

ASSESSMENT OF AGRICULTURAL INNOVATION TRANSFER SYSTEM IN THE DECENTRALIZATION ERA

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ABSTRAK

Proses alih inovasi pertanian yang sesuai dengan kondisi bio-fisik, sosial ekonomi petani dan budaya setempat yang masih berjalan lambat telah lama disadari sebagai hambatan dalam upaya akselerasi pembangunan pertanian. Pada era desentralisasi ini, sistem alih inovasi pertanian menjadi lebih kompleks dan perlu pendekatan yang disesuaikan dengan lingkungan strategis yang ada dan sangat bervariasi antar provinsi dan kabupaten. Pembentukan Balai Pengkajian Teknologi Pertanian di tingkat regional/provinsi pada tahun 1994 merupakan realisasi kebijaksanaan desentralisasi/regionalisasi penelitian dan pengembangan pertanian yang diinisiasi oleh Badan Penelitian dan Pengembangan Pertanian. Walaupun demikian, setelah lebih dari tujuh tahun didirikannya BPTP, ternyata ketersediaan teknologi tepat guna spesifik agroekosistem yang sesuai dengan kebutuhan petani masih terbatas. Lemahnya keterkaitan antar berbagai lembaga yang mengemban fungsi alih inovasi pertanian, termasuk kelembagaan tani, serta pendekatan sentralistik di dalam pembangunan pertanian selama lebih dari tiga dekade dianggap sebagai faktor penghambat utama dari efektifitas sistem alih inovasi pertanian. Implementasi kebijaksanaan desentralisasi pada awal tahun 2001 telah mengakibatkan perubahan mendasar dari struktur organisasi dan manajemen institusi pemerintah yang mengemban fungsi penyuluhan pertanian. Perubahan mendasar ini telah mengakibatkan kinerja dari sebagian besar organisasi dan personal penyuluh pertanian di tingkat provinsi dan kabupaten sangat menurun. Koordinasi yang efektif antar institusi yang mengemban fungsi penyuluhan, dan revitalisasi organisasi dan personal penyuluhan perlu memperoleh perhatian yang serius, terutama dari para penentu kebijaksanaan Pemerintah Daerah Tingkat II. Pada penerapan kebijaksanaan otonomi daerah (OTDA) di dalam pembangunan pertanian, termasuk di dalam penyelenggaraan alih inovasi pertanian, diperlukan persiapan yang matang dan komitmen dari para penentu kebijaksanaan serta administrator di tingkat Daerah maupun Pusat. Penerapan kebijaksanaan desentralisasi ini, termasuk di dalam alih inovasi dan teknologi pertanian, akan berhasil bila ada upaya khusus untuk saling mendukung antar institusi terkait. Tujuan dari pengkajian ini adalah untuk mengidentifikasi kinerja dari sistem alih inovasi pertanian pada awal penerapan kebijaksanaan desentralisasi.

Kata kunci: *penelitian, penyuluhan, kelembagaan tani, keterkaitan, sistem alih inovasi pertanian*

ABSTRACT

The slow process of technology transfer, which is suitable to the bio-physic and social economic of its intended users, has been realized as a serious impediment in the acceleration of agricultural development. In this decentralization era, the agricultural innovation transfer system becomes more complex that needs an adjustment to the changing strategic environment, which is specific to each respective regional area. The initiation of the Agency for Agricultural Research and Development in the establishment of the Assessment Institute for Agricultural Technology (AIAT) at the provincial level in 1994 intended to decentralize agricultural research and development. However after seven years of the AIAT establishment, the availability of specific agro-ecosystem technologies at the field level is still limited. The centralistic approach in the implementation of agricultural development in the last three decades and the weak linkage among institutions dealing with agricultural innovation transfer are considered to be the main impediments for an effective agricultural innovation transfer system. The implementation of decentralization policy in early 2001 has resulted in several fundamental changes in the organizational structure and management of government institutions dealing with agricultural innovation transfer. These changes have increased the ineffectiveness of extension organization and personnel. For this reason, deliberate efforts to strengthen the linkage among institutions that have extension function and the revitalization of extension organization and personnel, are badly needed, especially at the district level. The implementation of decentralization in agricultural development, including in agricultural innovation transfer, needs appropriate preparation and deliberate efforts from regional (provincial and district) administrators and central bureaucracies, whereas mutual support and reinforcement toward each other are the prerequisite to

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decentralization success. The purpose of this study was to identify the performance of agricultural innovation transfer system in the early implementation stage of the decentralization policy.

Key words: *agricultural research, extension, farmer organization, linkage, innovation transfer system*

INTRODUCTION

Technology generation, development, transfer and adoption, are critical factors in the process of agricultural and rural development. They should be considered as an interrelated and continuum process of an integrated and dynamic innovation transfer system that support efforts to achieve the objectives of agricultural and rural development. In this respect, the political factor plays an important role in determining policies that are conducive to agricultural development. The decentralization policy that started being effective on the first of January 2001, have affected a substantial impact on government institutions at the provincial and district levels. The impacts were not only on the organizational structure, but also on the job descriptions of the government institutions and management of agricultural development programs. In this decentralization era, relatively all provincial and district governments have changed the organizational structures of government institutions within the agricultural sector, including the organizations dealing with agricultural innovation transfer.

Several studies in developing countries reported that agricultural research results hardly reach farmers. Acoba (2001) reported results of a Philippine agricultural extension study on the weaknesses of research and extension linkage as follows: (1) Research results were limitedly transformed into extension materials; (2) Research and extension activities were scatterly attached and being conducted by different agencies, and those agencies were not adequately attuned to research and extension needs; (3) Personnel, funding and management problems were impediment to the Regional Research Consortia; (4) The competition for very limited resources among various research agencies and the lack of inter-related agencies cooperation were perceived as a predominant constraint; (5) The non existence of participatory research and extension system has lowered the technology adoption rate.

Syam (2000) reported similar research results that was conducted in 1993 as follows: (1) The research program was formulated based on previous research results and the national (central government) guidelines and issues. The involvement of extension workers and farmers in agricultural research and development was minimal; (2) Agricultural technology recommendation from the national level was directly implemented without or only went through a limited level of adaptive trial to the local condition; (3) The dissemination of research results was relatively ineffective, and it relied too much on publications and scientific meetings such as seminars, workshops and field days. The research result publication was too scientific, incomplete (partial), unattractive and or unsuitable to the need of extension workers. Moreover, the publications were only distributed to the provincial level due to the limited printing capacity; (4) There was no mechanism to accommodate farmer's feedback, where farmers only conveyed their feedbacks through accidental occasions.

As the continuing stream of innovations that flow from their sources to the potential users is one of the important factors being required for agricultural development, it is necessary to anticipate the impact of decentralization policy on the agricultural innovation transfer system. For this reason, a study on the performance of agricultural innovation transfer system after the implementation of regional autonomy was conducted in Riau, East Java and West Nusa Tenggara provinces. The specific objective of the study was to identify the performance of the existing agricultural innovation transfer system in the initial stage of the decentralization era.

The selection of the study areas was based on the institutional capacity of AIATs in those three provinces. Riau province represents the western part of Indonesia, where the Riau AIAT belonged to the B category (medium capacity of AIAT). East Java AIAT represents the strongest AIAT, which is located in the central part of the country. The eastern region is represented by the West

Nusa Tenggara province, where its AIAT belongs to the C category (lower capacity of AIAT). The study used descriptive method, which was complemented with diagnostic analysis of each sub system of the agricultural innovation transfer system as suggested by

Swanson and Peterson (1989). The sub systems being analyzed were: 1) policy, 2) research and development, 3) extension, and 4) technology user sub system. The indicators and parameters of each sub system to be analyzed are presented in Table 1.

Table 1. Sub Systems, Indicators and Parameters in the Agricultural Innovation Transfer System

Sub System	Indicator	Parameter
1. Policy	- Related policy concerning agricultural innovation transfer;	The impact of the policy towards the agricultural innovation transfer system;
	- Government's commitment towards research & development (R&D) and extension;	The budget allocation of the Department of Agriculture for R&D and extension;
	- Price policy;	Trend of staple food and fertilizer prices;
	- Credit policy;	The availability of formal credit for agricultural sector;
	- Participation of farmers in agricultural development decision-making.	The effectiveness of farmer organizations regarding their: a) sustainability, b) farmer representatives in the decision making institutions/fora.
2. Agricultural Research & Development	- Access of AIAT (Assessment Institute for Agricultural Technology) to knowledge and technology;	The AIAT's linkage with the National Agricultural Research and Development Centers (NARs) within the Agency for Agricultural Research and Development (AARD), and their networking with other R&D institutions;
	- Human resources of AIAT;	Number and qualification of researchers and extension personnel at the AIAT;
	- AIAT's budget allocation for innovation transfer.	Budget allocation ratio between dissemination of technology assessment results and technology assessment programs.
3. Agricultural Extension	- Access of field extension workers to agricultural technology;	Participation of field extension workers in the AIAT's research/technology assessment activities;
	- Human resources of extension organization;	Number and qualification of extension personnel at the extension organization;
	- Personnel supervision and evaluation;	- Job description of extension personnel; - Technical guidelines in the performance supervision and evaluation of the extension personnel;
	- Allocation of the financial resource for extension;	Financial resource allocated for extension organization and personnel;
	- Technology dissemination.	The frequency of field extension workers in conducting innovation transfer activities.

Table 1. (continuation)

Sub System	Indicator	Parameter
4. Technology Users/Farmers	- Technology adoption;	Technology adoption of ex farmer cooperators and non cooperators;
	- Access of farmers to agricultural inputs;	The distance between farm location and inputs suppliers;
	- The availability of agricultural innovation.	Farmer's source of technology;

NARs: including Centre Research Institutes (CRIs) and National Research Institutes (NRIs)

Source: Modified from Swanson and Peterson (1989).

*R&D: agricultural research and development

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POLICY SUB SYSTEM

The policy concerning agricultural innovation transfer system can be analyzed from the following indicators (Swanson and Peterson, 1989): 1) the government's commitment toward agricultural R&D and extension, 2) agricultural price policy, 3) agricultural credit policy, and 4) participation of farmers in agricultural development decision making.

Related Policies Concerning Agricultural Innovation Transfer System

Due to the substantial impact of policy on the overall performance of the agricultural innovation transfer system, Swanson and Peterson (1989) asserted that policy should be included as a sub system of the agricultural innovation transfer system. Pertinent policies, which are not conducive to the effectiveness of agricultural innovation transfer, that need to be replaced and or improved are as follows:

1. Minister of Agriculture's Decree No. 01/Kpts/OT.210/1/2001 regarding the Organization and Working Mechanism of the Department of Agriculture
 - The function of NARs (Centre Research Institutes/CRIs and National Research Institutes/ NRIs) in providing technology components, which are needed by AIAT, was not formally defined. The job description of NARs is to conduct upstream and strategic research. Furthermore, NARs are not formally assigned as the technical back-stopper of AIATs;
 - No specific description regarding the areas of interface and the need to

strengthen the linkage among the AARD, the Agency for Agricultural Human Resource Development (AAHRD) and with other agencies within the Ministry of Agriculture in the area of agricultural innovation transfer system.

Suggested Improvement: (1) Description regarding an institution's function, job description and mandate in a Minister's decree will strongly influence the institution's outputs. The formulation of an institution's function, job description and mandate, including for the AARD and AAHRD, should be carried out in a participatory manner in order to appropriately accommodate the institution's need and aspiration; (2) The empiric experience since the First Five Year Plan (1969), the coordination and linkage among institutions dealing with agricultural innovation transfer at all levels (national, provincial, district and field levels) are very weak. To reduce this weakness, there is a need to describe clearly in the job description of each related institutions dealing with innovation transfer at all levels, regarding the areas of interface that needs coordination, and by what institutions.

2. Minister of Agriculture's Decree No. 350/Kpts/OT. 210/6/ 2001 (June 14, 2001) regarding the Organization and Working Mechanism of the AIAT

- The AIAT's job description in the area of agricultural innovation transfer system is only to prepare and formulate agricultural extension materials.

Suggested improvement: (1) This job description needs to be widened, covering other activities to increase the adoption and diffusion of the technology that has been adapted by

AIAT; (2) To increase the effectiveness of technology dissemination, there is a need to specifically add a very important function of AIAT in its job description, namely the information and communication function, which is responsible in the area of knowledge management and innovation transfer; (3) In the description concerning the working mechanism of AIAT (Chapter III, Minister of Agriculture's decree), there is a need to specifically emphasize a compulsory participatory approach, coordination and linkage with related institutions dealing with agricultural innovation transfer in carrying out technology assessment and dissemination of the adapted technology..

3. The Decree of Minister for Government Reformation No. 19/Kep./M.K./Waspan/5/1999

- The duty of the extension personnel at the AIAT is not the same with the extension personnel who work at agricultural related institutions at provincial, district and field levels. Thus, their job description needs to be adjusted according to their function.

Suggested improvement: The AARD needs to formulate a more appropriate job description for extension personnel who work at AIAT.

4. Minister of Agriculture's Decree No.804/Kpts/OT.210/12/95 regarding Guidelines on Generation, Development and Adoption of Agricultural Technology

- The R&D planning, technology adaptation and feedback mechanisms in the innovation transfer system as described in this decree are only partially implemented. This is due to: 1) In the decentralization era, many district governments abolished the Institute for Agricultural Information and Extension (IAIE) and Rural Extension Centre (RECs). The integration of extension functions to the District Agricultural (related) Services has decreased the intensity and effectiveness of extension activities (which is already low) at the field level; 2) Most of the field extension workers (FEWs) at the existing REC neither carry out the identification of technology needed by farmers nor

provide feed-back on technology performance to the AIAT and other related institutions, 3) The R&D program of NARs is either unsuitable to the need of AIAT or not intended to provide technology components that are needed by AIAT.

Suggested improvement: This Minister of Agriculture's decree No.804/Kpts/OT.210/12/95 needs to be replaced in the very near future.

Government's Commitment Toward Agricultural R&D and Extension

The central government commitment toward decentralized agricultural R&D is quite high. A steady budget increment allocated for AIAT since its establishment in 1994 (*Badan Penelitian dan Pengembangan Pertanian*, 2000) indicates a very conducive policy toward the provision of locally specific agricultural technology. At the national level, the Agency for Research and Development (AARD), which is one of the 11 agencies within the Ministry of Agriculture, was allocated 15.5 percent of the Ministry's total budget in year 2000 (*Biro Perencanaan dan Keuangan, Departemen Pertanian*, 2000). In the same year, the budget allocation for the AAHRD was 8.8 percent of the Ministry of Agriculture's total budget.

The commitment of central government toward agricultural extension used to be extremely high during the early period of the Five Year Development Plan (the first period of the Five Year Development Plan started in 1969). However, the government financial support decreased drastically in the early 1990's after the termination of an extension project supported by the World Bank. The effort to decentralize agricultural extension through a Joint Decree of Minister of Agriculture and Ministry of Home Affairs No. 539/Kpts/LP.120/7/1991 and No. 65 in 1991 is considered to be the initial period of degrading performance of agricultural extension organization and personnel (Taryoto *et al.*, 1995).

Agricultural Price Policy

Despite the high commitment of government toward agricultural development, the agricultural price policy is not supportive

toward efforts to increase farmer's income. The average growth of husked rice price on Java in the period of 1994 – 1999 was 24.6 percent annually compared with the average growth of fertilizer prices (Urea, TSP and Potash) which a range of 36.8 – 38.8 percent annually (Adnyana *et al.*, 2000). In this respect, Simatupang (2002) criticized the government rice policy in trying to control the price of rice as being unfair to the Indonesian rice farmers.

Credit Policy

The price of agricultural products that stimulates the increase of farmers' income and the availability of agricultural credit will positively influence the adoption rate of agricultural technology. Concerning the agricultural credit policy, the government is considered being inadequately supportive toward farmers. The real value of farmer's income, especially food crop farmers, is constantly decreasing, and the provision of production credit is biased towards farmers in irrigation areas. There is no special credit scheme for farmers in upland areas who are poorer and greater in number. Moreover, the credit scheme for the previous agricultural intensification program was poorly managed.

In Kampar District, one of the study areas in Riau Province, the debt of *KUT* in the period of 1985 – 1998/1999 is 84 percent out of the total credit of Rp. 13, 746, 804, 077 (S.K. Bupati Kampar, 2001). Recently, the *KUT* credit scheme has been changed into expectedly more flexible credit scheme namely Food Security Credit Scheme (*Kredit Ketahanan Pangan/KKP*). However due to a more strict procedure, result of interviews with farmers in all study locations revealed that the number of farmers who received *KKP* credit was very small. In Karya Mukti Village (Rimba Melintang Sub District), the study area located in Rokan Hilir District (Riau Province), the number of farmers who were proven to obtain the *KKP* credit was only 11 people. As farmers usually face difficulty in providing adequate working capital, this situation is not conducive to the technology adoption which requires external inputs.

The previous *KUT* (*Kredit Usaha Tani*) credit scheme, which has been replaced by the food security credit scheme (*Kredit Ketahanan*

Pangan), was approved based on a proposal that was submitted by a farmer group. Thus, the establishment of farmer groups in all study areas is usually initiated by the Provincial/District Agricultural (related) Services as a medium to accommodate development projects. In this respect, there was no farmer organization at the grass root level that was established by farmers themselves in order to accommodate their common needs. As the development project becomes the main cohesion factor for farmers to join a farmer group, this kind of farmer organization is not sustainable.

Participation of Farmers in Agricultural Development Decision Making

A majority of Indonesian farmers, especially small and poor farmers, do not have a bargaining position in marketing their produce. The government efforts to facilitate the consolidation of farmers into strong farmer organizations in the last three decades have not shown a significant result. A strong top-down approach in the implementation of agricultural development, emphasizing on the achievement of physical project objectives, has resulted of farmer's dependency toward government assistance, including in agricultural innovation transfer (Sulaiman, 1998).

The decree of Head of Kampar District No: Kpts. 184/BIPP/2000 regarding the approval and job description of the Representative Committee of Kampar Farmer and Fisher Groups (*Kepengurusan dan Keanggotaan Kelompok Kontak Tani Nelayan Andalan Kabupaten Kampar*) indicated a strong government influence in farmer organization. A similar procedure was found in the other districts of the study areas. This strong government intervention is counter productive toward the empowerment process of farmer organizations.

It is very important to note that even though the community empowerment effort is a long and tedious process, but it is a prerequisite for the development sustainability. The increase of local leader capacity to consolidate farmers into strong organizations should be strongly emphasized in the decentralization process, especially as the local community is expected to continue the deve-

lopment program (Mboi, 1992; Djogo, 1996; Haba, 1996; and Marlessy, 1996). For this reason, an acquisition system in agricultural innovation transfer is strongly suggested, where farmers should be facilitated to actively seek their needed information and technology.

Even though the majority of rural community are farmers, the existing farmer groups in all study areas were not taken into consideration in the decision making process of development programs. Farmer groups are neither represented in the Community Empowerment Council (*Lembaga Pemberdayaan Masyarakat/LPM*), analogously with parliament at the village level, nor in the higher fora of the Development Coordination Meeting (*Rapat Koordinasi Pembangunan/Rakorbang*) and Parliament at District and Provincial levels. Head of the Ketemas Dungus Village, the key informant of the study location in Mojokerto District (East Java Province), suggested that farmers should convey their needs and aspiration in agricultural development through political parties. This is quite naïve, considering the farmer's low level of education, including in politics.

AGRICULTURAL RESEARCH AND DEVELOPMENT SUB SYSTEM

So far, the government has been very dominant and poses a strong influence in the agricultural innovation transfer system. Thus, the focus of analysis in this paper will be public institutions dealing with agricultural innovation transfer at national, provincial and district/field levels. The Assessment Institute for Agricultural Technology (AIAT) is an R&D institution within the agricultural innovation transfer system at the provincial level. This R&D public institution has a mandate to conduct agricultural research and technology assessment that is needed in its area of jurisdiction. Adding to its mandate, one of the AIAT's job descriptions is to prepare its technology assessment results for extension materials.

Access of AIAT to Knowledge and Technology

So far, AIAT is expected to become one of the main agricultural technology sources at

the provincial level. However in fulfilling this expectation, AIAT still faces several problems. Rusastra *et al* (1999) reported that AIAT researchers and extension personnel had limited access to the NAR's research results. This is partly due to the centralistic policy in publishing the NAR's research results. The prohibition for the National Research Institute (NRI) to publish its own scientific journal, but has to go through its respective Center for Research Institute (CRI), has added to the limitation of NAR's capacity to disseminate its research results. This policy has sharply increased the competition among researchers, and decreases the opportunity to publish research results of NAR researchers in scientific journal.

The absence of incentives and disincentives for NAR researchers to generate technology needed by AIAT is not conducive to the fulfillment of technical backstopping function of the NARs. Furthermore, the low appreciation toward downstream research in the personnel evaluation system for NAR researchers is disincentive to the provision of technology components to be adapted by AIAT.

Human Resources of Assessment Institute for Agricultural Technology (AIAT)

The other factors that influence the quality of research/technology assessment are number and qualification of researchers and extension personnel at AIAT (Table 2). In the three AIATs of the study areas, the qualification of their researchers and extension personnel was predominantly B.S. holders, ranging from 69 percent in the West Nusa Tenggara AIAT to 74 percent in the Riau AIAT. Considering the available number of researchers and extension personnel, the number of research/technology assessment to be conducted by those three AIATs is too many. For an illustration, in year 2000 the number of research/technology assessment in the Riau, West Java and West Nusa Tenggara AIATs were 17, 24 and 9 respectively (*Badan Penelitian dan Pengembangan Pertanian*, 2001), whereas the numbers did include collaborative research with other R&D institutions.

Table 2. Number and Qualification of AIAT Researchers and Extension Personnel (including those who attended degree program) in the Study Areas, Year 2000

Profession	Riau AIAT				East Java AIAT				West Nusa Tenggara AIAT			
	BS	MS	Ph.D	Total	BS	MS	Ph.D	Total	BS	MS	Ph.D	Total
Researcher	31	7	0	38	53	22	5	80	6	2	1	9
Extension Personnel	3	5	0	8	20	3	0	23	12	4	1	17

Source: Badan Penelitian dan Pengembangan Pertanian. 2000.

Budget Allocation of AIAT for Innovation Transfer

The budget allocation for dissemination of AIAT research/technology assessment results will influence the intensity and effectiveness of its innovation transfer capacity. Table 3 shows that the budget allocation of Riau AIAT for dissemination was higher than for research program in the first year of the AIAT establishment, and directly dropped in the following years.

In the West Nusa Tenggara AIAT, the budget allocation for dissemination is always lower since the early year of the AIAT establishment, and the budget allocation ratio between dissemination and research/technology assessment keeps relatively increasing in favor for research/technology assessment program. The increase of awareness among the top decision makers at the agricultural R&D institutions regarding the importance of the dissemination of the AIAT research results has created a conducive policy toward agricultural innovation transfer. Starting as of year 2003, AIAT is expected to allocate 50

percent of its budget to increase the information, communication and dissemination function of the institution.

The imbalanced budget allocation indicates that the importance of technology transfer is overlooked. The limited number of technology recommendation generated by AIAT has added to the lower AIAT capacity in fulfilling its function as the main source of agricultural innovation in its area of jurisdiction. In year 2001 the numbers of recommended technology that have been released by Riau, West Nusa Tenggara and East Java AIATs were 13, 19 and 78 respectively. Thirty-one of the East Java AIAT's recommendations were on alternative fertilizers.

Institutional Linkage within the Agency for Agricultural Research and Development

In the effort to increase the AIAT's capacity as the main source of agricultural technology in its area of jurisdiction, the linkage between the National Agricultural Research institutions (NARs including Commodity Research Institutes/CRI and National Research

Table 3. Budget Allocation Ratio Between Dissemination and Research/Technology Assessment Programs of AIATs in the Study Areas

Fiscal Year	Riau AIAT			West Nusa Tenggara AIAT *		
	Dissemination	Technology Assessment	Ratio	Dissemination	Technology Assessment	Ratio
1994/95	96.920	16.300	5,9: 1			
1995/96	194.830	294.835	1: 1,5	12.059	20.680	1: 1,7
1996/97	144.162	545.890	1: 3,8	38.560	54.850	1: 1,4
1997/98	258.000	369.755	1: 1,4	26.740	69.513	1: 2,6
1998/99	319.750	1.044.500	1: 3,3	58.890	92.572	1: 1,6
1999/00	290.400	1.160.960	1: 4	76.750	415.680	1: 5,4
2000	450.000	1.043.000	1: 2,3	82.378	620.824	1: 7,5

Source: Tjitropranoto, 2001.

*Source of data for the West Nusa Tenggara AIAT in the fiscal year of 1997/1998 - 2000: *Laporan Tahunan Pelaksanaan Bagian Proyek ARMP-II*. T. A. 1999/2000.

Institutes/NRI) and AIAT becomes very important. Rusastra *et al.* (1999) reported results of a research management study regarding linkage problems between NARs and AIAT as follows: 1) The NAR's formal mandate is to support the national agricultural development program, and it is not specifically aimed toward the generation of technology component which is needed by AIAT; (3) Seminar is the medium frequently used by NARs to disseminate their research results. This interpersonal communication medium only reaches a very limited number of audiences; (4) The absence of feedback mechanism from AIAT to NARs and vice versa has added to the weak linkage among these R&D institutions at the national and regional levels.

Further, Rusastra *et al.* (1999) asserted these following suggestions to increase the technical backstopping capacity of NARs: 1) To establish an effective mechanism for working relationship between NARs and AIAT in formulating the NAR's research program to continually provide technology components to be adapted by AIAT, 2) To increase the intensity of collaborative research program between NARs and AIAT; 3) To form a working relationship mechanism which is conducive to an intensive dialog between researchers at NARs and AIAT; 4) To increase the flow of technology, the National Commodity Research Institutes should be allowed to publish its own scientific journal; 5) The AARD should create scientifically proportional incentive system for the NAR researchers to stimulate the technology generation needed by AIAT, and to effectively transfer the available technology.

AGRICULTURAL EXTENSION SUB SYSTEM

In this era of regional autonomy, there have been dynamic changes in the organizational structure of the agricultural (related) institutions at the provincial and district levels. The implementation of decentralization policy has affected the number, position and the workplace of extension personnel, especially at the district level. Due to the transitional situation, the up-dated and current data were

not available in the study areas during this study period.

The integration of extension function into Agricultural (related) Services or splintered among a variety of agencies with similar role and function at provincial, district and field levels in this decentralization era, will weakened the extension role and function. Watts (1984) asserted the requirements of an effective extension organization, which were suggested nearly two decades ago that still relevant in this decentralization era, as follows: 1) strong linkage with R&D institutions; 2) its establishment and mission is statutory basis; 3) adequate and stable financial support; 4) program priorities are set through a participatory approach and inputs from the potential clients; 5) continuing and effective in-service training; 6) adequate supporting facilities such as field offices, transportation and communication equipment and system; 7) the organization is not imposed upon with regulatory or input supply responsibilities; 8) a competitive salary and incentive system that is conducive to the professional development and advancement of the extension personnel; 9) supported by qualified staff who poses effective communication, information knowledge and skills; 10) the staff has gone through an orientation process to fully understand the extension philosophy in facilitating farm families.

Based upon study results on decentralization of development planning and administration that was conducted in nine Asian and Pacific countries, Rondinelli (1987) emphasized these following prerequisites to a successful implementation of a decentralized development program: 1) the need for changing attitudes and behavior of central and local officials, field staff, and rural residents, toward decentralized development planning and management, 2) the central government needs to increase the political and administrative support for decentralization, 3) development programs should be organized to accommodate conducive local/field management, 4) the need to provide adequate financial, human and physical resources at the local level. In the case of the Indonesian agricultural extension decentralization, those four prerequisites mentioned above were anticipated in a very limited degree.

Table 4. The Number of Extension Personnel, IAIE and REC in Riau, East Java and West Nusa Tenggara Provinces, 1998

No.	Province & District	Extension Personnel			IAIE		REC	
		Tenured	Non Tenured	Total Province	#	Total Province	#	Total Province
1	Riau Province:			1,137		7		81
	• Rokan Hilir*	191*	32*		1		19	
	• Kampar	328	31		1		18	
2	East Java Province:			3,639				
	• Mojokerto	107	3		1	35	18	425
	• Nganjuk	107	6		1		10	
3	West Nusa Tenggara Province:			1,039				
	• West Lombok	179	10		1	7	9	67
	• East Lombok	153	15		1		10	
Total Indonesia**		37,288			285		3,110	

Source: *Pusat Penyuluhan Pertanian, Departemen Pertanian, 1998.*

*Data for Rokan Hilir District are data for Bengkalis District, which has been divided into three districts namely Bengkalis, Rokan Hilir and Rokan Hulu Districts.

**Source of data: Munandar, 2000.

Human Resources of Extension Organization

The ratio between the number of extension personnel and REC in all study areas (Table 4) indicates that the number of the extension personnel should not be a hindrance to the effectiveness of extension personnel.

The limited training and low educational level of FEWs are the determining factors in the low performance of extension personnel at the field level (Table 5). The highest percentage of FEWs' educational background is equivalent to the Senior High School level (including the Vocational Agricultural School), ranging from 68 percent in Mojokerto (East

Table 5. Educational Background of Extension Personnel in the Study Areas, 1998

No.	District	Educational Level							Total
		University Graduate			Non University Graduate				
		Ph.D.	MS	BS	D*3	D2	D1	SHS** level	
1	Rokan Hilir***	0	0	5	22	0	1	174	202
2	Kampar	0	0	6	38	0	4	294	342
3	Mojokerto	0	0	19	27	0	0	98	144
4	Nganjuk	0	0	21	3	0	0	89	113
5	East Nusa Tenggara	0	1	19	25	0	7	159	211
6	West Nusa Tenggara	0	0	11	18	0	8	168	200
Total Riau Province		1	3	52	139	0	6	936	1,137
Total East Java Province		8	10	498	388	3	34	2,699	
Total West Nusa Tenggara Province		0	4	110	129	0	14	762	1,039
Total Indonesia		45	112	3,049	4,152	75	930	28,925	37,288

*D: Diploma;; **SHS: Senior High School/Agricultural Vocational School

*** Data for Rokan Hilir District is data for Bengkalis District, which has been divided into three districts (Bengkalis, Rokan Hilir and Rokan Hulu Districts).

Source: *Pusat Penyuluhan Pertanian, Departemen Pertanian, 1998.*

Java) to 86 percent in Rokan Hilir and Kampar Districts (Riau Province). The FEWs' low educational level with limited training opportunity would hardly contribute to an effective extension organization.

Access of Field Extension Workers to Agricultural Technology

The FEW's participation in the implementation of AIAT technology assessment varied, where all FEWs in West Lombok and Central Lombok Districts (Nusa Tenggara Province) were involved in the selection of the technology assessment's location. The highest participation of FEWs in the implementation of AIAT technology assessment was found in West Lombok District, where they were also involved in the technology assessment planning, observation, and evaluation on the implementation of the technology assessment. The dominating role of researchers/extension personnel of Riau AIAT in the implementation of technology assessment was more apparent compared with those in the other two AIATs, where only few FEWs who were involved in the selection of the technology assessment's location and cooperator farmers. FEWs in Rokan Hilir (Riau) and Mojokerto (East Java) were also limitedly involved in the observation of the technology performance, which was being assessed. This indicates the very weak linkage between AIAT with FEWs/field extension organization.

The low participation of FEWs in the implementation of AIAT technology assessment also a hindrance to the innovation flow from its source to the potential users. The FEW's high involvement in AIAT technology assessment will increase the adoption rate of the technology, since they are the personnel who will continue the innovation transfer process to the farming community.

Personnel Supervision and Evaluation

The job description of agricultural extension personnel has been up-dated through the Minister for Government Reformation's decree No. 19/Kep/M.K./Waspan/5/1999 that was enacted in 1999. However, the extremely limited budget provided for the extension

activities and a relative absence of an effective supervision and evaluation of extension personnel and program implementation, the job description of agricultural extension personnel mentioned above could not be appropriately implemented. The District Agricultural (related) Services, which had extension function in all study areas, had not adjusted the existing supervision and evaluation system of extension personnel into their new mandate in the decentralization era.

Allocation of the Financial Resources for Extension

In this decentralization era, the financial support for extension organization becomes worse as the extension budget is channeled to the District Government through the General Budget Allocation (*Dana Alokasi Umum/DAU*). This new management of budget allocation has resulted in the uncertainty for the amount of budget allotment for extension organization. The budget allocation depends on the perception of district government decision makers regarding the benefit going to be generated by investment in extension organization.

Before the implementation of decentralization policy, Munandar (2000) reported the total number of FEWs and extension personnel who worked at the sub district and district levels were 30,608 and 5,972 people respectively, whereas the total number of RECs was 3,528. The high number of extension personnel and organizations at the field level indicate the recurrent costs of implementing the T & V system of extension are high as criticized by Roberts (*in: United Nations Development Program, 1991*). As the financial support for the extension project (National Agricultural Extension Project) supported by the World Bank decreased, and eventually terminated in the beginning of 1990's, the available extension budget provided by central government sources could not sustain this high cost of extension system. This situation was likely the main consideration to decentralize agricultural extension through the Joint Decree of Minister of Agriculture and Minister of Home Affairs No. 539/Kpts/LP.120/7/1991 and No. 65 of Year 1991. A failure to meet the prerequisites for a successful decentralization has resulted in a drastic performance degradation

Technology Dissemination

The frequency of FEWs in conducting technology dissemination is very rare. Basuki *et al.* (2000) reported that the average frequency of FEWs in conducting food crop technology transfer in West Nusa Tenggara Province was only once a year with a range between none (zero) to five times a year. Head of Nganjuk District Food and Estate Crops Services suspected that the very low frequency of FEW's activities in innovation transfer was due to the limited number of available technology and information to be conveyed to the farmers.

Since the AIAT establishment, the number of recommended technology generated by Riau, East Java and West Nusa Tenggara AIATs were 13, 78 (including 31 recommendations for alternative fertilizers) and 19 technologies respectively. The Riau AIAT applied a more strict procedure in recommending the technology package that required the adoption rate by 20 percent of farmers at the location of research/technology assessment in three successive planting seasons.

Most of the existing Farmer Groups in all study locations were not established by the farming community themselves, but being initiated by the Agricultural Related Services as a medium to implement various agricultural development projects. The impact of this project approach in the implementation of agricultural extension programs is the slow empowerment process of farmer organization. The use of the extension delivery system such as the T & V System has increased farmer's dependency toward government assistance, including in acquiring agricultural innovation and information to increase their productivity and income.

Technology Adoption

Results of this study concerning the adoption of technology being assessed by AIATs in all study locations are encouraging. Except in Mojokerto, most of ex cooperator farmers still adopted the technology, ranging from 60 percent to 100 percent. However a higher percentage of ex cooperator farmers, except in Nganjuk (East Java), modified the technology according to their financial condition and or their need. Except in Kampar,

Table 6. Technology Adoption of Ex-Cooperator Farmers (%)

No.	Item	West Nusa Tenggara		Riau		East Java	
		WL ¹	CL ²	RH ³	KMP ⁴	MJK ⁵	NJK ⁶
1	Adoption by ex-cooperator farmers*:						
	• Farmers still adopted the technology	60	100	89	100	44	92
	• Farmers stopped adopting the technology	40	0	11	0	56	8
2	Adoption level of technology package:						
	• Fully adopted	20	40	0	42	28	67
	• Modified based on financial condition	40	30	38	33	66	8
	• Modified based on farmers' need	40	20	50	25	6	25
	• Others	0	10	12	0	0	8

*Cooperator farmers are farmers who participate in AIAT research/technology assessment.

WL¹: West Lombok; CL²: Central Lombok; RH³: Rokan Hilir; KMP⁴: Kampar; MJK⁵: Mojokerto; NJK⁶: Nganjuk

Rokan Hilir and Nganjuk Districts, farmer's awareness about the existence of AIAT was still low, including among non-cooperator farmers who lived in the surrounding village of the technology assessment location.

However, data in Table 7 show that the diffusion of the AIAT's technology assessment results was very slow, even to the non-cooperator farmers who lived near the technology assessment location. For this reason, AIAT needs to carry out more intensive collaborations with extension institution and District Agricultural (related) Services that hold extension function.

price of the agricultural products were their reasons to stop adopting the AIAT recommended technology. However, the inaccessibility of agricultural inputs was more often caused by the lack of farmers' working capital.

Availability of Agricultural Technology

AIAT researchers and or extension personnel were not the main source of agricultural information for ex-cooperator and non-cooperator farmers in the technology assessment locations (Table 8). The main

Table 7. The Percentage of Non-Cooperator Farmers* Who Were Exposed to the Existence of AIAT and Information about the Conduct of AIAT's Technology Assessment

No.	Item	West Nusa Tenggara		Riau		East Java	
		WL	CL	RH	KMP	MJK	NJK
1	Have ever been exposed to the existence of AIAT:						
	• Yes	7	47	77	100	42	66
	• Never	93	53	23	0	58	34
2	Have ever received information about the AIAT technology assessment:						
	• Yes	3	30	41	97	58	25
	• Never	97	70	59	3	42	75

WL: West Lombok;
MJK: Mojokerto;

CL: Central Lombok;
NJK: Nganjuk

RH: Rokan Hilir; KMP: Kampar;

*Non-cooperator farmers: farmers who were not involved in the AIAT's technology assessment and lived in the same hamlet or village with the ex-cooperator farmers.

Access of Farmers to Agricultural Inputs

In all study areas, farmers had no difficulty in reaching agricultural input vendors. Even in a remote area such as Karya Mukti Village, the study location in Rokan Hilir District, the distance of the farthest agricultural input kiosk from the Village Office was only around three Km. The inaccessibility of inputs and agricultural tools at the local level were reasons of Rokan Hilir farmers to stop adopting the AIAT recommended technology. The ex-cooperator farmers in Mojokerto District who stopped adopting the AIAT recommended technology revealed that the technology did not solve their agricultural problem. West Lombok farmers stated that the uncertainty of demand, the low and fluctuating

source of agricultural information for ex-cooperator farmers were FEWs who were followed by farmer group leaders and or family members/other farmers. For non-cooperator farmers, family members and farmer group leaders/other farmers are their main source of agricultural information, which were followed by FEWs and Head of Sub District Agricultural Services. Agricultural input kiosks, cooperatives and local traders of agricultural products are also potential sources of agricultural information for farmers.

Since FEWs are still the main source of agricultural information for farmers in all study areas, AIAT should proactively intensify the involvement of FEWs in its research/technology assessment. AIAT also needs to

Table 8. The Percentage of Farmers Who Have Ever Exposed to Various Sources of Agricultural Technology and Their Perception Regarding the Easiness to Look for Agricultural Technology and Information

Source of Technology Information	Riau				East Java				West Nusa Tenggara			
	RH		KMP		MJK		NJK		WL		CL	
	C*	NC**	C	NC	C	NC	C	NC	C	NC	C	NC
Exposure to sources of technology information:												
a. AIAT	56	41	100	77	0	0	31	25	50	3	100	3
b. FEWs	89	74	100	97	100	52	92	41	100	70	100	80
c. Head of Sub District Agricultural Services	22	9	0	0	61	19	25	13	70	23	90	7
d. Family members/ Other farmers/ Farmer group	100	75	83	89	72	82	50	42	70	87	70	70
e. Agricultural kiosks/ Local traders/ Cooperatives	100	0	8	3	33	16	8	3	50	7	80	17
f. Local leaders/Head and Staff of Village Office	100	0	67	10	89	22	0	3	30	7	0	10
g. Others	33	0	50	0	6	3	33	68	0	63	0	0
The Easiness to Look for Agricultural Information:												
a. Easy	44	38	100	100	100	100	100	100	20	13	20	47
b. Not so easy	22	27	0	0	0	0	0	0	50	17	60	27
c. Difficult	34	35	0	0	0	0	0	0	30	70	20	26

C*: Ex-cooperator farmers of AIAT; NC**: Non cooperator farmers who were involved in the AIAT technology assessment and lived in the same hamlet/village with ex-cooperator farmers; WL: West Lombok; CL: Central Lombok; RH: Rokan Hilir; KMP: Kampar; MJK: Mojokerto; NJK: Nganjuk

specifically arrange regular technical meetings such as a workshop with FEWs from the same agro-ecosystem area to inform its technology assessment results in order to increase the adoption rate.

CONCLUSIONS

In this decentralization era, it is impossible to increase the effectiveness of the agricultural innovation transfer system without a strong commitment from decision makers at the central, down to the field level, especially decision makers at the district level. Furthermore, there are several policies at the central and district levels that are not conducive to an effective agricultural innovation transfer system. Those policies need to be replaced or revised with ones that accommodate the function and mandate of each institution dealing with agricultural innovation transfer. There is also a need to replace policies that are not suitable with the current strategic

environment and decentralization policy such as the Minister of Agriculture's decree No.804/Kpts/OT.210/12/95 regarding guidelines on development and adoption of agricultural technology.

Even though the central government commitment toward the provision of agricultural innovation is quite high, but the weak linkage between AIAT and the National Agricultural Research institutions (NARs) is an impediment to increase the capacity of AIAT to function, as the main source of agricultural innovation, at the regional level. Policy adjustment and institutionalization of an effective working relationship that is conducive to the fulfillment of NAR's function to continually provide technology components to support technology assessment conducted by AIAT are needed in the effort to increase the linkage. Furthermore, the weak linkages between AIAT with extension and farmers, need serious attention from the AIAT and AARD decision makers. These weak linkages will directly affect the adoption rate of the AIAT

technology recommendation, which is one of AIAT's main criteria for success. In this decentralization era, the existence of AIAT among other regional public institutions and among farmers is strongly influenced by its capacity in generating location specific innovation to support agricultural development in its area of jurisdiction.

After the implementation of decentralization policy, the organizational structure of District Agricultural (related) Services, which is responsible for agricultural innovation transfer, is fragmented into more than one District Agricultural Services, which is based either on sub sectors or a specific mandate. Due to coordination and synergic problems, the integration of extension function into the existing Agricultural (related) Services, or splintered among a variety of agencies with similar role and function at district and field levels, will weaken the extension effectiveness. For this reason, besides depending upon extension organization in disseminating its technology assessment results, AIAT needs to facilitate the innovative farmers to function as change agents for their fellow farmers. Moreover, AIAT should also proactively facilitate the acquisition system of agricultural extension, where the technology users actively look for information they need.

For accommodating effective extension services, the ideal organizational structure would be only one District Agricultural Service with regulatory and controlling functions at the district level. This District Agricultural Service is then supported by a separated District Agricultural Extension Organization for its much needed extension component. The District Extension Organization has to be given a full mandate to conduct the extension component of all agricultural development programs of the District Agricultural Service. It means, there is no extension function in the District Agricultural Service. In this organizational setting, a strong coordination in all management aspects, starting from planning to evaluation of the extension program between those two District Agricultural Organizations mentioned above, is a prerequisite to a successful operation for agricultural development. Moreover, each organization needs to understand clearly its tasks and responsibility within the interface of the agricultural inno-

vation transfer system, and is strongly committed to make the system works effectively.

Participatory approach in the implementation of agricultural innovation transfer, through the empowerment of the existing farmer/rural community institutions, should replace the centralistic (if there is still any) R&D and extension approach. The sustainability of agricultural development and an acquisition system of agricultural extension should become the ultimate goal of all institutions that have the mandate and responsibility in agricultural innovation transfer. To achieve this goal, the prerequisites for an effective decentralized development program and management should be accommodated by all institutions dealing with agricultural innovation transfer, including the strengthening of the technical and administrative capacity of local agricultural (related) organizations.

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