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Diffusion of a Mechanical Technology: The Case of Combines in Muda

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RINGKASAN

Faktor-faktor yang mempengaruhi penggunaan mesin penuai "combine" oleh petani di Rancangan Muda telah dikenalpasti sebagai keluasan sawah petani, tanggapan petani tentang faedah ekonomi mesin, faktor jiran, keanggotaan dalam Pertubuhan Peladang dan beberapa faktor lain. Kesimpulan telah dibuat bahawa teknologi baru ini akan terus meresap di kalangan pesawah padi kerana kosnya yang rendah dan kecepatan bekerja berbanding dengan tenaga manusia.

SUMMARY

Factors associated with the use of combine harvesters by the farmers in the Muda Scheme were identified as the farm size, farmers' perception of the economic benefit of the machine, neighbourhood factor, membership in Farmers' Organisation and several other factors. It was concluded that the new technology will continue to spread among the paddy farmers because of its cost saving and speed of operation compared with human labour.

INTRODUCTION

Double-cropping with improved short-term, high-yielding varieties of rice is the means by which Malaysia is attempting to attain self-sufficiency. The pre-requisite to double-cropping is water availability and its efficient management. This means that irrigation facilities have to be planned and implemented in the traditional rice areas. The more recent and important areas affected in Malaysia are the Muda, Kemubu and Besut schemes, with the Muda scheme the largest in terms of geographical area covered and development expenditure incurred.

The Muda scheme lies in a flat alluvial plain, about 14 miles wide and 46 miles long between the foothills of the Central Range in Kedah and the Straits of Malacca. The scheme is located in the north-western corner of the Malaysian Peninsula, stretching from South Perlis to the Yan District in Kedah.

Partly financed by a M$135 million World Bank Loan,[1] the Muda scheme was undertaken between 1966 and 1970 to enable the practice of double cropping of 260,000 acres of paddy land (MADA, 1970b:1), over 28 per cent of the paddy land in Peninsular Malaysia. The project had long been a single crop paddy farming area which provides the major source of livelihood and employment for about 50,000 farm families. The total farm population of the scheme was estimated at around 325,000 people (MADA), 1970c:1).

To implement the Muda Project, the Malaysian government in 1970 established the Muda Agricultural Development Authority (MADA). The area is divided into four irrigation districts which are further subdivided into 27 Farmer Development Areas (FDAs). Each FDA has a Farmers' Association through which modern agricultural practices, credit, inputs and marketing services are channelled to the farmers. Also, each is organized into several small agricultural units (SAUs) and each unit is headed by a leader elected from among the progressive farmers. The FDA in Muda

[1] The current rate of exchange gives: U.S. $1.00 = M$2.20.

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is a "farming locality" (Mosher, 1969:3-4) and contains about 2,000 farm households.

This paper is concerned with the diffusion of the service of the combine harvester, a form of capital-intensive technology, in the small-holding agriculture of Muda. The combine harvester is a relative newcomer in peasant paddy production compared with the tractor. At present the use of the harvester is primarily confined to the double-cropping area of the Muda Scheme, made available by both private contractors and MADA. Data for the study came from a survey of 858 farmers in three selected localities in the Muda scheme, conducted in 1978-79.

The arrival of the combine harvester in the Muda Project area, primarily smallholding agriculture, is interesting in itself. It portrays a picture of what Mellor (1966:226) calls a technologically dynamic agriculture, characterized by high capital investment, which normally occurs after the process of economic development has been underway for some time, and describes the agriculture of the industrialized countries.

The presence of the combine harvester in Muda appears to be a classic example of a *direct* transfer (Evenson and Binswanger, 1978:166) of a mechanical capital-intensive technology from the developed economies to a developing country. Under this kind of transfer, a country simply screens and adopts the technology without modification.

As is true with other forms of new technology, the difussion of the use of the combine harvester among the small rice farmers is not uniform over time and space and across individual farmers.

What are the major elements that have contributed to the spread of this new imported technology among small farmers, the majority of whom have neither the financial nor the technical ability to own the machines? Can a meaningful pattern be discerned of this diffusion process over time and across farms in the study area?

OBJECTIVES

The overall objective of this study is to explain the incidence of the rice combine harvester in the Muda scheme by specifically

(i) identifying and measuring the relative contributions of the factors that are associated with farmers' level of use of mechanical harvesting technology in the Muda scheme; and

(ii) explaining the pattern of the diffusion of the combine harvester over time.

METHODOLOGY

The theory of induced innovation (Hicks, 1932: Rosthschild, 1954; Ahmad, 1966) postulates that changes in relative prices of inputs influence the *creation* of a new set of production insoquants in the economy. This theory, while providing useful insight into the process of technical change, does not offer much explanation regarding producers' decisions to shift from the old unit isoquant to a new one. That is, the theory does not venture to explain producers' decision to *adopt* or use a new technology, such as the combine harvester. The approach used in the following discussion is based on fairly simplistic behavioral models in which the decision variable (dependent variable) is influenced by certain characteristics of the actor and his environment.

The dependent variables of interest in connection with this technical change are: first, the extent to which the new technology is adopted (y_1); and secondly, how early to adopt the new technique (y_2). The term "to adopt" refers to the implementation of the decision to contract for the use of a combine harvester. The extent of use was measured by the actual area of the farm that was harvested mechanically (ARCOM) while the earliness of use was measured by the number of cropping seasons (TIME) that the farmer had used the machine.

The Model. Letting Y be an N-component vector of observations of a dependent variable and X an $N \times K$ matrix of observations on the explanatory (independent) variables, the stochastic relationship between Y and X is $Y = f(X, U)$ where U is an N-component vector of random disturbances. The relationship expressed above does not necessarily imply causality in the $X \rightarrow Y$ direction but merely association in the statistical sense between X and Y. We now turn to a justification of the independent variables of the model.

Farm Size (FSIZE). It is conventional wisdom in the literature to include farm size as an independent variable to explain use of a new technology. In Muda, double cropping means that the harvesting period has been shortened and therefore it has to be done rapidly to avoid bad weather.

This condition means that, *ceteris paribus*, larger farms with a lower ratio of labor to land will have to use the combine harvester to a greater extent than the smaller ones in order to avoid risks of bad weather. These farms are also more likely to fall within the group of early adopters.

If "extent" of adoption is measured by the actual acreage harvested by the machine, then it is likely that "extent" tends to depend directly on the farm size. Designate the actual acreage mechanised as y_1 and call this the "demand" for the contract service, and y_2 the earliness in adopting the technology:

$$\partial y_1/\partial x_1 \geqslant 0 \text{ ("Demand")}$$
$$\partial y_2/\partial x_1 \geqslant 0 \text{ ("Earliness")}$$

where x_1 is the farm size. The farm size was measured in the local unit relong (equals 0.711 acre or 0.288 ha.).

Schooling (SCH). There are many compelling reasons for viewing education as an explanatory variable. Elementary education programs will develop in the child the habit of turning to the printed page for information about new technology (Gittinger, 1968:253). Increased education may enhance a worker's ability to acquire and decode information about costs and productive characteristics of other inputs (Welch, 1970:42). Additional schooling also increases the economic productivity of farm labor and farmers with more schooling will organise production more efficiently than farmers with a lower level of schooling (Gisser, 1965:582). For example, a study by Wiransinghe (1977:66) in Sri Lanka showed that the number of years of schooling of the farm operator and average schooling (years) of the family members were highly statistically significant in determining the "rice farming knowledge" of the farmer, in a regression framework. In this study, schooling was measured by the number of years of school attendance which, in the sample, ranged from 0 to 15.

Tenure Status. Traditionally, Muda paddy farmers have been divided into three distinct tenure categories; namely, the full owner-operators who do not rent in additional land, the full tenants who rent in all of their land and the part-owner, part-tenant group (Jegatheesan, 1976). In this study, tenants made up 31 per cent of the sample, while pure owners constituted 45 per cent of the sample. From the preliminary visits to Muda, it was learned that some farmers rejected the idea of the combine harvester because of the machine's tendency to "damage" the land. Thus, tenants may be prevented by landlords from employing the combine harvester if the landlords believed the damaging effect of the machine on the soil.

On the other hand, if tenants are more motivated to achieve higher output in order to meet rent payments (Jegatheesan, 1976:39), then one would expect tenants to be more likely to use the combine harvester. These opposing possibilities tend to suggest that, *a priori,* it would be difficult to postulate a set of definite hypotheses about the influence of tenure status on the level or earliness of use of the combine harvester.

Fragmentation (PCL). A farm may be considered fragmented if it is made up of several noncontiguous plots or "parcels". For a given farm size, the more parcels there are, the more fragmented it is. Hence, "fragmentation" is a function of farm size as well the number of parcels. The combine harvester is a gigantic machine which must move across farm boundaries to perform its specific task. Some of the technical problems in the use of the combine harvester include difficulty of movement in small plots, difficulty in crossing bunds, bogging, transfer of rice from combines' bulk tanks to bags, and difficulty of entry into the field during the off-season when fields are full of water (MADA, 1970a:7).

A farmer whose farm is greatly fragmented, *ceteris paribus,* is not likely to achieve full mechanisation in his harvesting operation compared with another farmer whose farm is less fragmented. Since fragmentation is a function of farm size (FSIZE) and number of parcels (PCL) operated, intuitively the function should have the following properties:

$$\partial(FMN)/\partial(FSIZE) < 0$$
$$\partial(FMN)/\partial(PCL) > 0$$

As a practical matter, an index of fragmentation could be written as

$$FMN = PCL/FSIZE$$

which meets the stated properties. However, to avoid the possible confounding effect of FSIZE on FMN, the number of parcels (PCL) was used as a proxy for the fragmentation index. Therefore, the coefficient of PCL measures the effect of PCL upon the dependent variable after controlling for the effects of all other explanatory variables, including the farm size. In this study, PCL ranged from 1 to 6 with a mean of 1.73.

Sex of Respondent (SEX). Sex is a demographic characteristic of the farmer and is included as an explanatory variable to enable a testing of the null hypothesis that male and female farmers do not display any difference in their pattern of adoption of the new mechanical technology. However only 6 per cent of the respondents were women. This is a dichotomous variable.

Perception of Economic Advantage (ECON). This is a binary variable. The theory of induced innovation postulates that changes in relative prices induce new technologies to be developed which will save the relatively more expensive factor. It is hypothesised here that similar changes in relative prices induce farmers to use the new technology, provided that they have perceived its cost advantage. It is assumed that farmers operating with perfect knowledge will act rationally to reduce costs. Forty one per cent of the respondents believed that harvesting by machine was definitely cheaper than by hand.

Perception of Better Grain Recovery (RCV). This is also a binary variable. Preliminary investigation in the study area tends to suggest two opposite views on the grain recovery rate of the combine vis-a-vis the traditional method. One group claimed that manual threshing has a lower recovery rate compared with the combine harvester, while the other group held the opposite view. If farmers perceive the greater technical efficiency of the combine harvester, we hypothesise that they will tend to choose the combine rather than manual method of harvesting. However, only 17 per cent of the respondents believed that mechanical harvesting was more efficient in grain recovery than hand method.

Neighbourhood Effect (NHBR). This is a dichotomous variable intended to reflect two separate effects – namely, environmental and social. A farmer whose neighbour had used the combine was coded 1, otherwise he was coded zero. Environment determines a machine's availability in an area. A machine must be available in an area before a farmer can summon its service. Fifty four per cent of the farmers reported that their neighbours had used the machine to harvest their crop.

On the social side, the neighbourhood variable reflects what is commonly known as the bandwagon effect, the demonstration effect or the desire to keep up with the neighbours. Neighbours bours often serve as important "communication channels" (Rogers and Shoemaker, 1971:251) in the diffusion of new technology in agriculture.

Age. Age in years is a farmer characteristic often used as an explanatory variable in technology diffusion studies Rogers and Shoemaker (1971: 185-186), however, postulate that earlier adopters are not different from later adopters in age and cite inconsistent evidence about the relationship of age and innovativeness. In the sample, AGE ranged from 17 yeras to 99 years, with a mean of 43.3 years.

Labour Availability. If the major reason for adoption of a machine was shortage within the farm household, then households with ample supply of labour would be less likely to use a machine, *ceteris paribus.* This variable was measured in adult-equivalents available in the household to do farm work. It ranged from 0 to 2.09 in the sample.

Full-time Status. This is again a binary variable. A full-time farmer may regard farming as his way of life and want to do the various operations using his own labour. On the other hand, another farmer may regard farming as a business and source of income, and may, therefore, want to keep abreast with "modern" technology and be a better farmer. To this group, therefore, machinery "is in". Consequently, it would be presumptuous to state a definitive hypothesis concerning the effect of this categorical variable on the dependent variable. Eighty eight per cent of the respondents claimed to be full-time farmers in the sample.

Farmers' Association Membership. This is a dichotomous variable. Although none of the 27 Farmers' Associations in the Muda area owns a combine harvester, the service of the smaller type of machine is made available to farmers through the FA's by MADA. It is hypothesised that members of the FA's, because of their closer contact with the authority, are more likely to adopt mechanised harvesting than nonmembers. Farmers' Association members made up 49 per cent of the sample.

Data and Analytical Tools. Primary data collected by means of personal interviews with 858 farmers in three FDA's in the Muda Scheme made up the bulk of the data used in this study. The interviews were conducted in late 1978 and early 1979 by use of structurally designed questionnaires. Details of the sampling may be found in Ayob (1980).

The Tobit model (Goldberger, 1964:253) was employed to analyse the "extent" and "earliness" of use of the new technology on individual farms. This model was deemed the most appropriate in explaining the extent and earliness of use of the combine harvester because the dependent variables to be explained were truncated at the zero level for over 70 per cent of the farmers interviewed, i.e., the non-users of the machine. The Tobit model may be stated as follows:[2]

$$Y_t = \beta' X_t + u_t \text{ if } \beta' X_t + u_t > 0$$

$$\text{if } \beta' X_t + u_t \leqslant 0 \quad (t = 1, 2, \ldots, N)$$

where X_t is a K-component vector of values for the t^{th} observation, β is a K-component vector of unknown coefficients and u_t is a stochastic disturbance term independently distributed as $N(O, \sigma^2)$. Parameter estimates were obtained by maximum-likelihood procedures with the setting up of appropriate likelihood functions and maximising these functions with respect to the parameters. The resulting normal equations were non-linear in the parameters and an iterative procedure was used to arrive at the estimates.

RESULTS

Extent of Use

An overall test of significance of the first model by the likelihood ratio test gave a test statistic of 429.46 (Table 1), which is distributed as a χ^2 statistic with 15 degrees of freedom. The critical value for $\chi^2{}_{.005}(15)$ is 32.801; hence, the null hypothesis that the coefficient vector equalled the null vector was rejected at the 0.005 level of probability, i.e., the independent variables

Table 1
Results of Tobit analysis of actual area of paddy land harvested mechanically, Muda Scheme, 1977-78 (dependent variable = ARCOM)[a]

Independent variable	Coefficient	Asymptotic "t"	Elasticity	
			Index	$E(y_{20})$
CONST	−12.937	7.948		
FSIZE	0.499	8.663	2.334	1.195
OWN	0.215	0.396		
TEN	0.432	0.771		
PCL	0.168	0.621	0.261	0.134
SEX	−0.542	0.553		
ECON	1.216	2.824		
RCV	0.439	0.865		
NHBR	6.637	11.591		
AGE	−0.016	0.827	−0.633	−0.324
LABOR	0.028	0.115	0.053	0.027
FUI	1.523	1.669		
SCH	0.055	0.754	0.194	0.099
FAS	1.132	2.671		
FDA3	1.746	3.125		
FDA1	−0.166	0.303		

Log of likelihood function:
Unrestricted model = −842.88
Restricted model (with CONST only) = −1057.61

$-2 \ln \lambda = 429.46^* \sim \chi^2$, 15 d.f.

[a] NOTE: Number of limit observations = 623
Number of nonlimit observations = 235

* Significant at 0.005 level.

[2]See Amemiya (1973) and Fair (1977)

postulated to influence the area mechanised did collectively exert influence on the dependent variable to a significant degree.

The Tobit estimates for farm size (FSIZE), perception of economic advantage (ECON), neighbour's decision (NHBR), full-time status (FUL), Farmer's Association membership (FAS) and the locality dummy variable (FDA3) all have small standard errors and the hypothesized signs. Thus, for instance, the area combined varies directly with farm size, *ceteris paribus*. Farmers who perceived the economic advantage (ECON) tended to harvest a larger area by machine than those who did not perceive the cost advantage of the new technology, other things equal. The remaining variables did not appear to be important in influencing the area mechanised.

The ARCOM equation may be considered as a type of "demand for machine" equation as ti could be used to predict the actual acreage to be harvested by machine. The equation lacks a price variable, which is not uncommon for cross-sectional studies. This ARCOM equation would be analogous to an Engel function in demand studies.

Earliness of Use

An overall test of significance was also conducted on the earliness of use model, as was done with the extent-of-use model, giving a test statistic of 377.6, distributed as χ^2 with 15 degrees of freedom (Table 2). The critical value for $\chi^2_{.005}(15)$ is 32.8. The null hypothesis that the coefficient vector in the Tobit equation of

Table 2

Results of Tobit analysis of earliness of use of the combine harvester, Muda Scheme, 1977-78 (dependent variable = TIME)[a]

Independent variable	Coefficient	Asymptotic "t"	Elasticity	
			Index	$E(y_3)$
CONST	–3.156	7.215		
FSIZE	0.074	4.858	1.207	0.620
OWN	0.015	0.104		
TEN	0.143	0.934		
PCL	0.121	1.622	0.652	0.335
SEX	–0.183	0.698		
ECON	0.265	2.262		
RCV	0.207	1.502		
NHBR	1.817	11.970		
AGE	–0.006	1.069	–0.773	–0.397
LABOR	–0.025	0.363	–0.160	–0.082
FUL	–0.557	2.257		
SCH	–0.003	0.158	–0.039	–0.020
FAS	0.322	2.794		
FDA3	0.416	2,751		
FDA1	–0.043	0.291		

Log of likelihood function:

Unrestricted model = –556.89

Restricted model (with CONST only) = –745.71

$-2 \ell n \lambda = 429.46^* \sim \chi^2$, 15 d.f.

[a] NOTE: Number of limit observations = 623

Number of nonlimit observations = 235

* Significant at 0.005 level.

earliness-of-use equalled the zero vector was rejected.

Farm size appears to be a significant variable with the anticipated positive sign. The positive sign indicates that larger farms adopted the machine earlier than the smaller farms. Gerhart (1975:43) found farm size to be significant in influencing earliness of HYV maize adoption in Kenya. In the present study, the elasticity $E(y_3)$ shows that a 1 per cent increase in farm size increased the expected number of seasons mechanised by 0.62 per cent.

As anticipated, the estimated coefficients for the perceived cost saving (ECON), technical superiority (RCV), neighbour's use (NHBR), Farmers' Association membership (FAS) and locality (FDA3) variables had positive signs with small standard errors. The standard errors of the remaining variables were about equal to or greater than their coefficients. The coefficients of the tenant (TEN) and owner (OWN) variables are both positive but have large standard errors. The results indicate that the early users did not come from any particular tenure group.

The PCL coefficient suggests that the farmer with more parcels of land adopted the machine earlier, other things being equal. The result, therefore, indicates that farmers with fragmented holdings were not at all the laggards in the use of the new harvesting technology in the Muda Scheme. Mechanisation of smallholding agriculture, therefore, has not been hampered by the subdivision of holdings into "small uneconomic units." This is not to suggest that fragmentation is conducive to mechanisation, but only to emphasise that the available evidence from the Muda area suggests that mechanisation of small paddy farms can be successfully implemented so long as neighbouring farmers will cooperate with one another.

The estimated coefficient of the "neighbourhood" variable (NHBR) had a small standard error with the hypothesised positive sign. The positive sign suggests that farmers whose neighbours had used the machine, used the combine harvester more times than those farmers whose neighbours had not used the machine. As the NHBR variable was intended to reflect the availability of the machine in an area, the results indicate that, once available, the technology will be readily received.

The estimated coefficient of AGE is now positive with a small standard error. The negative sign means that the younger farmers compared to older farmers had a longer experience with mechanical harvesting in the Muda area. Bearing in mind the relatively short history of the combines in the Muda Scheme, the suggestion that younger farmers used the machine earlier than the older ones does not imply that the younger farmers had more farming experience than the older ones. The data only revealed the fact that with the combine harvester, which was introduced in the last four or five years, younger farmers were more likely to be the first ones to adopt the new technology.

The negative sign and large standard error of the estimated coefficient of LABOR provide some evidence in support of a belief that the spread of the combine harvester has not forced labour from farms. Perhaps what is happening is that some family members are seeking employment on other farms, leaving their own farms to be tended by the household head, outside labour and the combine operator. It should be realized that family members are rarely paid on a regular basis to work on the family plot, and selling their labour to other farms may be the only avenue to earn cash during the harvesting season.

The results of the analysis showed that the full-time farmer adopted the combine harvester sooner than part-time farmers, other things equal. It is suggested that, the part-time farmer might have made long-term commitments with friends and relatives to harvest his crop, while he attended to his main occupation.

The schooling variable again appeared to be of little consequence in influencing the time of adoption, i.e., better educated farmers (in terms of years of schooling) did not necessarily form the group of early adopters as far as the new harvesting technology in Muda is concerned.

The Tobit analysis of earliness of adoption provided further evidence of the underlying role of the Farmers' Association as an important agent of technological change in the Muda area. The results of the present analysis indicate that members of the FA's adopted mechanical harvesting sooner than nonmembers.

In addition to these farm and farmer characteristics, two regional dummy variables were also included in all equations to take into account the three "mechanisation intensity" strata from which the localities were drawn. The positive sign of the estimated coefficient of the FDA3 variable indicates that farmers in FDA3 (Permatang Buluh locality) were generally earlier adopters than those in the "excluded locality," i.e., FDA2. This could be explained by the fact the terrain in FDA3 is more conducive to mechanical harvesting than that in FDA2; FDA3 is also nearer to the township of Tokai where ownership of the combines is concentrated.

POLICY ISSUES AND IMPLICATIONS

This paper has dwelt on the spread of the combine harvester in the smallholding economy of the Muda Irrigation Scheme. The approach taken was entirely micro, i.e., the goal was to determine what factors had been instrumental in farmer acceptance of the new technology. It is appropriate now to turn to some policy issues and implications of the innovation to the Muda economy.

While farmer acceptance of the new technology was conditioned by several micro factors, the spread of the private contractual business has been encouraged by several macro factors. First, there existed a group of enterprising rural businessmen who saw the opportunity to share in the benefits of the Muda Scheme, a relatively new development project designed to uplift the living standards of small paddy farmers. The scarcity of labour, either in an absolute sense or because of a reluctance of the available labour to work on farms, created a favourable condition for investment in combine harvesters. The necessity to adhere to planting schedules specified by the Muda Scheme further enhanced the utility of the combine harvester in overcoming severe labour bottlenecks during the shortened harvesting seasons. Above all, the investments in combines in Muda indicated the favourable investment climate in Malaysia in general, which has been nurtured by a stable political structure that subscribes to the free enterprise system. Under this system a well developed financial institution has emerged to mobilize savings which ultimately become loanable funds to be invested in combine harvesters in the Muda Scheme.

The spread of the combines has no doubt resulted in a certain amount of redistribution of income from manual workers to combine owners, brokers and those employed to man the machines. By far the biggest beneficiary of the new technology, in monetary terms, appeared to be the group of machine owners who have invested heavily in these machines.

The potential scope for expansion of mechanised harvesting is still wide, and no serious barriers to farmer acceptance appear to exist. In view of the so-called labour shortage in the area, any displacement of labour might have been only a temporary dislocation until the displaced labour could find other paddy farmers who wanted to harvest by hand. There were always farmers who were "forced" to use the traditional method since access of the combine is still rather limited. Furthermore, a badly lodged crop cannot be harvested by machines. Areas with potential danger of bogging too are shunned by the machine operators. These trouble spots will continue to be harvested by hand, very much to the displeasure of the workers who have complained that they were getting a "raw deal." In a sense their working conditions have deteriorated since they work on plots that have been skipped by the machines. To a certain extent, therefore, these workers have experienced a "welfare loss" even if there was no reduction in the number of days worked.

It is envisioned that complete mechanisation could never be reached with the present state of the arts and the existing institutions. However, the *acceptance* of the new techniques by farmers is expected to expand since factors that were found to influence adoption could easily be manipulated by policy. For example, as more farmers join the Farmers' Association, as more of them become aware of the economic and technical advantages of the machine, the new technology is expected to be used more extensively.

A land reform program which is aimed at consolidating land holdings and increasing the mean farm size and at the same time making land distribution more equitable, if implemented, is expected to accelerate the spread of the new technology since the evidence of the present study indicates that farm size was positively associated with the level of use of the machines. As level of mechanisation increases, the distribution of income between the farming population of Muda and the non-farming machine owners will continue to be more regressive against the farming population, unless the ownership is shared more equitably between the farming population and the small number of rural "industrialists." On the other hand, further mechanisation does not have to await increases in ownership, reduction in tenancy nor reductions in land fragmentation as the evidence indicates that these conditions, to date, have not retarded the acceptance and use of combines.

In view of the New Economic Policy, the Farmers' Association should evaluate the feasibility of direct ownership of some combines. MADA should also reappraise the economic profitability of the small combines in view of the numerous complaints heard from farmers about machine breakdowns and slowness in operation. The direct involvement of the FA's in the ownership of the combines, if operated efficiently, might divert at least part of the profits from ownership of the combines from the already welathy owner class to members of the FA's.

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