Challenges in Choice of Parameters for Classifying Farmers in Socio-economic Surveys in Tanzania: The Experience from the Tanzania Bean Project Adoption Study

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Abstract

The selection of parameters and models to be used in a socio-economic study receives a specific attention from socio-economic researchers. All researchers face the problem of identifying units of analysis, sampling and interview. The use of already developed variables, concepts and models in most cases developed from the West, is now a norm in Tanzania and many developing countries. As a result the selected parameters are mostly those which are frequently found to be significant or they are commonly used in other related studies regardless of their usefulness or their interpretations in that particular study area. Therefore, the purpose of this paper is to show that there are some areas where some commonly used parameters do not give very useful results, and that it is good to think of more practical parameters. Using farm size as an example, a survey was carried out during the 1996/97 crop season in selected villages in Morogoro regions to assess the adoption rate and potential of the SUA 90 bean variety. About 277 farmers were interviewed and out of these, 40 farmers were asked to indicate their bean plot areas and volumes of seed planted. Then the researcher physically measured the plots. Farmers were also asked to measure seeds in their own ways to show the amount mentioned earlier, this was then measured using a weighing scale. Plot sizes were then calculated using geometric procedures and farmers responses were compared to the actual values found. The same was done for seed measurements.

The study showed that unlike in many adoption studies carried out in many countries, farm size is not a very good measure of adoption rate in Tanzania since most farmers (96%) did not know the exact size of their farms nor their seed rates and spacing specific. The difference between the size mentioned by farmers and the actual values was found to be statistically significant at 1%. This implies that the perceived high adopters may have larger areas but with large spacing and low seed rates hence low plant population density, while the perceived low or non-adopters may have smaller plots but seved more seed because of preference thus used low spacing and a relatively higher seed rate. This is even truer for crops like beans, which normally are grown at low spacing. It was also found that farmers are relatively more consistent and accurate with seed measurements (the difference between farmers measurements and the actual values was not statistically significant) than with plot sizes. On the other hand, in most cases farmers were found to express their preference by the amount of seed saved for the next crop even before the season starts, and it is from this amount seved that the scarce land is later allocated when the season comes. As for those who buy seeds sellers use the same types of measurements (i.e tins) and the volume bought depends on the output anticipated.

Key words: *Adoption, farm size, agricultural research, green revolution*

1 Introduction

Developing countries continue to be interested in social data and research because policy markers recognise the need for such data in policy development. In order to satisfy the expectations of policy markers, ready defined concepts, well established variables and orientations are quickly transported for use from the West to Africa. The accumulation of raw data and finding statistical relationships in order to impress donors and bureaucrats often overshadow the real problems. Too often, researchers are more concerned with finding statistical relationship than with identifying units of analysis, sampling units, interview units and the modification of concepts that fit into the African context. What is needed most is more thorough applied research. As argued by Chivilumbo (1970), one of the mysteries of most of the research currently being conducted is the selective concerns. The questionnaire that is usually in English but interviewed in local vernaculars e.g. Swahili, is the preferred method of research. The methodological discussions center on training interviewers, sampling procedure, survey costs and sampling problems. The lacks of concern for appropriate concepts and of new variables lead researchers into the practice of intellectual exploitation of raw data. The use of western developed variables, concepts and models of analysis result in sustaining the same research techniques. In many cases variables are included in the study because either they are frequently found to be significant, or they are commonly used in other related studies (Feder *et al.*, 1982). According to Feder *et al.*, (1982) in some cases important variables are not included in models because the relevant data were not collected.

The problem of variable spread and identifying units of analysis, sampling and interview are faced by all researchers both in Africa and in the West (Chivilumbo, 1970). The problem is even more serious to economists who sometimes need to put numerical values even to unquantifiable parameters such as those related to perception (Adesina *et al.*, 1993). In the recent past researchers have been trying to measure research impact and adoption. Different models have been proposed and different arguments have been put forward, each with own limitations. Some of these models and the parameters involved will not produce accurate information if used in Tanzania. Among other reasons, this is mostly due to the poor data system and poor record keeping habit among farmers and the society in general.

Farm size or acreage is a very common variable in new adoption models (CIMMYT, 1993). The models assume that more land is allocated to the most preferred varieties and that the ratio of the land allocated to the new variety to the total land owned increases with time during the adoption process (Grisley and Shamambo, 1993: Shakys and Flinn, 1985; and Polson and Spencer, 1992). This assumption leads to the conclusion that the magnitude of adoption increases as the land cultivated with the new variety increases. This paper tries to examine the validity of this assumption in the Tanzanian context. The discussion is based largely on the reliability and problems related to the use of the variable farm size in adoption studies in Tanzania. The discussion is based on the adoption study conducted in 1995/96 and 1996/97 by the Tanzania Bean CRSP Project.

The specific purpose of this paper is three folds: first, to examine and illustrate problems and limitations associated with the use of farm size as a measure of adoption of a new bean variety. Second, to assess the level of accuracy of the farm size information potrayed by respondents and its impact on statistical information. Third, to suggest an alternative variable for measuring adoption in Tanzania.

1.1 Tanzania Bean CRSP Project

Tanzania Bean CRSP was established in 1982 in Tanzania. The project coordinates research on common bean crop, which is a pulse normally grown in the tropics by a majority of small holder farmers. The common bean, *Phaseolus vulgaris* L. is a self-pollinated crop which was introduced into Eastern Africa 400 years ago (Edje *et al.*, 1981, Gepts, 1984; cited by Ferguson and Sprecher, 1989). The main problems that are addressed by the project include; (i) low yield (ii) diseases (iii) pests (iv) drought and (v) low income and poor nutritional status of smallholder farmers. Since its establishment, three important technologies have been developed and tested through the project. They include SUA-90 bean variety, EP4-4 bean variety and NITROSUA (a substitute to fertilizer use in bean production).

The SUA-90 bean variety was released in 1990 and ever since small amounts of the variety seeds are distributed to farmers in Morogoro region every year. In 1994, the project initiated an impact assessment study to assess the adoption rates, intensity, type of adopters and its impact on income and well being of the small holder farmers. A major survey was carried out in 1995/96 followed by another one in 1996/97. This paper discusses part of a more detailed study based on fieldwork conducted in 1996/97.

1.2 Adoption studies: a review

A growing body of literature on the threshold adoption model argues that adoption and diffusion patterns of a new technology are the result of explicit maximizing behavior of a heterogeneous population. The threshold approach requires identification of the various dimensions of heterogeneity in the population that is relevant for the adoption of specific technology and incorporates them in the analytical study (Rajendra *et al.*, 1993). Economics has proposed several techniques for measuring adoption. Each technique differs significantly in its definition of what determines adoption. Consequently estimates of factors influencing adoption have been mixed. Given that adoption is subjective, it is important to examine the variables used to truly fit and represent the environment where adoption is measured.

Literature shows that different models have been used to study and explain the determinants of innovation diffusion and adoption. Behavioural models or qualitative response models as discussed in Amemiya (1981) have widely been used in empirical adoption analyses. These models (e.g. the tobit and logit models) are also known as binary or discrete or dichotomous models. In specifying a binary adoption decision models, a random variable takes a value of 1 if the event occurs and 0 otherwise. Feder *et al.*, (1982) criticize the frequent use of bivariate analysis as not providing insights into the relationships between adoption and adoption determinants. The usefulness of ordinary and generalised least squares regression models is also limited when the dependent variable is not normally distributed - as is usually the case in adoption. Feder et al. (1982) recommend the use of probit and logit models as a more defensible approach.

Literature also shows that the intensity of adoption of a new variety can be measured using farm size ratios. The ratio of the land allocated to the new variety to the total land owned represents the adoption intensity increase. Polson and Spencer (1992) used this ratio in a study carried out in Nigeria on the adoption of improved cassava varieties. The ratio was used to compare the adoption intensity between migrant farmers and indigenous farmers. However, the study did not consider the effect of spacing because it is possible to have farmers with low acreage but with more cassava plants. The accuracy of the land size information is also very important when using this ratio in adoption studies.

2 Methodology

Morogoro Rural and Kilosa Districts were selected for the study. Considering their bean production potential, climatic differences including altitude with respect to farming systems as well as accessibility identified seven villages. The villages were Kinole, Mgeta, Kisanga, Msolwa, Ulaya-Mbuyuni, Magole and Dumila. SUA-90 bean variety is grown in all these villages.

The main survey was carried out in two phases, in 1995/96 and 1996/97 where 277 farmers were interviewed using a structured questionnaire. However, the land size and seed volume data obtained through physical measurements of bean plots were collected in 1996/97 from only 40 farmers. Time, resources and the fact that the process is quite laborious limited the number. Farmers were asked to give the size of their SUA-90 bean plots and the amount of seed used. The plots were then physically measured to get the actual measurements and areas were calculated using mathematical/geometrical principles and tools. Farmers were also requested to measure seeds in their usual ways and these seeds were later weighed using a weighing scale for comparisons. Therefore, five types of data were collected; (i) farmers' plot size values, (ii) values taken from the actual measurements, (iii) volumes of seeds as measured by farmers, (iv) volumes of seed obtained after weighing, (v) information on spacing, and planting seed rates (not the recommended but the one normally used).

Descriptive tools were then used to analyse the data and therefore the study is mainly descriptive. Further, use of the two parameters i.e. farm size and volume of seed planted data in econometric models is planned to see how the adoption rates and intensity results differ from each other.

3 Results and discussion

Results show that about 96% of the interviewed farmers did not know the exact size of their bean plots. Only 5 respondents mentioned to have taken the trouble of measuring their planted bean plots All values given by farmers were divisible by five as it was easy to mention (e.g. 0.25, 0.5, 1, 1.5 etc.). Most of the plots were irregular in shape. More than 90% gave figures above the exact values (Table 1). The difference between farmers' estimates and the actual figures was as big as 0.35 acres. The difference between the two was statistically significant at 1% ($P = 0.001$). Sixty five percent made an error of about or more than 1/4 of an acre. This difference is very significant in bean production because the crop normally has a high plant population density.

About 26 farms out of the 40 visited, had patches of uncultivable areas either surrounding a big tree, big stone, a hill (mostly termite/ants hills or pillars locally known as "kichuguu") or a thick bush. These areas were found to be included in the estimates given by farmers. Findings showed that the problem of inaccuracy in plot size information was more serious with farmers who just cleared land and settled. For example, the majority of farmers in Kisanga, Msolwa and Dumila villages migrated from other regions. Most of such farmers do not know the size of their farms with certainity. This problem is exarceberted by the fact that land is currently not privately owned in Tanzania and farmers in the villages do not have land titles, which require the land to be measured.

Observations showed that traditional ways of measuring farms e.g. by using sticks or paces are also used in the study area but mostly when hiring or selling plots. However, these are hardly used in small plots. This is possibly because most of the farms visited were parts of larger farms owned by the respondents whose exact sizes may be known.

It was also found that bean plot sizes were estimated by eye depending on the volume of output anticipated. The volume of output for each variety is anticipated well before the season when the decision of how much seed is to be saved is made. The output volume anticipated is well associated with preference and purpose. Varieties which fetch good market and prices like soya and red-large-kidney type "Maharage mekundu" were found to be allocated with bigger shares of seed stocks. About 80% of the respondents explained that low volumes of seeds are saved for varieties, which are meant for household food only. One farmer explained that he decided not to save seeds of a black-seeded variety because the variety has no market and the family does not like it either. Therefore, it is clear that preference, which determines what and how much to cultivate/produce, is mostly associated with the volume of seed saved by the family. As for those who buy seeds, findings show that the amount of seed to be bought also depends on the volume of output anticipated and not necessarily on the amount of land available because sometimes part of land is left uncultivated.

Another important finding shows that the farmers interviewed were not uniform in plant spacing. The planting was harphazad and the distance between holes was estimated by eye hence not uniform even within a farm. Few farmers, about 10% were found to use rows but the space among plants within a row and the distance between rows were not uniform.

It was also found that, about 87% of the respondents used a planting seed rate of 20 kg per acre on average. The recommended seed rate for SUA-90 bean variety is between 26 and 28 kg per acre (or 65-70 kg/ha) (SUA Bean CRSP Project Annual Report, 1994). Differences in seed rate were observed among farmers. The difference was due to variations in both spacing and sowing rate. Fifty six percent of the respondentr used a sowing rate of 2 seeds per hole while 42% used a rate of 1 seed per hole. The rest were not uniform, sometimes they put 2 seeds, sometimes one and sometimes even more depending on the perceived level of fertility of the soil around the hole or sometimes depending on the size and assumed viability of the seeds to be thrown into the hole at a particular moment. Therefore the plant population per unit area varied a lot.

When the measurements of seeds done by farmers using tins of different sizes were compared with those done by a weighing scale the difference was found to be very small and statistically in significant (P=0.4). The highest difference was 110 grams. About 62 percent of the respondents had an error of between 0 and 20 grams (Note: 21 grams = 100 seeds of SUA-90). This suggests that farmers are relatively more accurate with seed volume measurement than with acreage.

Therefore by having different spacing, different sowing rate and the possibility of having patches of uncultivable land within plots it is possible to have the same amount of seed volume planted in plots with different sizes.

This is an important finding because it can be misleading when arguing that a group of farmers has a higher adoption intensity represented by a larger ratio of the area allocated to a new variety over the total area owned because this study has shown that large farms do not necessarily mean more bean crop. On the other hand, it was found that not all farmers are accurate with their farm sizes but are relatively more accurate with measurements of seed volumes.

Table 1 Comparison between farm size values given by farmers and actual values obtained from measurements.

Values given by farmers		Frequency	Actual values (averages)		Average difference	
in acres	in m^2		in acres	in m^2	in acres	in m^2
0.25	1011.75	6	0.05	202.35	+809.40	+0.2
0.50	2023.50	7	0.31	1264.65	+758.85	+0.19
0.75	3035.25	4	0.85	3439.95	- 404.70	-0.1
1.00	4047.00	5	1.09	4411.23	- 364.23	-0.09
1.25	5058.75	3	1.00	4047.00	+1011.75	0.25
1.50	6070.50	4	1.68	6829.35	-758.85	-0.19
1.75	7082.25	1	1.44	5827.68	+1254.57	0.31
2.00	8094.00	3	1.88	7608.36	+485.64	0.21
2.25	9105.75	1	1.99	8053.53	+1052.22	0.26
2.50	10117.50	4	2.32	9389.04	+728.46	0.18
2.75	11129.25	1	2.40	9712.80	+1416.45	0.35
3.00	12141.00	1	2.89	11695.83	+445.17	0.11
TOTAL						

Significant difference at 1% (P = 0.001).

Source: Field Data, 1997.

4 Conclusion

This paper has argued against hastily application of foreign well-developed adoption models in an African situation. The appeal is made for more concern with the development and refinement of these models so as to take account of the Tanzanian and African situations in general. Experience with the Tanzania Bean CRSP adoption study reinforces the need to examine very closely problems that can arise not only in adoption but also in other studies when Awestern models, definitions, variables and concepts are applied blindly. If these have to be used, as they must, users should give more consideration to broader questions of methods than at present.

This paper suggests that researchers should always keep in mind that in the western countries unlike Tanzania, farmers have land titles and the accurate measurements of farms are known. Therefore, when a parameter for land size is used in models the level of accuracy is much higher. Furthermore, spacing and seed rates are standardized when mechanisation is used and hence less variations among farmers. It is not always safe to use land size information in adoption studies in Tanzania. For example this study suggests that it is safer to use amount of seed planted when measuring adoption intensity of a new variety especially in crops like beans, rather than farm size or acreage. This implies that farmers who use larger volumes of seed have adopted more but in relation to the volume of seeds of other varieties grown by the same farmer.

The use of seed volumes to measure adoption intensity is better because under the existing situation in the country most farmers may not afford to measure their farms. Farmers will continue to estimate their farm sizes as it is not worth to incur the cost of measuring them. Therefore, it is worthwhile for researchers to adjust accordingly and use the estimated farm sizes only where the degree of accuracy of such values does not significantly affect the anticipated results.

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