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SUPPLY AND DEMAND ELASTICITIES FOR MAJOR AGRICULTURAL COMMODITIES IN THE PHILIPPINES: NATIONAL AND REGIONAL ESTIMATES

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Australian Centre for International Agricultural Research
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A REVIEW OF TECHNOLOGY ADOPTION IN THE PHILIPPINES[1]

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1 Paper prepared for the Intercountry Meeting of Research Priorities Projects, Punta Baluarte, Batangas, Philippines, October 1990.

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1. INTRODUCTION

The role of technology transfer in increasing productivity and accelerating rural development is well recognised. Government planners and program implementors have consciously advocated the development and utilisation of technologies for development. In the Philippines, substantial amounts of resources have been invested in research which resulted in the generation and development of agricultural technologies. Many of these technologies hold potential for increasing farm productivity and improving the standard of living in the rural countryside.

Technologies generated through research may be considered successful only if they are adopted by the farmers. Past studies have shown that despite significant breakthroughs in technology farm productivity has remained low. This is further compounded by the very low adoption rates of new technologies.

This paper provides information on the adoption of new/recommended technologies for different commodities in the Philippines. It reviews rate of technology adoption by commodity and by location. It also identifies the factors that affect the adoption/non-adoption of technologies.

2. METHODOLOGY

The measurement of adoption was frequently conceptualised in terms of a scoring system based on the number of technologies adopted to the total number of technologies available to the farmer. The resulting score was used as the basis for classifying the adopters, oftentimes with the mean as the dividing mark (Samonte 1989). For instance, in one study, the indicator for adoption was the use of recommended technologies where farmers who adopted 6 or more practices were classified as high adopters and those with 5 or fewer practices as low adopters.

Another type of measurement consisted of a scale where points were assigned to a fixed set of responses as for instance three points for fully adopted, two points for partially adopted and one point for non-adopted. The summation of the points was the total adoption score.

Adoption rate was measured by the cumulative percentage of farmers using the recommended technologies.

Regression analysis was used in determining the significance of several factors affecting technology adoption. Some of the factors included in the regression model include farm characteristics (farm size, number of parcels, availability of irrigation, soil type, distance of farm from input market); farmers' characteristics (educational attainment, tenure status, household size); and exposure to change agent (membership to farm organisation, contact with technicians, source of farm information, farming beliefs, and willingness to adopt new technology). Another measure used was the chi-square (χ^2) test.

3. RATE OF TECHNOLOGY ADOPTION

Tables 1-6 summarise the rate of adoption of various component technologies for the different commodities and farming systems. Improved varieties on new cultivars predominate in the production of potato, cabbage and cacao whether grown in cacao plantation or under coconut

or hilly farming systems. Cacao plantation in Mindanao is relatively young in age and farmers tended to look for recommended varieties when they established their plantations. In Eastern Visayas, the Farming Systems Development Project-Eastern Visayas (FSDP-EV) introduced new cacao varieties which were adopted primarily by project cooperators. Coconut, which is the main crop, still consists of old varieties.

Similarly, virtually all strawberry farmer respondents in the valley areas were contracted by a private company which introduced new cultivars. In the hillside, only 20 percent planted new strawberry cultivars.

Soil analysis has always been recommended to enable farmers to determine the right kind and quantity of nutrients to apply. However, only a few farmers have subjected their soils to laboratory analysis, a major reason being the lack of knowledge and facilities for soil analysis. Nevertheless, they try to determine the type and quantity of fertilisers to apply based on their own experience or recommendations for other farmers or from technicians. All potato, cabbage, and strawberry sample farms were fertilised and almost all coffee sample farms in Luzon. However, in Mindanao only about one-half of the farmers used fertilisers mainly on the perception that the soil is still fertile and therefore does not require fertiliser. Only about one-third of the mango and the hilly farms were fertilised while very few of the coconut farms used fertiliser despite the presence of the FSDP-EV in the area.

Pest and disease control was a very important operation for annual crops and for mango. All sample mango farms were using chemical flower inducers which need complementary pest and disease control.

Only one percent each of mango and cacao farms irrigated their trees. In general, irrigation seemed to be practised only for lowland rice. Irrigation facilities have never been provided to upland farms except in plantations of sugarcane and banana.

Technology adoption in rice has been relatively high (Table 3). Practically all irrigated rice farms are planted to modern varieties. Fertilisation, pest and disease control and other recommended technologies are being followed. The high adoption rate in rice was made possible by a determined and aggressive extension delivery system, eg Masagana 99 Program. The technologies being disseminated were able to meet farmers' expectations. Support services such as low interest loans and easy acquisition of farm chemicals, fertilisers and inputs encouraged the farmer to adopt the new rice technologies.

For many other crops and farming systems, the rate of technology adoption had been quite low (Tables 4, 5, 6). Farmers were using traditional varieties and only a few were using fertiliser and practising pest and disease control. Irrigation was hardly practised.

4. FACTORS AFFECTING ADOPTION/NON ADOPTION

What factors explain the adoption or rejection of a technology? Tables 7 and 8 attempt to provide some explanation. Regression equations relating rate of adoption with several factors indicate the following as important factors affecting adoption : farm area for cabbage and strawberry; education for cabbage, coffee, and rice-based farming system; membership in farmers' organisation for cabbage, strawberry, coffee and mango; and financial assistance for cabbage and mango.

Among cacao growers in Mindanao, the number of household members adversely affected technology adoption. A big household would require more expenditure for household needs and therefore only a little could be allocated for farm expenditures. Cosmopolitanism, measured as frequency of visit to the city, had a positive and statistically significant coefficient for rate of technology transfer in coffee in Mindanao.

For coconut-based farming system, the adopters were usually farmer-cooperators, with a flat parcel of land, with a large area planted to coconut, had a higher income, and availed credit and employed more labour for crop production.

In hilly lands of Eastern Visayas, farmers who planted ipil-ipil or madre de cacao hedgerows in their farms were cooperators, without flat parcels of land, active participants in farmers' organisations and availed credit from both formal and informal sources.

On the other hand, non adoption was explained by economic, technical and social reasons (Table 8). Either the inputs were not available or expensive or that the farmers were constrained financially. Equally important reasons were lack of knowledge about the technology or that the inputs were not available and that the technology was not necessary.

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Table 1. Rate of adoption of selected technologies in various commodities

Technology	Potato	Cabbage	Strawberry		Coffee		Coconut-based Farming System (Eastern Visayas)			Mango	Hillyland Farming System	Cacao
	Benguet and Mt Province	Benguet and Mt Province	Benguet & Mt Prov. Hillside	Valley	Luzon	Mindanao	Coconut	Fruits	Cacao	Luzon	E. Visayas	Mindanao
Varietal/cultivar selection												
IVs/new cultivars	77	94	5	96	-	-	-	-	88	-	-	79
TVs/old cultivars	17	5	80	2	-	-	100	100	12	-	-	-
Combination	6	1	15	2	-	-	-	-	-	-	-	-
Fertilizer usage	100	100	100	100	95	47	9	-	-	36	37	43
Soil analysis	-	-	-	-	-	18	-	-	-	-	-	19
Insect control	-	-	-	-	-	9	-	-	-	-	-	17
Chemicals	76	100	100	100	12-77	-	-	-	-	100	-	-
Disease control	-	-	-	-	-	7	-	-	-	-	14	-
Use of chemicals	99	48	82	98	-	-	-	-	-	-	-	40
Covercropping	-	-	-	-	-	-	-	-	-	-	-	-
Irrigation	-	-	-	-	-	-	-	-	-	-	-	1
Flower Induction	-	-	-	-	-	-	-	-	-	100	-	1
Weed control												
Manual	100	100	100	100	-	-	-	-	-	37	-	97
Chemical	1	-	-	-	-	-	-	-	-	-	-	1
Top pruning	-	-	-	-	26-83	-	-	-	-	-	-	86
Rejuvenation	-	-	-	-	7	-	-	-	-	-	-	4
Harvesting												
Total	-	nil	-	-	36	-	-	-	-	-	-	-
Priming/selective	-	100	-	-	23	-	-	-	-	-	-	-
Combination	-	-	-	-	41	-	-	-	-	-	-	-

Source: Librero, A R (ed) 1990

Table 2. Rate of adoption of selected technologies in various commodities

Technology	Rootcrops		Abaca	Sugarcane	
	Eastern Visayas	Bicol	Eastern Visayas	Philippines	Batangas
Use of MVs	41	21	NA	100	100
Seed selection	69	-	-	100	NA
Seed treatment	-	-	-	62	0.3
Soil analysis	0	-	2	58	NA
Fertiliser usage	2	0	2	100	42
Pest control	1	9	2	58	80
Disease control	2	9	2	58	80
Irrigation	0	0	0	11	0.6
Subsoiling	-	-	-	28	35
Liming	-	-	-	21	44

Sources: Samonte, V et al. 1976
Samonte, V and Legaspi, E 1978
Pascual, N et al. 1976
Gianan, N 1983
Ilao, R 1982

Table 3. Rate of adoption of selected technologies in rice

Technology	Mt Province	Cagayan	Isabela	Bulacan	Batangas	Laguna	Bataan	Camarines Sur	Bicol	Samar	Bukidnon
Use of MVs	1	94	98	95	40	100	94	100	86	75	82
Seed selection	18	-	-	76	45	-	-	-	-	-	-
Seed treatment	-	-	-	-	-	-	55	-	14	15	-
Fertilizer usage	9	95	98	99	99	100	63	99	-	29	95
Pest control	5	57	100	99	91	100	92	100	74	35	97
Disease control	5	57	100	99	91	100	-	100	-	24	97
Weed control	-	-	93	89	58	100	67	93	58	19	69
Irrigation	29	-	100	92	71	100	-	100	-	-	76
Soil analysis	-	5	-	-	-	-	-	-	-	-	-

Source: Gomez and Orozco 1979
Magpantay, R 1980
Consolacion, C et al. 1984
Alviar, N et al. 1984

Table 4. Rate of adoption of selected technologies for corn

Technology	Cagayan	Isabela	Camarines Sur	Cebu	Bukidnon	Negros Oriental	Leyte	Samar	Region II
Use of MVs	1	67	94	48	55	39	44	5	42
Seed selection	100	-	-	-	-	-	70	25	-
Seed treatment	4	-	-	-	-	13	16	4	88
Soil analysis	-	-	-	-	-	-	1	-	-
Fertilizer usage	7	60	86	29	87	55	9	9	57
Pest control	16	67	88	30	52	25	2	4	58
Disease control	-	67	88	30	52	-	1	1	28
Weed control	-	75	43	54	81	11	-	-	88
Irrigation	-	16	6	8	13	-	-	-	-

Sources: Marasigan, M 1977
Gomez and Orozco 1979

Table 5. Rate of adoption of selected technologies for coconut

Technology	Quezon	Camarines Sur	Leyte	Leyte and Southern Leyte
Use of new/modern varieties	-	0	1	-
Seed selection	-	-	1	88
Fertilizer usage	6	6	1	-
Intercropping	8	91	-	-
Cover cropping	2	59	2	-
Replanting	-	94	0.5	74
Weed control	-	24	-	-
Pest and disease control	-	1	-	-

Sources: Abarientos, R 1970
Alcober, D 1978
Go and Cañada 1981
Samonte, V et al. 1976

Table 6. Rate of adoption of selected technologies in milkfish production

Technology	Philippines	Bicol	Eastern Visayas	Western Visayas
Pond drying	87	100	100	97
Pond levelling	61	79	94	83
Pest control	98	100	100	98
Catch and kill	55	70	56	67
Use of chemicals	73	51	38	92
Pond drying	12	42	44	6
Fertilizer usage	67	57	19	88
Inorganic	53	17	67	90
Organic	19	73	33	8
Combination	28	10	-	52
Supplemental feeding	26	6	12	33
Harvesting				
Total	79	72	81	88
Selective	20	28	19	9
Both	1	2	-	3

Source: Librero, A R et al. 1976
Ramos, D and Aspuria, T 1979

Table 7. Factors affecting technology adoption

Factors	Corn	Cabbage	Strawberry	Coffee	Cacao	Rice based FS	Mango	Prawn/Milkfish
Area		X	X					
Number of parcels		X						
Education		X		X		X		X
Number of family members			X		X			
Age						X		X
Tribe								
Religion								
Cosmopolitanism				X				
Membership in organisation		X	X	X			X	
Soil type			X					
Contact with technicians	X	X						
Financial assistance	X	X					X	
Tenure						X		X
Income	X						X	
Source of farm info		X						

Table 8. Reasons for not adopting technologies

Reasons	Corn	Coconut	Coffee		Cacao	Rice	Sugarcane	Abaca	Prawn/ Milkfish
			Luzon	Mindanao					
Expensive	X			X	X	X	X	X	X
Financial constraint	X	X	X	X	X	X	X	X	X
Utilized indigenous sources		X							
Laborious		X	X		X			X	
Not familiar with pesticides		X						X	
Lack of knowledge	X	X	X			X	X	X	
Lack of water source and facilities			X						
Small farm area			X						
Inaccessible from road			X						
Unavailability of input	X					X	X		
Others don't adopt	X	X				X		X	
Ineffective inputs		X				X			
Effect of chemicals to man and crop						X			
Not perceived as a problem/not necessary		X	X		X	X	X		X
Peace and order situation									X

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Table 4. Summary of Validated Objective and Subjective Demand and Supply Elasticity Estimates

FISHERIES	PHIL	CAR	ILOCOS	CAGAYAN VALLEY	CENTRAL LUZON	SOUTHERN TAGALOG	BICOL	WESTERN VISAYAS	CENTRAL VISAYAS	EASTERN VISAYAS	WESTERN MINDANAO	NORTHERN MINDANAO	SOUTHERN MINDANAO	CENTRAL MINDANAO
DEMAND														
MILKFISH	-0.63*	-0.80	-0.50	-0.80	-0.50	-0.56*	-0.60	-0.50	-0.60	-0.80	-0.60	-0.70	-0.60	-0.70
TUNA	-1.50	-1.80	<---- -1.50 to -1.80 ---->				<---- -1.30 to -1.40 ---->				<---- -1.30 to -1.50 ---->			
ROUNDSCAD	-0.50	<-- -0.5to -0.6-->		<---- -0.40 to -0.50 ---->			<---- -0.30 to -0.40 ---->							
TIGER PRAWN	-1.52	-1.80	-1.50	-1.80	-1.40	-1.50	-1.60	-1.20	<---- -1.50 ---->					
TILAPIA	-0.65*	-0.75	-0.55	-0.55	-0.55	-0.55	-0.50	-0.75	-0.65	-0.75	-0.75	-0.70	-0.60	-0.70
SUPPLY														
MILKFISH	0.60	0.30	0.80	0.40	0.80	0.60	0.65	0.80	0.50	0.45	0.70	0.35	0.45	0.40
TUNA	0.21	0.10	0.10	0.15	0.15	0.22	0.22	0.25	0.20	0.20	0.30	0.22	0.30	0.30
ROUNDSCAD	0.21	0.15	0.15	0.15	0.20	0.35	0.25	0.25	0.20	0.25	0.25	0.20	0.20	0.20
TIGER PRAWN	0.63	<---- 0.60 ---->			0.80	0.60	0.90	0.90	0.50	0.50	<---- 0.45 ---->			0.50
TILAPIA	0.50	0.20	0.65	0.65	0.65	0.65	0.30	0.50	0.30	0.30	0.40	0.50	0.40	0.40

* Elasticities based on previous studies, the rest are subjective estimates

III. Export crops - coconut, sugarcane, tobacco
IV. Plantation crops - coffee, cocoa, cotton
V. Livestock - cattle, chicken, hog, carabao
VI. Fishery - milkfish, tuna, roundscad, tiger prawn, tilapia

In validating the regional estimates the following criteria were considered:

(i) **Regional income** - regions with high income levels tend to be more responsive to price changes, especially on luxury goods, than regions with lower income levels.

(ii) **Consumption level/budget share** - demand for a commodity is elastic when a large fraction of total expenditure is devoted to that single commodity.

(iii) **Urbanization** - urban areas as measured by the proportion of the population showed a bigger magnitude of elasticity estimates compared to rural areas.

(iv) **Availability of substitute**- commodities with many close substitutes have a more elastic demand.

(v) **Uses of the commodity** - the more uses of a commodity the more elastic is the demand for it.

The regional supply elasticity estimates were based on the following considerations:

(i) **Principal crop within the area** - If the commodity is primary crop within the area and the volume of production is high then that commodity is elastic.

(ii) **Crop suitability** - Adaptability of crops to a particular region makes it more elastic to price changes.

(iii) **Land use pattern/availability of potential areas** - In regions where potential areas are available which makes it easier for the farmers to adjust their production, then commodities tend to be elastic.

(iv) **Presence of infrastructure** - The presence of irrigation facilities, farm-to-market roads and warehouses tend to make commodities more elastic in some regions than in regions where there is a lack of such infrastructure facilities.

Cereals - For crops, especially rice and corn, various opinions were shared by the members. Dr. Ingco gave the following estimates for rice and corn at -0.102 and -0.078, respectively. The demand for rice appears to become less responsive to its own price over time. Others think that Bouis's elasticity of -0.58 for Mindanao was too high for rice. Since the magnitude of elasticities varied markedly due to differences in methodology and data used, an upper limit and lower limit were adopted as long-term and short-term elasticity estimates. This was done for most of the commodities.

For corn and soybean separate estimates for food and feeds were used. Corn as food was assigned a lower value compared to corn as feed. The same method was applied for soybean.