as much as 2.858 (Table 8), and then followed by the cropping pattern of (maize-soy bean-kangkong+yard long bean). Therefore, those two introduced cropping patterns are more suitable to be developed compared to farmer's cropping pattern of (maize-soy bean).

*Table 8. The total production cost, production value and income of the farmers in the cropping pattern of farmer and (farmer+introduction)**

Cropping pattern	Production cost (Rp/0.25 ha)	Production value (Rp/0.25 ha)	Income (Rp/0.25 ha)	R/C ratio
1. Farmer:				
Cropping pattern of A1	866,00	1,033,750	166,50	1.192
2. (Farmer+introduction):				
Cropping pattern of B1	2,105,900	6,018,750	3,912,850	2.858
Cropping pattern of B2	2,146,600	5,305,150	3,159,150	2.472

*Based on the value in 1999

Cropping pattern of A1 : maize-soy bean

Cropping pattern of B1 : maize-soy bean-pechay+young maize

Cropping pattern of B2 : maize-soy bean-kangkong+yard long bean

CONCLUSIONS AND SUGGESTIONS

Yearly cropping pattern of (maize-soy bean-pechay+young maize) and (maize-soy bean-kangkong+yard long bean) can increase food, nutrition and income of the farmers in upland. Those can suffice the needs of nutrition per person per day. (Maize-soy bean) is the farmer's cropping pattern in rainy season, while (pechay+young maize) and (kangkong+yard long bean) are the introduced cropping pattern in dry season. The income of the farmers with the existing cropping pattern of (maize-soy bean-pechay+young maize) was Rp. 3,912,850.-, which is lower than the introduced cropping pattern of (maize-soy bean-kangkong+yard long bean) Rp. 3,159,150.- per year for the land size of 2,500 m^2.

The cropping pattern of (pechay+young maize) per ha in dry season needs water as much as 710 m^3, that can be fulfilled by one water reservoir sized 16 m x 16 m x 3 m, while cropping pattern of (kangkong+yard long bean) per ha needs water of 921 m^3, that can be fulfilled by the water reservoir sized 18 m x 18 m x 3 m. Each water reservoir can be used by 10 farmers who have own land with the average size of 1,000 m^2. Based on the gained income, recommended cropping pattern during a year in upland is the (maize-soy bean-pechay+young maize).

SUGGESTIONS FOR IMPLEMENTING THE TECHNOLOGY

For implementing the introduced vegetables farming during dry season as the continued farming after the old farmer's farming during rainy season, some suggestions are needed to be followed, such as:

- Water reservoir (*embung*) should be in good condition;
- Prepare the field by watering, ploughing, digging and giving the base fertilizer;
- All vegetables are planted individually. To reduce evaporation of the soil water, after planting the land should be covered by the mulch;
- The fertilizer given are the base and continuing ones, as presented in Table 2;
- Watering the plants in the afternoon, only for the soil surrounding the plant, especially to the plant's roots;
- Diseases and pests controlling should be done soon after a symptom of disease or pest attack appear;
- Harvesting time was determined in Table 1.

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ESTABLISHMENT OF TECHNOLOGY INFORMATION AND AGRIBUSINESS NETWORK SYSTEM IN EAST JAVA

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ABSTRACT

Decentralization, globalization and market-oriented agribusiness have forced all relevant parties in agribusiness to get access in actual and factual information on supply and demand sides. Actually such information are available, but not well systematically documented and they scattered in various institutions. Developing electronically agribusiness networking systems that all interested stakeholders, either farmers, private sectors and government officials involved could increase efficient used of the information. However, the effort faces various problems, since lack knowledge on information technology up to the cost in developing the networking. Collaboration among all parties could solve the problem.

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I. Background

Nowadays, decentralization era, economy globalization, and market-oriented business requires agribusiness executors (farmers, traders, businessmen) at each commodity producing centers to get input informations in terms of marketing aspects such as selling site, product prices, labour wages, production supply prices, credit loans, transportation cost, and technology information. They will decide business plans based on those information. Similarly, government officials, extension-workers and researchers also need information for formulating development program, public policies, producing extension materials, and as inputs for developing research proposals. In modern business system, information is considered as an important input besides production supplies, labour force, and capital (Ruthenberg, 1980).

Actually such needed information are available in an abundant quantity. However, it is not properly well documented systematically and widely scaterred in various institutions, so it is not easy to get the information timely. For examples: information on: (1) production supplies is possessed by production supplies agent; (2) agricultural technologies are possessed by research institutions and universities; (3) labour wages and product prices are possessed by producers/ farmers; (4) credit loan is held by banking institutions; (5) export quota is in the hand of importers. In addition: transportation is in charge of private sector while public policy is in the hand of the government. Information on labour wages, transportation service, production supplies and product prices in each district throughout East Java province is considerably varied depending on products' comparative superiority, labour market, and local cultures (Pangarsa *et al*, 2002).

These scattered information could be utilized more through developing a joint information network system among producers/providers, governments and the users. It will create efficiency on farm-business cost, cheaper products, accelerates technology transfer, optimum allocation of biodiversity and labour force, minimize business and product competition, and an efficiency on transportation cost. One of more applied information network system is electronic networking using internet technology (Anonymous, 1995).

II. Information network and its problems

2.1. Agribusiness information network system

The proposed information network system should involve both formal and informal institutions either as information producers/ providers or as users. The agribusiness network system

should cover upstream industry (fertilizer, seed, seedling, pesticide producers), producers (farmers and farmers groups), downstream industry (agroindustries, processing units, exporters/ importers), and supporting institutions (research and banking institutions). In the network system, there should be an institution assigned as a networking "nave" playing as "motive power" to coordinate, manage information flow, and interconnect among components of the system. The "nave" should make agreement with the involved network components on information presentation, access procedure, information exchange, and transaction contract among network components. The nave not only interconnects networking components locally but also g;obally with foreign farmers, institutions, and non-government organizations including APEC forum. After the communication network has been established, it can be followed by concrete actions e.g. agribusiness cooperation, farmer apprenticeship, skill courses, cadres exchange, etc.

The scheme of the information technology and agribusiness networking system can be illustrated as figure 1. Meanwhile the involved institutions and the kinds of information provided can be seen in table 1 in which AIAT play as the network nave.

Table 1. Institutions, provided information, and institutions' functions in the network system

No.	Institution	Kind of information provided	Function / status
1.	AIAT of East Java	Research result on innovation technology, facility service of laboratory, analysis of potency, opportunity, and future prediction of commodity, promotion of research-result superior commodities	The network nave or motive power that can give service on consultation and information, interconnects among components both inside and outside the network system.
2.	Research institutions and universities	Research result on innovation technology, facility service of laboratory, analysis of potency, opportunity, and future prediction of commodity, promotion of research-result superior commodities	Both information provider and user
3.	Provincial, city and district Administration / Government	Schedule of development program, list of exporters & importers and business executors, potency of both human and nature resources	Both information provider and user
4.	Office for Agricultural Information and Extension (OAIE)	Extension materials, promotion of farmer superior commodities, facility service on extension	Both information provider and user
5.	City/ District Agriculture Services (CAS/ DAS)	Program planning, promotion of superior commodities and agrotourism, licensing matters.	Both information provider and user
6.	Provincial/ City/ District Agency for Agricultural Research and Development	Research-result technology, policy analysis, research-version agricultural development program	Both information provider and user
7.	District Reliable Farmers Groups	Promotion of superior commodities; price, quality, and quantity of products, labour force wages.	Either information provider or user

8.	Other business executors (Farmer, businessman, NGO)		Users
9.	Center Bureau for Statistics (CBS)	General information / data	Both information provider and user
10.	TV and Radio Broadcast	Success story, scientific findings, scientific discussion.	Information provider
11.	Exporter / Importer	Standard quality of export products, accepted product price, intended product volume.	Both information provider and user

Source: Sudarmini and Mansyur, 2001; Anonymous, 2001; Anonymous, 1999

2.2. Problems

The problems faced in establishing the electronic networking system, among others are: (1) Capability of human resources (i.e. farmers, public, government officials such as extension workers and even researchers) is still weak in mastering to manage information technology. Just few people that can access internet (2) The cost for establishing the network is relatively expensive (3) Not all institutions are prepared to join the electronic network system (e.g. farmers group) realizing that they are still hesitate will enjoy the benefit from the net-work. (4) Presenting product or information through electronic media such as internet should be done attractively that needs special skill (5) The information should be provided not only in local language and Bahasa Indonesia but also in English so that the farmers in the world could accessed it. (6) Information in the website should update data daily, weekly, monthly, and annually. It takes time, and needs special skill-person, and actual information; (7) There should be a governmental institution that collects and processes data on labour force and wages, transportation service, post-harvest costs, etc. realizing that private institution won't be prepared for this (they are still think that they would not get benefit directly).

III. The required activities

Considering the problems and difficulties faced in establishing the agricultural networking system, the following activities are required:

1) Training on information technology for officials, researchers, extension-workers, and outstanding farmers on how to operate computer, getting access internet, send e-mail, and particularly for certain interested person how to develop and manage web-site;
2) Establishing and managing website installation in each institution/ component involved;
3) Organizing farmers groups to access the internet and offer their farming products which have been quantity and quality standardized;
4) Training on product advertisements so that they can produce the attractive and interesting ones;
5) Stipulating MoU among research institutions, universities, local government, and all parties involved in the network includes agreement on producing not overlapped but complementary information;

6) Presenting information on farmers' superior products and its prices to be exchanged with their partners in APEC member economies;

7) Positioning official or informant at each commodity center or main market in order to collect and process price information.

After the network system has been established especially interconnection with other countries the following activities can be done:

1) Exchange applied information technology and SciTech information among APEC member economies;

2) Develop collaboration on agricultural marketing, commodity export/ import, production supplies, and farming tools and machinery;

3) Exchanging development cadres among APEC member economioes through activities such as farmers' training courses and apprenticeship, and other informal skill education;

4) Doing cooperation on research and assessment among research institutions of APEC members;

5) Estabkish agreement on commodity export/ import quota and tariff to increase profit and minimize loss among farmers of the APEC members.

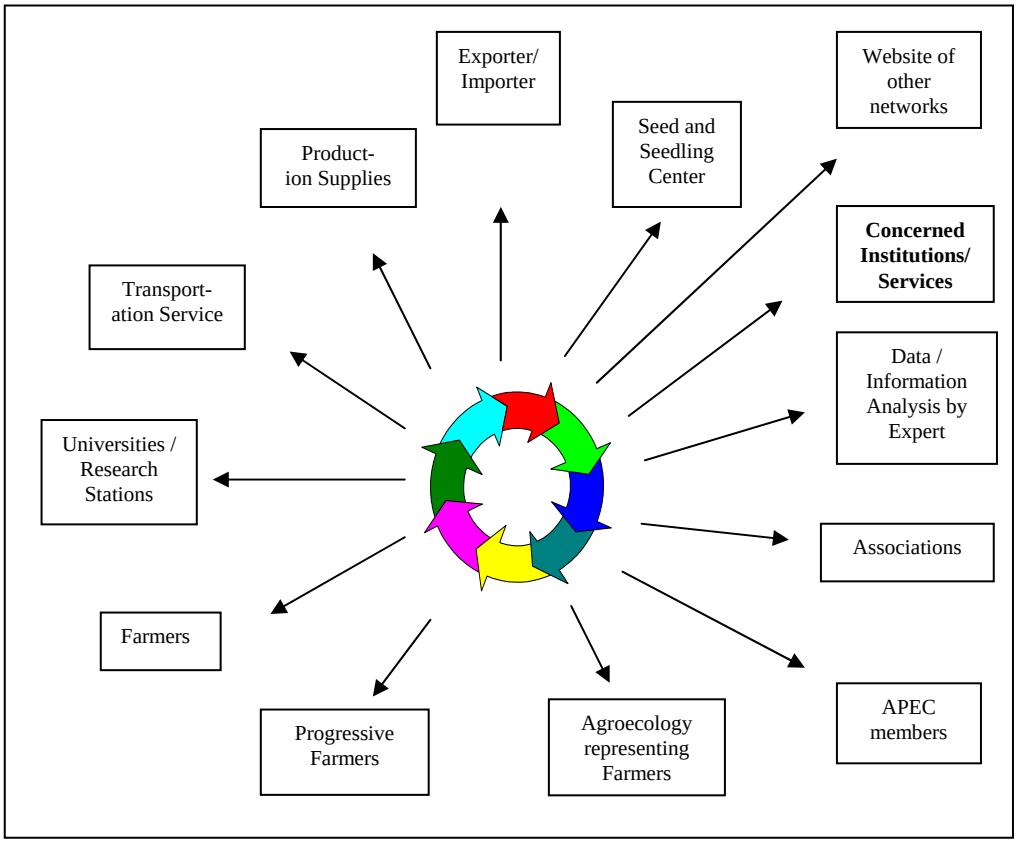

Figure 1. Agribusiness Information Network In East Java

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INFORMATION AND COMMUNICATION TECHNOLOGY IN SUPPORTING FARMERS TO ACCESS AGRICULTURAL INFORMATION

E. Eko Ananto and Retno Shm[18]

ABSTRACT

The information and communication technology is more important to develop suitable for farmers to increase the access of agricultural information. The district information center that established at strategic location can be used as a one stop shop for the farmers to information exchange and information access through electronic media (online through internet media and offline through CD-ROM and database) and conventional media (printed media) and personal (face to face) communication. This center must be supported by national farming website appropriate for poor farmers to gain benefit and impact effectively. The center utilization can be increased effectively to end-users at village level (grass-root level) through sub-district agricultural information center established by District Government as agribusiness terminal replicated from the district agricultural information centre. The information networking system in the all agricultural development system will support the dissemination of the agricultural development to people widely and easily. Besides that, the mechanism of information sharing between institutions related to support this system could be developed. Unfortunately, agricultural information established by MOA through national farming website can present the current, holistic, and comprehensive information appropriate to users, especially to poor farmers. MOA must have good coordination system between internal and external institution including central and district institution for the information access mechanism implementation.

Key words: ICT, access, agricultural information

[18] Indonesian Agency for Agricultural Research and Development (IAARD)

INTRODUCTION

Agriculture is the best safety net against poverty and hunger. Agriculture is not just a food-producer, but also the backbone of the livelihood and ecological systems of most developing countries. Every country, must have an agriculture compact with three components: defending the gains already made; extending the gains made into marginal areas such as the semi-arid and mountainous areas; and exploring new gains, using agro-processing and diversification, among other things. To accomplish these, institutional structures to manage such changes are necessary. Before there are misconceptions about small farmers in developing countries, such as the notion that farmers in poor areas could not produce because there were no accessible markets and agro-industries, and that there was no private investment in farm schemes because there was no rural infrastructure. To address those issues, the international community must make policies for promoting partnerships between farmers and private sectors, as well as partnerships between local governments and non-governmental organizations (Johannesburg, 2004)

Defining business is key, however, because business has a huge range of actors, such as cooperatives, small local enterprises, national enterprises and multinational corporations, partnerships are needed. The role of business in agriculture had traditionally been to provide services and products to farmers. Some food-processing companies had started sustainable agriculture initiatives and were working together with local communities to meet marketing demands.

A successful way to increase the production of small farmers so that they had a marketable surplus, is through the use of credit financing. However, many financial institutions and insurance companies are reluctant to engage in that activity in countries, because unpredictable weather patterns.

Farmers' incomes vary greatly from year to year because prices of farm products fluctuate depending upon weather conditions and other factors that influence the quantity and quality of farm output and the demand for those products. A farm that shows a large profit in one year may show a loss in the following year. Many farmers -primarily operators of small farms- have income from off-farm business activities, often greater than that of their farm income.

In supporting farmers to access agricultural information, Indonesian Agency for Agricultural Research and Development (IAARD) Ministry of Agriculture (MOA) have been implemented the Poor Farmers Income Improvement through Innovation Project (PFI3P) since 2004 until 2008, and covered 1000 village target area in marginal land. This project will develop information resources of importance to the poor farmers and facilitate poor farmers' access to them, which information and

communication technology (ICT) will be used to increase access of farmers to agricultural information resources to support agricultural innovation.

LESSON LEARNED: THE UTILIZATION OF ICT

Farmers make many managerial decisions. Their farm output is strongly influenced by the weather, disease, fluctuations in prices of domestic and foreign farm products, and farm programs. In a crop operation, farmers usually determine the best time to plant seed, apply fertilizer and chemicals, harvest, and market. They use different strategies to protect themselves from unpredictable changes in the markets for agricultural products. Many farmers carefully plan the combination of crops they grow so that if the price of one crop drops, they will have sufficient income from another to make up for the loss. Others, particularly operators of smaller farms, may choose to sell their goods directly through farmers' markets, or use cooperatives to reduce their financial risk and to gain a larger share of consumers' expenditures on food.

Farmers who plant ahead may be able to store their crops or keep their livestock to take advantage of better prices later in the year. Those who participate in the risky futures market -in which contracts and options on futures contracts on commodities are traded through stockbrokers- try to anticipate or track changes in the supply of and demand for agricultural commodities, and thus changes in the prices of farm products. By buying or selling futures contracts, or by pricing their products in advance of future sales, they attempt to either limit their risk or reap greater profits than would normally be realized. They may have to secure loans from credit agencies to finance the purchase of machinery, fertilizer, livestock, and feed. Like other businesses, farming operations have become more complex in recent years, so many farmers use computers to keep financial and inventory records. They also use computer databases and spreadsheets to manage breeding, dairy, and other farm operations.

Responsibilities of farmers range from raising livestock, to operating machinery, to maintaining equipment and facilities. The size of the farm often determines which of these tasks farmers will handle themselves. Operators of small farms usually perform all tasks, physical and administrative. They keep records for tax purposes, machinery services, maintenance of buildings, and growing of vegetables and raising of animals. Operators of large farms, on the other hand, have employees who help with the physical work that small-farm operators do by themselves. Although employment on most farms is limited to the farmer and one or two family workers or hired employees, some large farms have 100 or more full-time and seasonal workers. Some of these employees are in non-farm occupations, working as truck drivers, sales representatives, bookkeepers, and computer specialists.

The work of farmers and agricultural managers are often strenuous; work hours are frequently long; and they rarely have days off during the planting, growing, and harvesting seasons. Nevertheless, for those who enter farming or ranching, these disadvantages are outweighed by the quality of life in a rural area, working outdoors, being self-employed, and making a living working the land. Farmers and farm managers on crop farms usually work from sunrise to sunset during the planting and harvesting seasons. During the rest year they plan next season's crops, market their output, and repair machinery; some may earn additional income by working a second job off farm.

On livestock producing farms and ranches, work goes on throughout the year. Animals, unless they are grazing, must be fed and watered every day, and dairy cows must be milked two or three times a day. Many livestock and dairy farmers monitor and attend to the health of their herds, which may include assisting in the birthing of animals. Such farmers rarely get the chance to get away unless they hire an assistant or arrange for a temporary substitute.

On very large farms, farmers spend substantial time meeting with farm managers or farm supervisors in charge of various activities. Professional farm managers overseeing several farms may divide their time between traveling to meet farmers or landowners and planning the farm operations in their offices. As farming practices and agricultural technology become more sophisticated, farmers and farm managers are spending more time in offices and at computers, where they electronically manage many aspects of their businesses. Some farmers also spend time at conferences, particularly during the winter months, exchanging information.

Farmers need to keep abreast of continuing advances in agricultural methods both in the national (Indonesia) and abroad, as well as changes in governmental regulations that may have impact on methods or markets for particular crops. Besides print journals that inform the agricultural community, the spread of the Internet allows quick access to the latest developments in areas such as agricultural marketing, legal arrangements, or growing crops, vegetables, and livestock. Electronic mail, on-line journals, and newsletters from agricultural organizations also speed the exchange of information directly between farming associations and individual farmers.

Farmers need the managerial skills necessary to organize and operate a business. A basic knowledge of accounting and bookkeeping is essential in keeping financial records, while a knowledge of credit sources is vital for buying seed, fertilizer, and other inputs necessary for planting. It is also necessary to be familiar with complex safety regulations and requirements of governmental agricultural support programs. Computer skills are increasingly important, especially on large farms, where computers are widely used for farm record keeping and business analysis. For example, some farmers use personal computers to access the Internet to get the latest information on prices of farm products and other agricultural news.

Despite the expected continued consolidation of farm land and the projected decline in overall employment of farmers, an increasing number of small-scale farmers have developed successful market niches that involve personalized, direct contact with their customers. Many are finding opportunities in organic food production, as more consumers demand for food grown without pesticides or chemicals. Others use farmers' markets that cater directly to urban and suburban consumers, allowing the farmers to capture a greater share of consumers' food dollars. Some small-scale farmers, such as some dairy farmers, belong to collectively owned marketing cooperatives that process and sell their product. Other farmers participate in community-supported agriculture cooperatives that allow consumers to directly buy a share of the farmer's harvest.

Farmers strive to improve the quality of agricultural products and the efficiency of farms. Others whose work is related to agricultural products include agricultural engineers, agricultural and food scientists, agricultural workers, and purchasing agents and buyers of farm products. In this moment, the ICT is more important to develop suitable system for farmers to increase the access of agricultural information.

Many countries apply several ICT supporting the farming activities. Markets aren't only for the rich. Certain kinds of information, however, convey advantages to those have the right data at the right time. Until recently, only the relatively wealthy had swift access to relevant market information. In the early 20th century, with their home ticker-tape machines to the day-traders of recent decades with their desktop PCs, and now, to farmers in developing countries who are beginning to own mobile phones to access the market information. With more than 320 million mobile subscribers in China already, and 150 million mobile phones among the 200 million phones projected for India (where mobile phone use already exceeds land line use) by 2007, the mobile phone looks like tomorrows most likely become an access device for agricultural market information.

Small farmers worldwide have traditionally been at the mercy of middlemen and victims of their own lack of timely information. If pilot projects like KACE in Kenya, Peru's Huaral Valley Network, the wireless experiments in India by Brewer and his colleagues' ICT4B (Information and Communication Technology for Billions) organization or any of dozens of other experiments underway now around the globe prove successful, the mobile internet might make a real economic difference in the lives of rural farmers, especially in the developing world, where wireless technology can leapfrog landline infrastructure.

India abounds in rural and urban infrastructure projects of both the top-down and grassroots-up variety. The wireless pony express of Daknet uses thousands of buses equipped with Wi-Fi transceivers to pick up and deliver e-mail wirelessly from village kiosks. Malappuram, India's "first e-literate district," provides basic knowledge of computer and Internet usage to more than 600,000 people. Madhya Pradesh State Initiative built an intranet to give villagers direct access to government documents: in the past, farmers had to pay $100 to officials for a copy of a land title. Now, the same titles can be ordered online for less than a dollar. Deeshaa Network uses the same Drupal software that the Howard Dean campaign used so effectively as a groupblog and information portal dedicated to "bring about greater participation in the economic development of India by providing a platform to collaborate and cooperate." Nabanna, a Unesco-implemented project, provides ICT access and training for women in rural communities in West Bengal. Peoplelink and CatGen help rural artisans increase their profits by eliminating middlemen and selling their products directly over the Internet.

Thailand Canada Tele-center Project (TCTP) is one of the planning study to test the most promising concepts under actual field conditions for the delivery of ICT services in a commercially sustainable manner in the rural and remote, as well as underserved, areas in Thailand. Working with several agencies of the Government of Thailand, together with private sector providers and the World Bank, the approach is to promote “Universal Access” to ICT services in villages by locating several phones and computers with internet access at a single location that is easily accessible to the community. This one location is often referred to as a “telecentre”. The primary objective of TCTP is to demonstrate that valuable ICT services can be delivered to people in the rural and remote areas in a financially sustainable manner.

INCREASING THE ACCESS OF AGRICULTURAL INFORMATION THROUGH ICT

The number of population in most rural area in Indonesia is the poor farmers, for several reasons. One of the reasons was because the poor farmers could hardly make any innovative way of producing and marketing in order to improve their income. They could not innovate way of producing and marketing because they lack of access to information and, in some cases, lack of access to the market and sources of technology; they lack of access to the market because the infrastructure might not support the attempt. For the purpose of improving the access of the poor farmers to agricultural information on the market and on the sources of production technology, the MOA intend to design a model of the development of agricultural information resources through Poor Farmers Income Improvement through Innovation Project (PFI3P). This project is going to be implemented in about 1,000 villages in five districts. The Project will enhance poor farmers’ capacity to adopt innovative agricultural production and marketing methods by better targeting village-level public investments to location-specific needs, providing farmers with access to information, and reorienting the focus of agricultural research to the needs of marginal rainfed areas. The Project will comprise three components to be implemented over 5 years until 31 December 2007: (i) poor farmer empowerment, (ii) development of national and local agricultural information resources, and (iii) support for agricultural innovation development and dissemination.

The objective of the development of agricultural information resources is to develop local and national agricultural information resources, including: production technologies and input/output markets that can be accessed by farmers (farmers groups) gain comparative advantages. This activity will be developed by Indonesian Ministry of Agricultural (MOA) which involve the centre, regional, and district institutions including district government, the private sectors, and non-government organization.

Scope of the development of agricultural information resources proposed by MOA includes three main activities: (i) upgrading the agricultural market information system of the Center for Agricultural Data and Information (CADI) of the Ministry of Agriculture, (ii) development of national farming website, and (iii) establishment of information centers within district agricultural offices, or the office of bupatis (head of district). The concept of this activity is to establish a networking consists of agricultural actors which each actor has information that can be formed holistic agricultural information.

There are five steps to support the development of National and Local Agricultural Information Resource: (i) To develop an agricultural market and technology information system; (ii) To develop a national farming website; (iii) To develop operational procedures for farming website and market information system; (iv) To conduct workshop on farming website/market information system and information access electronically; (v) To conduct training for officials of agricultural (technology and market) information services from five related districts.

An assessment of the agricultural networking within MOA and scope of the existing market information system must to be conducted before the project implemented. Based on this assessment activity, the existing agricultural networking infrastructures at MOA for supporting the development of agricultural market information system including servers, routers, switch hubs, and other networking tools could be listed. Besides that, the activity of the data communication from center to district and from district to centre will be conducted through facsimile, e-mail, or website. Most of the Market Information Services existing at districts are most adequate in hardware and software supporting the agricultural market information system based on web. And then, through this MOA activities/project the Market Information Services (Pelayanan Informasi Pasar-PIP) must be to support by hardware and software and training for technical information staff at districts area.

Software modification and procedures supporting the market information system consist of sending data module at districts, server module at centre, and query module through internet, will be developed by CADI. This agricultural market information system and database appropriate to poor farmers in will be established, and need to improve and updated regularly. Agricultural market information database developed based on sub-sectors of agriculture (such as food crops, horticulture crops, estate crops, and livestock) consists of many kind commodities with implementation on: several tables with center database server is Dbms MySQL and districts database server is MS-Access.

A Team of Directorate General of Processing and Market of Agricultural Product (*Direktorat Jenderal Pengolahan dan Pemasaran Hasil Pertanian*-DG of P2HP) through PIP at districts under coordination by CADI is using SINGOSARI, for market information and data collection. SINGOSARI is the software of market information system which utilizes market information updating at the district. In the preparation of Market Information System procedure, four modules have been designed, which consist of: district data entry module, district data mailing module, server module at CADI, and query through on-line modules. The SINGOSARI market information system was modified by CADI and DG of P2HP to improve its appropriateness to the farmer beneficiaries. The preparation of the procedures is aimed at providing guidance for district Market Information System managers in collecting data on price, data entry and electronically mailing the data. The market information data from districts

consolidated at centre and to upload on website. Unfortunately, this information available on internet and can be accessed electronically through online system. The content of this website will be completed and updated regularly by CADI staff.

For developing a national farming website, MOA will carried out the web design and hosting including other supporting activities such as grouping based on sub-sectors, types of information (commodities price, kinds of price, price development, demand and supply, chain of distribution, and directory of private sectors). The development of national farming website was implemented by CADI, with the following aims: (1) To develop an agricultural website as information resources for farmers and other agribusiness operators at district level, and (2) To strengthen existing agricultural marketing information network as basis for the development of the National Farming Website.

The development of National Farming website include the following activities:

a. Review similar websites in other countries, such as AgriWatch.com (India), agriwatch portal, Trade Weekly, Farm Weekly, Business Consulting, Trade Promotion Services, News Realease, Market Watch & Price. It has been identifying the applicable model for an Indonesia website appropriate for agricultural development in the marginal lands.

b. Web-design and hosting including grouping of agricultural information system based on four subsectors (food crops, horticultural crops, estate crops and livestocks), types of information (price of commodity, types of price, price development, processing technologies, distribution chain, demands, bargain, and company directory).

c. Data Collection and Website Publication. Data collection for inputting to the national farming website has been implemented by a team established by the DG of P2HP under the coordination of the CADI. With the results, the national farming website could be accessed through on-line system with the website address and by using subdomain of deptan.go.id with the URL http://portalagribisnis.deptan.go.id.

d. Supporting the existing Market Information Center - MIC in each district including visiting to MICs for consultation and coordination, identification of information needs, and accessing availability of information (unstandardized forms and inappropriate sampling method for data collection were found). It was also found that the MICs have yet inadequate facilities and the standard market information forms issued by the DG of P2HP have not yet been operationally used.

e. Preparation of Technical Guidance for Farming Website. The technical guidances for management and utilization of national farming website were prepared. It is to be used as guideline material for the operators of district agricultural information center staff as well as for other users of websites so that they can use the websites as a bridging tool for the end users (farmers) to access the market information.

f. Workshop on farming website to socialize the website and to gain the feed back for improving the national farming website regularly. In this workshop the technical guidelines and procedures for operation and use of the national farming website was introduced to head of sub-dinases and operators of the concerned dinases in five districts.

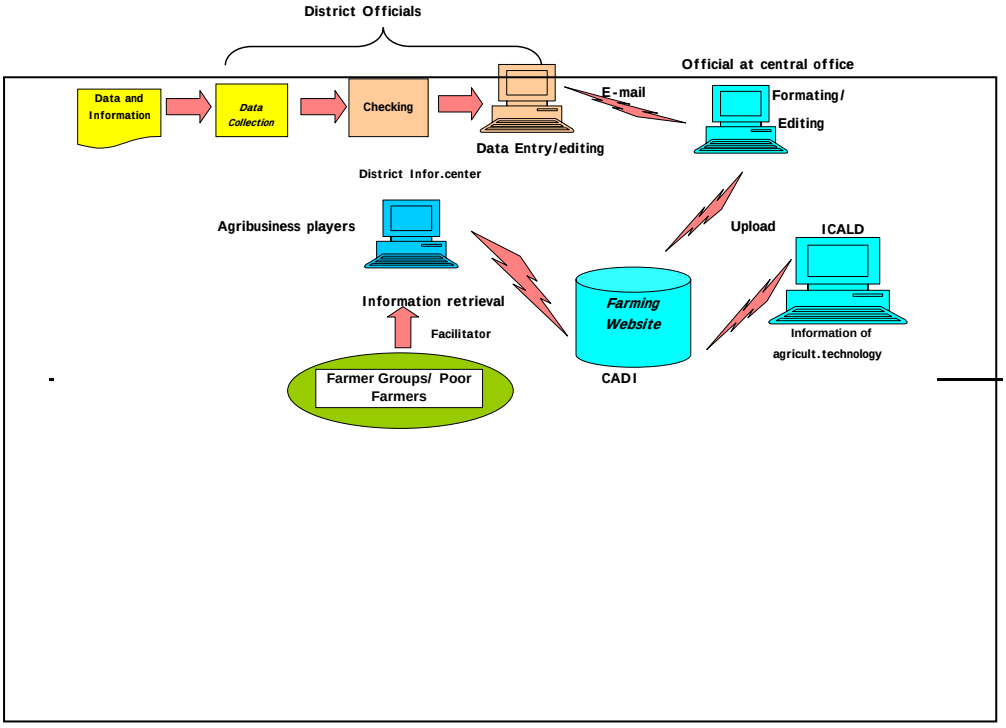
Increasing the access of poor farmers to agricultural information will be implemented through District Agricultural Information Centers (DAIC) as a Tele-center established within district agricultural offices. This Tele-centre will be supported by MOA and district government and completed with Information and Communication Technologies system such as hardware (PC desktop as a workstation with internal modem), human-ware (ICT staff), software (market information system and operating system), and networking by telephone line. At this centre, must be supported by the radio broadcast station is needed. The radio is a one of the user-friendly media especially at

Indonesian rural area. The radio broadcasts information that the farmers need for improving the production and marketing of their agriculture. It also entertains the farmers when the farmers are at work in the field, if they bring their radio along with them.

The district agricultural information center established at strategic location can be used as a one stop shop for the farmers to information exchange. The users can get some information through electronic media (online through internet media, offline through CD-ROM and database, or through radio broadcasts information, other multimedia) and conventional media such as printed media (brochures, leaflets, and posters) and personal media (face to face) communication. At the district agricultural information center, the farmers can discuss with other farmers and the technical experts to solve their agribusiness problems or to discuss the market product challenges. Collaboration between district agricultural office including extension workers, staff of market information services, and researchers at the regional (such as Agricultural Institute and Assessment Technology of Indonesian Agency of Agricultural and Research Development/AIAT-IAARD) and central level (National Agricultural Research Institutes/NARIs-IAARD) must be developed to support the operational of the district information center. This district agricultural information center must be budgeted regularly through district government budget, especially the agricultural district government to operate this system such as to manage the agricultural information center, to pay the telephone-line and Internet Service Provider, and to give incentive for the operators.

At the district information center established by MOA and district government, users and facilitator such as village facilitator (non-government organization) can be access the technical production and market agricultural information from the local-national-global information resources through online system directly. However, the poor farmers (end-users) are not capable to access information electronically especially through internet from district information centre. The several reasons of this condition are the area domicile of the farmers so far from the center information location and the internal characteristics (knowledge and capabilities).

There are three steps to facilitate poor farmers to access agricultural information through this intermediate access model to decrease the disadvantage of this system. The first step, the users or facilitator and technical staff (operators and extension workers) at district information center as the intermediate users can access agricultural information by browsing from the global information resources through internet directly. The second step, the information searched by facilitators must be formed, repackage, and managed simplify appropriate to poor farmers (end-users) using user-friendly formed and local language if needed. The third step is to disseminate this agricultural information package through other media such as electronic media (radio broadcast information, video, CD/VCD, and telephone-mobile telephone) or printed media (leaflets brochures, and posters) or personal media



through formal and non-formal extension workers (Picture 1). Formal extension worker is a people who responsible to facilitate poor farmers to access the agricultural information and give some technical assistance to support their problems under coordinate by district agricultural government. Non formal extension worker is a people under coordinate by private sectors such as agriculture input distributor or non-government organization (NGO).

Note : CADI is Center of Agricultural Data and Information-Secretary General-MOA
ICALD is Indonesian Center for Agricultural Library Dissemination-IAARD-MOA

Picture 1. Development and access model of agricultural information by users proposed by MOA.

To face this access system, the potential users need to train the access to information electronically. Workshop on the use of information technology for accessing information agricultural through offline (CD-ROM) and online (internet) system is a one of the activity to increase user awareness in ICT. The participants are the potential users including extension workers, technical assistance, and facilitators. The training must be conducted for officials of agricultural (technology and market) information services from related districts, especially for managing, using, and updating the market and technology information.

Based on lessons learned from the TCTP project at Thailand, women must supported this centre because several reasons. This results from the TCTP study known that women are better retailers, better at financial management and reporting, more sensitive to privacy concerns of women customers, and more women will use the agricultural information centre if its run by woman.

CONCLUSION

Farmers strive to improve the quality of agricultural products and the efficiency of farms. Others whose work is related to agricultural products include agricultural engineers, agricultural and food scientists, agricultural workers, and purchasing agents and buyers of farm products. In this moment, the information and communication technology is more important to develop suitable for farmers to increase the access of agricultural information.

The district information center that established at strategic location can be used as a one stop shop for the farmers to information exchange and information access through electronic media (online through internet media and offline through CD-ROM and database) and conventional media (printed media and personal (face to face) communication. This center must be supported by national farming website appropriate by poor farmers to gain benefit and impact effectively. The center utilization can be increased effectively to end-users at village level (grass-root level) through sub-district agricultural information center established by District Government as agribusiness terminal replicated from the district agricultural information centre.

MOA must have good coordination system between internal institution and external institution including central and district institution for the information access mechanism implementation. Through ICT system, the access of poor farmers to agricultural information could be increased more effectively. This is a one of the challenge to improve the poor farmers' quality of life through increasing the access of information.

The information networking system in the all agricultural development system will supported the dissemination of the agricultural development to people widely and easily. Besides that, the mechanism of information sharing between institutions related to support this system could be developed. Unfortunately, agricultural information established by MOA through national farming

website can present the current, holistic, and comprehensive information appropriate to users, especially to poor farmers.

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AGRICULTURE E-COMMERCE IN THE U.S.A.: AN OVERVIEW OF COMMUNICATION AND INFORMATION TECHNOLOGY AND AGRICULTURAL BUSINESS

Peter L. Stenberg[19]

Historically changes in technology have strongly influenced agriculture production in the United States (Cochrane). Communications and information technology (CIT) has not been an exception. We are now in the midst of waves in the introduction of new CIT that includes the Internet and the Web and wireless and broadband communication (Zilberman et al). Conventional wisdom has it that CIT will play an increasingly significant role in the agricultural marketplace.

This study aims to provide a brief overview of CIT and agricultural business in the United States. The first section discusses e-commerce and what it means with respect to agriculture. The second section covers CIT and its role in e-commerce and the changes that it has been undergoing. The section also presents a discussion on policy toward the development and deployment of new CIT. The third section will present findings from the 2004 USDA Agricultural Resource Management Survey on the adoption and use of CIT on farms. The fourth section presents findings from a Bureau of the Census survey on household adoption and use of CIT. The fifth section discusses the e-commerce provisions of the Farm Security and Rural Investment Act of 2002. The final section presents examples of CIT use in niche markets and food chain activities.

[19] The views expressed here are those of the author and do not necessarily reflect the views of the Economic Research Service or the U.S. Department of Agriculture.

THE CONCEPT OF AGRICULTURAL E-COMMERCE

The concept of e-commerce has been used to cover a number of economic activities. The activities may be grouped into three broad categories: information gathering, input channels, and sales channels. Farm operators and consumers have used the Internet to gather information (Stenberg [1999]; Varian). Farmers have used the Internet to gather information on the weather and market conditions for crops. They have used it to acquire information from farm cooperatives and the U.S. Department of Agriculture as well as read such trade publications as the Farm Journal. Consumers have used the Internet for information on items such as prices, nutrition, and food products.

When the dot-com boom began, people dreamed of vast new markets opening up (Beurskens). The facts proved more mundane. CIT improved the efficiency of input chains and sales channels, but new channels were the exception and not the rule (Barton; Stricker et al; Zilberman et al). Farmers have increasingly purchased inputs through the Internet, but they typically purchased from suppliers with whom they had prior business relationships (Mueller). Trust has been a key factor in the determination of suppliers.

Business-to-business (B2B) transactions over the Internet have increased substantially in the agriculture sector (Kinsey and Buhr; Stricker et al; Zilberman et al). Although commerce between companies already took place through electronic data interchange (EDI) systems, the Internet has opened up the system more and has reduced transaction costs (Barton; Brynjolfsson and Smith).

Agriculture sales direct to the household have also increased. These activities include supermarket home delivery, direct sales from manufacturer to consumer, and horticulture and other specialty farm produce direct to consumer sales. These e-commerce activities increased efficiencies in existing relationships, increased market presence because of the reduction of cost in reaching larger market areas, and brought about new services (Kinsey and Buhr).

COMMUNICATION AND INFORMATION TECHNOLOGY

A limiting factor for agriculture e-commerce, though, is the technology available for farms and households. Cable service has been limited in most rural areas. As a consequence the other main land-based hard-wired system, DSL, is the most likely for rural areas (Stenberg [2004]). DSL services, however, with some variation, are only viable to subscribers within 18,000 feet, as the wire goes, from the central office switches. Sometimes they are not available beyond 12,000 feet. The National Telephone Cooperative Association survey of rural carriers found that 54 percent of their loops were under 12,000 feet, 29 percent were between 12,000 and 18,000, and 17 percent were beyond 18,000 feet.

The National Telephone Cooperative Association study of rural telephone carriers in the U.S. that serve only rural areas found that it would cost US$11 billion to bring DSL service (one technology that would allow broadband Internet connections) to their customers. The study also indicated that companies would not be able to recoup their investment from their customer base. Companies would need accordingly, they argue, low interest government loans and other programs for them to invest in DSL. In addition to the rural telephone providers, nonrural telephone providers service rural areas. It would cost many billions of dollars more to provide DSL service to their rural customers.

The estimates of cable availability are highly variable. On the high side, the cable industry association states that their lines passed 96 percent of the households in the United States in 2002. The association also states that 86 percent of households where cable service is available could also

subscribe to broadband Internet service. At the end of 2002 just over 13 percent of households subscribed to cable broadband.

On the low side of estimates, the Rural Utility Service, however, found the percent of households that could subscribe to be much lower. They estimated that roughly 85 percent of U.S. households had cable available. Of the 15 percent that did not, all were in rural areas.

Operating costs are another problem for U.S. rural areas. In 2000, the operating costs for a system handling 10,000 lines per square mile were US$100, and it increased exponentially as density decreased. It was US$292 for handling 5-100 lines and US$694 for less than 5 lines (Glass).

Satellite access became a true broadband alternative in 2002 because of technological improvements. The drawback here though is two fold. First, satellites do not scale well as the subscriber base increases. Mainly this is due to bandwidth capacity limits. Second is performance and cost. The typical system capability is 400 kbps down load and 128 kbps up as compared to DSL with 1.5 mbps down and 128 up. The cost is also typically higher both in upfront as well as monthly charge.

Wireless may be the future of broadband Internet access in rural areas, but spectrum is still a problem (Wacnichkorn and Sirbu). While cost for urban users of wireless may be higher compared to DSL and Cable, the reverse is true for rural areas. No matter what the least cost broadband service is, however, the delivery cost of broadband will be higher for rural areas than urban areas.

COMMUNICATION AND INFORMATION TECHNOLOGY POLICY

Historically government policy has been influential in having new CIT available broadly across the United States, especially in high-cost service areas, as most rural areas are, and poor communities. Federal level policy has been along two legislative paths: the Communications Act of 1934 and the periodic farm bills. The Communications Act of 1934, as last amended in 1996, has not required support for Internet into households, though it allows for regulatory action to mandate it. The only current federal legislative mandate comes from the 2002 farm bill, the Farm Security and Rural Investment Act of 2002. The 2002 Act mandates a loan program for rural broadband providers and is administered by the Rural Utility Service, U.S. Department of Agriculture, with a budget determined by Congress annually.

The Farm Security and Rural Investment Act of 2002 has three provisions and principles to encourage the investment in new CIT in rural areas. First it authorizes US$100 million in grants, loans, and loan guarantees for the purpose of improving access to broadband telecommunication services in rural areas. Second these grants and loans are mandated to be for the construction, improvement, and purchase of equipment and facilities for rural broadband service in eligible communities. Third the definition of what constitutes broadband service would be reviewed regularly to take into account changes in technology.

In the United States the federal government, however, is not the sole generator of policy initiatives. The state and local governments also play a major role in the future of broadband Internet access, though their role is constrained by the federal government (Computer Science and Telecommunications Board). If federal law and state and local actions conflict, the federal law takes precedence. Federal limits became even more a fact of life after the enactment of the Telecommunications Act of 1996. Nevertheless, state and local governments have a great deal of latitude. In studies by Johnson; Laudeman; Parker and Hudson; Strover and Berquist; and others, four basic types of state and local policy initiatives can be identified: (1) demand, (2) rule, regulation, and tax, (3) finance, and (4) infrastructure policies.

Demand policies

Limited local broadband availability may be a result of real or perceived lack of demand. The lack of demand, as a consequence of either low level or fragmented demand, only discourages private investment. If demand is low or fragmented, local governments may step in. The source of demand insufficiency leads to different sets of policy prescriptions.

When low demand is the case, the policy prescription has often led to demand stimulation. Demand has been stimulated through extension programs, often business training in the use of information and communication technologies. Increasing business acumen in these technologies, it is argued, then leads to increased use by the businesses (Hurley and Keller; Stark).

When fragmented demand is the perceived problem, local governments have often adopted programs that will aggregate demand. The local government, in this case, acts as a monopsonist and governments follow one of two policy prescriptions. They act either as an anchor tenant or a group pricing facilitator. When local governments act as an anchor tenant they will negotiate with a provider to get the service. The provider then may offer the service to others. When local governments act as an agent for group of potential users to obtain the service, they may either directly negotiate or assist in the development of a group to negotiate with a service provider.

Rule, regulation, and tax policy

Reform of rules, regulations, and tax policies has been another mechanism for encouraging investment in local broadband services. Governments, in this case, adopt reforms that reduce the cost or shorten the period to gain positive returns of an investment. The two most common reforms affect access to local facilities or are industry specific regulation. Access reforms address such issues as zoning and right-of-ways (National Association of Regulatory Utility Commissioners, National Telecommunications and Information Administration). Industry specific regulations include franchising and licensing.

Overlaying reforms affecting rules and regulations are the taxes and fees charges designed for telecommunication companies and levied by local governments. They include:

- Franchise taxes;
- Telecommunication taxes;
- License fees;
- Utility taxes;
- Local 911 tax;
- Access line tax;
- Telephone relay surcharge;
- Public service taxes;
- Infrastructure maintenance fees;
- Right-of-way charges.

The taxes and fees may be adjusted to affect the access to local facilities or industry-specific regulations.

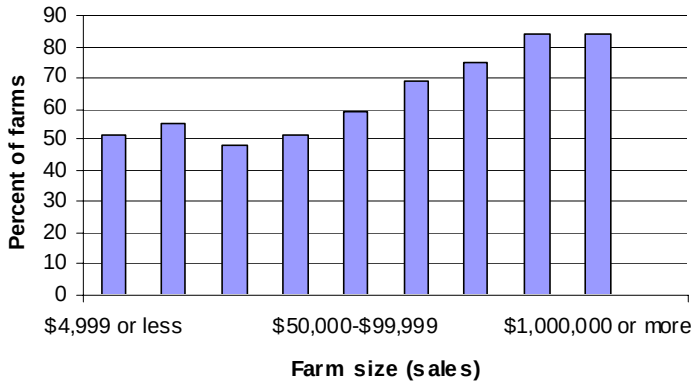
Finance and Infrastructure policy

Government finance policy includes the familiar grant and loan programs. Finance policy also includes tax incentives to providers, equipment and services to users, and planning grants, training, and non-profit deployments to community groups (Stark).

Infrastructure policy involves governments making their own investments in infrastructure. While state governments have not been involved in infrastructure development, local governments have been. It also has been quite controversial. On the one hand local government sponsored broadband deployment may diminish competition by crowding out private investment. On the other hand local government provided infrastructure may be the only way to provide competition, or in some cases the only recourse, where unfavorable economics discourage private investment. Research on this subject includes Clark and Baker; Gabel and Huang; Glaeser; Rizzuto and Wirth; and Savas.

INTERNET ON THE FARM

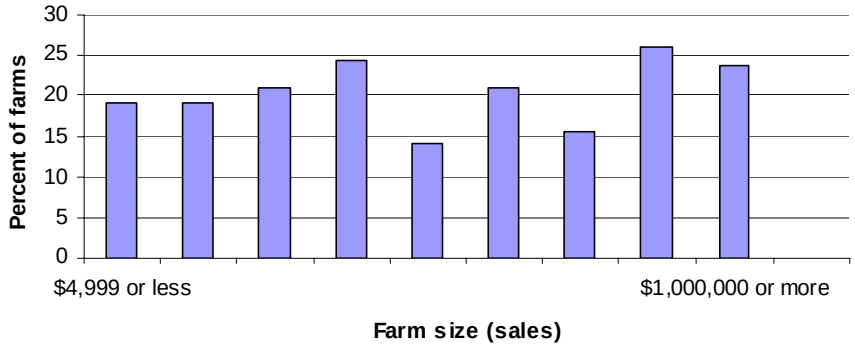
The changes in technology, economics of technology, and policy has resulted in farm Internet access and use growing substantially over the last ten years. Over half of farm operators now subscribe to the Internet. Larger farm operators are the most likely to have Internet access in 2004 (figure 1). Over 85 percent of farm operators with sales in excess of US$1 million have Internet access.



Source: 2004 USDA Agricultural Resource Management Survey.

Figure 1: Farm Internet Access, 2004

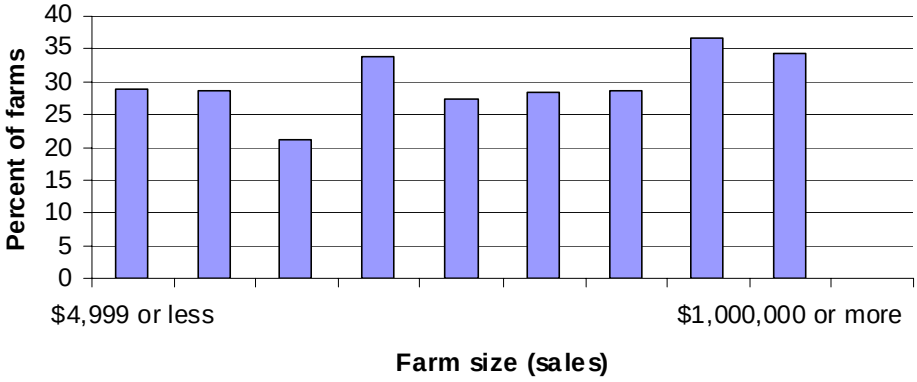
Farm operators have increasingly purchased inputs over the Internet. Nearly 20 percent of farm operators with access used the Internet to purchase inputs for farm production in 2004. Large farm operators were the most likely to make input purchases (figure 2). Hobby farms also tended to purchase inputs on the Internet. Approximately 25 percent of farm operators with sales in excess of US$1 million use the Internet for farm purchases.



Source: 2004 USDA Agricultural Resource Management Survey.

Figure 2: Internet Used for Farm Purchases

Farm operators have increasingly purchased household items over the Internet (figure 3). They were still more likely to make household rather than farm input purchases over the Internet. This fact further substantiates the observation by researchers such as Mueller that input channels are only slowly changing and taking advantage of the economies that the Internet has to offer.



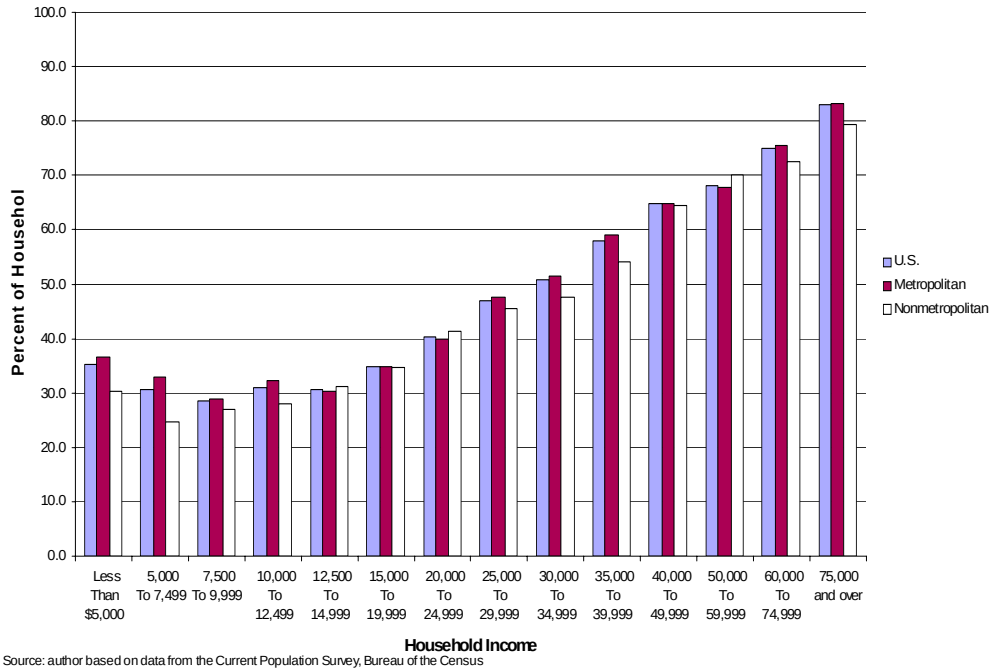
Source: 2004 USDA Agricultural Resource Management Survey.

Figure 3: Internet Used for Household Purchases. 2004

Nearly 30 percent of farm operators with Internet access purchased household items over the Internet in 2004 and large farm operators were the most likely to make these purchases (figure 3). Over one-third of farm operators with sales in excess of US$1 million used the Internet for household purchases.

INTERNET IN THE HOUSEHOLD

Like farm operators, households in the U.S. have increasingly obtained access to the Internet and used it to make purchases (Stenberg[2003]). In 2003 over 55 percent of households had Internet access and had used it. Rural households were only slightly less likely to have Internet access than urban households (figure 4).



Source: author based on data from the Current Population Survey, Bureau of the Census

Figure 4: Percent of Haousehold with internet Access by income and Metropolitan Status, 2003

The 2002 PEW Internet & American Life Project survey showed that 62 percent of households on the Internet used the Internet to purchase products. The same survey data showed 32 percent bank online, 50 percent make travel reservations, and nearly all Internet households get information from the Internet.

E-COMMERCE POLICY

In addition to enhancing technology deployment the Farm Security and Rural Investment Act of 2002 directly supports the development of agricultural e-commerce. The 2002 Act authorized the establishment of a rural electronic commerce extension program. The program's goal is to expand and enhance e-commerce practices and technology to be used by rural small businesses and enterprises. Funding was authorized at US$60 million per year.

The 2002 Act also authorized the federal government to pay a share of the cost of establishing and operating a national rural telework institute. The maximum individual grant was limited to US$500,000 with up to US$30 million spent each fiscal year. The success of the program has still not been determined, but agricultural businesses that have received assistance through the program have been enthusiastic according to research and extension personnel at New Mexico State University and the University of Nebraska. In addition to the federal government grants they have received funding from private corporations such as US West, a major communication company.

NICHE MARKETS AND FOOD CHAIN ACTIVITIES.

Not all types of agricultural production lend themselves readily toward direct sales from producer to consumer (Stricker et al; Zilberman et al), though food chain activities, or the broader wholesale and retail food industry, have potential productivity gains from Internet adoption ((Akridge; Beursksens; Henderson et al; Kinsey and Buhr).

Mueller has argued that niche markets offer the best opportunities for direct farm to consumer sales. They identified the wine industry as one such agriculture production activity that lends itself readily to sales over the Internet. It is a highly differentiated product with many small-scale producers. The Internet opens up the potential market and perhaps most importantly allows customers who discovered a particular winery, favor specific varietals, or a particular growing region may use, and have already begun to use, the Internet to make further purchases from a great distance. The market, at least until recently, however, has been restricted by state legislation. In the United States it is the states, not the federal government, that regulate the sale of alcoholic beverages, including wine. Recent judicial decisions, however, will reduce these state barriers to trade in wine. The most recent decision struck down state laws that kept out-of-state wine producers from selling in other states over the Internet where in-state wine producers already had the right.

Zilberman et al have been studying the cut flower industry, another niche market. In the case of this industry there was an existing system to order flowers through the mail or over the phone. The introduction of the Internet has reduced the cost of the transactions while opening up the market for more direct sales. Transactions are increasingly on the Internet. Nevertheless, while adoption is taking place and the technologies hold great promise, the process of adoption is complex and adoption is not taking place fast (Zilberman et al).

The wholesale and retail food industry engages in e-commerce through three channels (Akridge; Henderson et al; Kinsey and Buhr). First, the food industry has Internet shopping for consumers, i.e. business-to-consumer sales. Second, food suppliers use Internet market discovery exchanges throughout the supply chain. Third, the reduction of costs and increased efficiencies in procurement, storage, and delivery of food to retail or wholesale food businesses in existing business-to-business market relationships using the Internet. Kinsey and Buhr argue that the multiple impacts of the Internet for supermarkets and other retailers and wholesalers will evolve over decades. They also argued that it is far from certain whether the Internet will lead to further or less consolidation in the food industry though large sums are being expended to adapt to the new CIT.

CONCLUSION

In the United States the Internet has led to significant economic transformations in the agriculture and food sector. The process, however, is difficult and challenging, and will likely take decades for the new CIT to be fully integrated into the economy. CIT has increasingly become available and is used on the farm and in rural areas, but more progress is likely.

CIT continues to change and improve in capability. Costs for CIT have also continued to decline. This has meant that CIT can more readily reach into rural areas while the cost of CIT for even the most remote farm or rural community continues to decline. In the next two years both the Communications Act as well as the current farm legislation will come under renewed discussion.

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CLOSING REMARK

By

Director General, The Agency of Agricultural Human Resource Development
The Ministry of Agriculture of The Republic of Indonesia

Distinguished participants, Ladies and gentlemen,

First of all, please allow me to thank Allah SWT for His blessings by which we can have this Seminar on Networking of Agricultural Technology Transfer and Training. After four days of intensive discussion, finally we have come to the end of this important event. It is a great honor and pleasure that Indonesia again has been selected five time to be the Organizing Committee of the ATT&T Seminar.

We have spent four days to fulfill all of the requirements of the Seminar. We have started with National Monument Tour and observing AF2E Expo in Jakarta to get more knowledgeable about Indonesian farming in general, and on the way to Bogor visiting Great Indonesian Orchid Garden. Between the seminar sessions we also visiting farmers' field in Bogor such us Saung Nirwan Farms, and Calisa aquaria in order to get real picture and experience of the farmers and their organization, and to finish it with 3 days fruitful discussion and finally come up with the recommendation to be discussed further, hopely in the next gathering in the year of 2006, again here in Indonesia.

Ladies and gentlemen,

Of course, to evaluate whether the Seminar has successed to achieve the target we should compare it with the expected benefit of the Workshop as: First, understanding on technological aspect on how to promote agribusiness in the village and how to reduce the distance between farmers and consumers for the middle manager government officials and farmers' leaders that increase agricultural production and promote value added agricultural products. Second, understanding technological transfer and training aspect on how to make efficient network among research institutions, extension services, and farmers organization to meet farmers' needs and solve their problems influencing specific agricultural technologies in order to achieve the increase of farmers' income and promote self-reliance the strategies, Third, understanding ATT&T networking systems that appropriate locally, nationally and globally to cope with the impact of the globalization on agriculture businesses.

I am sure that all of us have worked hard to achieve those expected benefit by discussing intensively related invited 13 papers. Several farmers activities that supported the topics being discussed have been visited and we agreed that intensive discussions during the Seminar have remarkable enriched the content of the papers and I am sure that we have gained fruitful result from the Seminar and have successfully taken another one step closer to the ultimate goal of "increasing farmers' income and self-reliance"

Ladies and gentlemen,

From the benefit of the first, the second, and the third seminar, and the fourth gathering in the form of the training workshop, and finally this seminar, we found out that experiences, methods and strategies on how to promote agribusiness in the village and how to reduce the distance between farmers and consumers, understanding technological transfer and training aspect on how to make efficient network, and understanding ATT&T networking systems that appropriate locally, nationally and globally to

cope with the impact of the globalization on agriculture businesses should be shared and examined deeply among researchers, extension personnel and farmers' leaders of the APEC member economies.

We do hope and we propose that this lessons learned' will be followed-up by each participant to disseminate all of the knowledge, skill and shared experiences get from the Seminar. As soon as the completion of the networking seminar, each of the APEC member economies will utilize the networking system and start to share information and experiences through the network. Some problems and weaknesses, unanticipated results of the networking might be exercised by some member economies. This proposed workshop to discuss experiences on the adoption of the agreed networking system, therefore, will be conducted in 2006, with the main objective is to assess the strength and weaknesses of the networking system and to find ways to improve the system.

Alhamdulillah, we have agreed that the propose topics for the next workshop are (1) Accelerate the access of farmers on information on agricultural technology and agribusiness for the purpose of increasing farmers' income and self-reliance, (2) Exchange information and experiences on the implementation of the utilization of ATT&T Networking System among member economies, (3) Discuss concrete actions to develop synergy taking into account the lessons learned in previous seminars and workshop in order to establish sustainability of APEC member economies activities beyond 2006 via strengthen the role of farmers in organizing joint activity of establishing and managing website and possibility of self-funded APEC farmers meeting.

Ladies and gentlemen,

Finally, I gratefully appreciate all of you for actively participating, sharing experience and contributing your brilliant ideas during the Seminar in Indonesia. Without your support, the Workshop will not be a success. Let me congratulate also the Organizing Committee for successfully organizing this Seminar. On behalf of the Steering Committee, I officially declare this Seminar closed.

Thank you and see you next year in the fifth ATT&T Seminar.