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AGRARIAN CHANGE AND THE ROLE OF THE ENTREPRENEURIAL FARMER *

BY

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ABSTRACT

This paper outlines the role played by entrepreneurial farmers in changing the agrarian structure of a Sinhalese village. The concentration of land and other forms of productive wealth in the hands of a few have led to a skewed distribution of income in the village and to the emergence of two clearly demarcated classes of peasants—the entreprenurial farmers and the landless wage labourers.

INTRODUCTION

The main objective of this paper is to examine the role played by entrepreneurial farmers[1] in the process of agrarian change with special reference to a Sinhalese village in North-Central Sri Lanka which has changed from a small, relatively isolated subsistence producing peasant hamlet at the turn of this century to a market oriented, clearly stratified agrarian community in the recent years. The changes were induced by a multitude of forces (i.e. historical, political, socio-economic, demographic, etc). But, as mentioned above, I seek to focus attention upon a category of entrepreneurial farmers for their presence in the local milieu which appears to affect the process of agrarian change in general and the distribution of fruits of economic growth in particular.

The following discussion is divided into several sections. First I will attempt to outline the historical background of the region and the village of Niltanne.[2] Secondly, an attempt will be made to examine the recent socio-economic changes in the locality. Finally, I will focus attention on the role of the entrepreneurial farmers mentioned above in the process of agrarian change.

Historical Background of the Region and the Village of Niltanne

When the Europeans first arrived in the country in the 16th century, the North-Central region of Sri Lanka (see Map 1) virtually remained a thick jungle containing some small peasant hamlets dependent on individual village irrigation tanks. This pattern of settlements persisted through the Portuguese and the Dutch periods (from early 16th century to late 18th century). Despite isolated attempts by the British (1796-1948), who were preoccupied with the promotion of commercial plantations in the central and the south-western province, to reconstruct some of the dilapidated tanks and encourage human resettlement in the area, except in the administrative and market centres, the inhabitants in the hinterland perpetuated their old life style in their traditional habitats.

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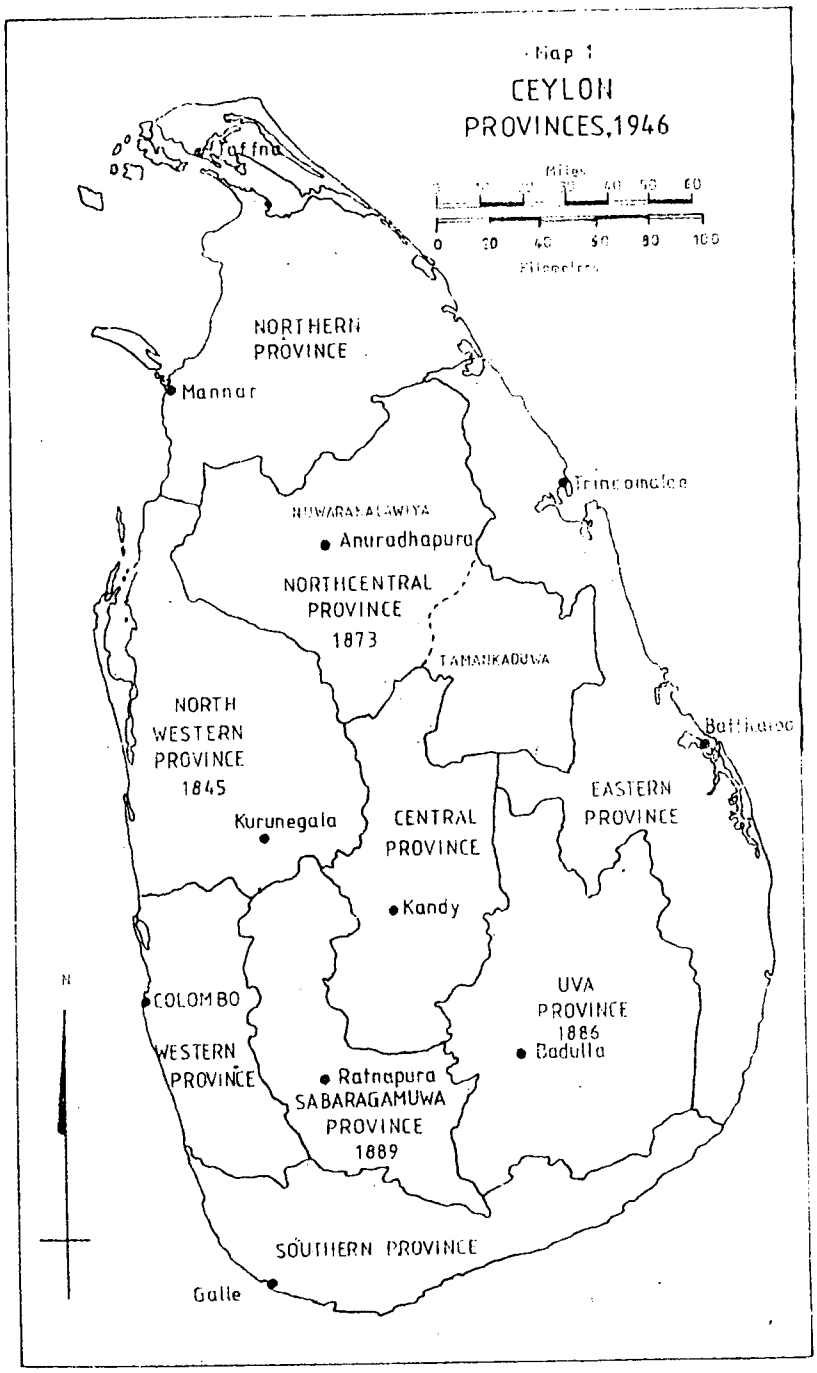

Map 1
CEYLON
PROVINCES,1946
Miles
0 30 40 50 60
Kilometres
0 30 40 50 80 100
Jaffna
NORTHERN
PROVINCE
Mannar
Trincomalee
NUWARA ELAWIYA
Anuradhapura
NORTHCENTRAL
PROVINCE
1873
TAMANKADUWA
NORTH
WESTERN
PROVINCE
1845
Kurunegala
CENTRAL
PROVINCE
Kandy
EASTERN
PROVINCE
Batticaloa
N
COLOMBO
WESTERN
PROVINCE
Ratnapura
SABARAGAMUWA
PROVINCE
1889
UVA
PROVINCE
1886
Badulla
SOUTHERN PROVINCE
Galle

The first half of this century however witnessed some changes in the administrative centres and townships, e.g. extension of railways into the area, anti-malaria work, provision of some basic amenities such as schools and dispensaries, which made the hitherto remote region more accessible to outsiders. On the other hand, the population pressure caused particularly by the absorption of peasant land into the newly developed plantations squeezed many peasants out of their traditional villages in the plantation districts. Many of these landless peasants were gradually pushed into the remote north-central province where there were large stretches of unoccupied lands; some migrated permanently with their families and others became itinerant workers migrating seasonally into the area for wage employment.

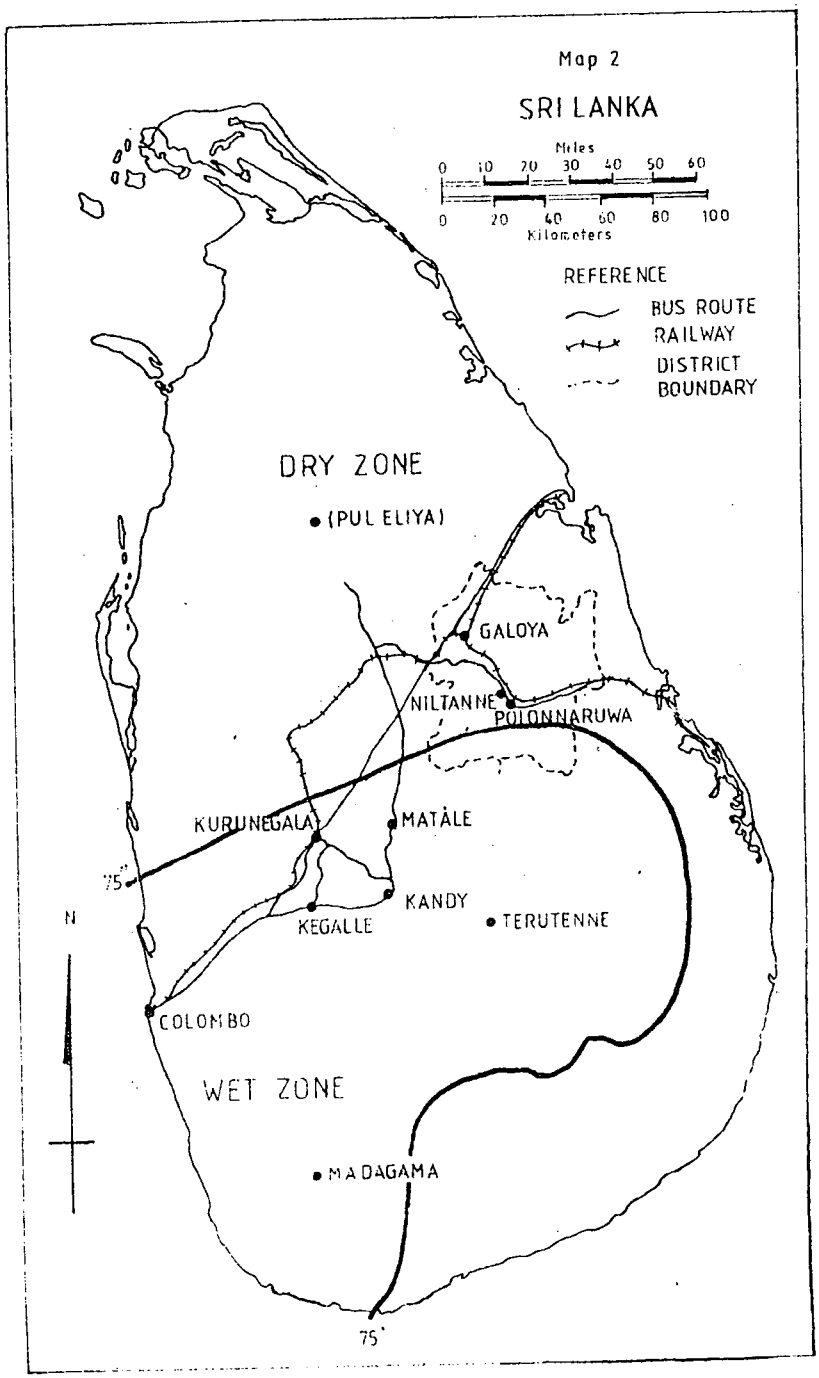
The implementation of British land and tax policies was responsible for many changes in the native land tenure practices. On the one hand, land laws such as the Crown Lands Encroachment Ordinance imposed restrictions on the use of crown and communal land (Obeyesekere 1967). For instance, it was customary for the peasants to use the bush land surrounding their homesteads for slash and burn or chena cultivation, but when the legislation declared such land as crown property, the peasants were required to obtain official permission to use such land paying a prescribed fee. On the other hand, various taxes, particularly the grain tax, forced the peasants to convert at least a portion of their produce into cash. Those who failed to meet their tax commitments were forced to sell their land either to well-to-do fellow villagers or to absentee landlords. This process brought land into the open market and eventually gave rise to a class of land owners who began to control a substantial proportion of peasant land which still continued to be tilled by poor peasants either as tenants or agricultural labourers.

The country's political independence in 1948 was followed by more changes in the region, particularly due to the special emphasis placed by the independent regimes on the modernisation of peasant agriculture and the establishment of planned human settlements known as "colonization schemes" in this part of the island (Farmer 1957:10). Multi-faceted development programmes sponsored by succesive governments involved the provision of further infrastructural facilities such as irrigation, transportation, schools and hospitals. A package of agricultural development aid — supply of high yielding seed varieties, agro-chemicals, agricultural machinery, credit, etc. at subsidised rates and the provision of market facilities and minimum prices for agricultural produce—attracted more and more people into the hitherto sparsely populated dry zone districts.[3] The process of migration brought in people belonging to two broad categories:

1. The poor peasants who lost or did not possess cultivatable land in the plantation districts where peasant land was enclosed continually into large estates of commercial production,

2. Indigenous businessmen who began to treat peasant agriculture as a profitable area of investment of their capital.

The above two groups of people began to play two different roles at their destination. The primary objective of the poor landless peasants was to regain the plots of land they lost in their natal villages. Some of them cleared new land and became small-holding farmers; they did not possess capital and therefore, cleared small plots which could be brought under cultivation with the use of family labour. Some


Map 2
SRI LANKA
Miles
0 10 20 30 40 50 60
0 20 40 60 80 100
Kilometers
REFERENCE
BUS ROUTE
RAILWAY
DISTRICT BOUNDARY
DRY ZONE
(PUL ELIYA)
GALOYA
NILTANNE
POLONNARUWA
KURUNEGALA
MATALE
KANDY
KEGALLE
TERUTENNE
COLOMBO
WET ZONE
MADAGAMA
N
75°
75°

peasants became share-croppers working the land owned by well-to-do villagers or absentee landlords. Those who failed to acquire land, or sufficient land, became agricultural labourers.

The motives of the incoming capitalist entrepreneurs were however different. The purpose of their involvement in peasant agriculture is to produce for the market for profit. Thus, the subsistence and other needs of their families do not set limits for their production. While continuing to expand their farms as the circumstances permit, they helped transform subsistence agriculture into a commercial enterprise oriented toward an outside market. Before attempting to elaborate the way they play their role, I will sketch the historical background of Niltanne (see Map 2).

The recent history of Niltanne conforms broadly to the historical sketch of the region outlined above. The small peasant hamlet which depended entirely on its irrigation tank for the supply of water for cultivation and domestic purposes had been virtually isolated from the centres of administration and mass culture due to physical barriers during the early British period. The available documentary evidence points to the fact that its inhabitants perpetuated a precarious existence in almost isolation (Ievers 1899:40). Around the turn of the century, they, however, began to feel the impact of the outside world. Roads were extended into the area; bureaucratic authority penetrated the remote countryside in the form of revenue collection, enforcement of rules and regulations, maintenance of law and order and so on; traders began to arrive more frequently for both selling and buying goods; villagers began to travel out of their hamlets for religious, official and other purposes; outsiders moved in to buy land from those who were forced to sell their land due to economic hardships thereby giving rise to new land owner/tenant relationships extending well beyond the village boundaries. By the end of the British rule, many peasant hamlets in the area like Niltanne were well integrated into the macro-structure of the national economy, polity and culture.

When the village tank was renovated by the newly established Department of Irrigation under the British in the first decade of the present century, the land area that could be fed by it expanded substantially. But, until the early 1940s, less than half of the cultivatable village land was brought under cultivation. The village population was small (about 12 families around 1940) and those outsiders who bought village land gave it back to local residents on a share-cropping basis. These transactions, therefore, did not lead to a considerable expansion of village fields. In the mid 1940s, this situation began to change.

The process of migration of landless peasants from the commercial plantation regions into the sparsely populated, newly developing non-plantation areas was well under way towards the end of the British rule. In the late 1940s and the early 1950s, landless peasant families migrated in large numbers into the colonization schemes in the dry zone (Farmer 1957:15). Some peasants moved into already existing peasant hamlets which are known as *purana gam* (lit. ancient villages).

The first wave of new settlers arrived in Niltanne in the early 1940s. Few of them cleared small plots of village land and became small-holding peasants. Most of them became share-croppers to *purana* villagers and absentee landlords.

As late as the early 20th century, Niltanne was surrounded by the wild animal infested bush land. It was connected with a few similar settlements in the area by foot paths running through the jungle. By mid-1950s, most of such bush land which bordered the village was cleared by new settlers who moved into the two newly established colonization schemes to the north-east of Niltanne. The growth of local population meant increased and diversified economic activity which in turn led to widespread commercial activity. Import of a host of consumer and other items from, and export of agricultural produce to external markets, became a profitable area of investment for the newly arrived entrepreneurs who either possessed or were able to raise finance.

Agrarian Planning and New Opportunities

Successive governments in independent Sri Lanka seemed to have treated the modernisation of peasant agriculture as perhaps the most important element of their overall development strategy. The reasons for this policy have been many. The usual practice of the British was to import food items in large quantities including rice which is the staple food in the country and no specific attempt was made by them to boost local food production. Their main concern was to encourage export crops such as tea and rubber. Even after independence, the import of food items that could be locally produced continued. With the worsening balance of payment problems in the 1960s there was no other viable option but to turn at least to partial import substitution. In order to increase the production of rice and other subsidiary food crops, every government, irrespective of their ideological differences, not only took various steps to facilitate agricultural modernization, i.e. supply of inputs and credit at subsidised rates and introduction of new farming techniques, but also offered numerous incentives e.g. market facilities and guaranteed prices for farm produce.

Growing of food crops thus became a profitable area of investment. Those who owned agricultural land but did not so far take an active interest in it began to evict their tenants and turn their land into commercial holdings. The class of agricultural labourers began to grow partly as a result of the new tenurial arrangements. Those who owned or acquired land and finance began to play a multiple role of providing commodity or cash loans to needy peasants, collecting and transporting agricultural products, hiring out agricultural machinery, farming and shop-keeping.

The changes that have been taking place in the rural economy in response to agrarian planning and the market forces clearly amount to what is popularly called the green revolution. Now I return to Niltanne and attempt to outline such changes as they are taking place there.

Before the first wave of new settlers arrived in Niltanne in the early 1940s, its inhabitants were mere subsistence producers. Population was small and, therefore, only a part of the village land was brought under cultivation. Since crop failures were common due to natural causes such as pests, wild animals and droughts, peasants also relied on the cultivation of secondary crops by slash and burn method. Farming techniques were very simple and less efficient. Land preparation was done by driving pairs of buffaloes on the wet field without using a plough. No effective

measures were taken to control either pests or weeds. Manure, either organic or chemical, was hardly used. In other words, peasants had little to do between sowing and harvesting. They devoted most of their free time for chena cultivation.

Hard environmental conditions in turn encouraged peasants to adopt suitable work sharing arrangements. They could not cope with the natural forces individually. Instead, they had to co-operate in many spheres of life. Their co-operation was expressed in two different forms, namely work sharing and social insurance against starvation of individual peasants.

Niltanne peasants, instead of working on their fields individually, formed work teams in order to exchange their labour. The exchange of labour was based on the principle of mutual help and, therefore, they were not concerned with the accuracy of labour units exchanged. Furthermore, giving material assistance to those who were in need was a highly valued practice among the local peasants. While it was customary for them to store their little surplus production in grain containers belonging to individual families, peasants felt obliged to share it with the others as the need arose.

It the late 1940s, physical and social organisation of production and exchange began to change steadily. With the growth of population due to the influx of new settlers and natural increase, (by the late 1940s, the number of families had risen to 50; in 1976 there were 169 households), more and more land had to be cleared for farming and settlement purposes. Under the influence of the wider market economy, peasants became increasingly market-oriented; they sought to produce more and more by adopting new farming technology. When the peasants ceased to be near subsistence producers, they also began to do away with co-operation in favour of competition.

By early 1960s, the expansion of the village (wetland used for rice cultivation) reached its optimum limits. The scrub which was hitherto used as grazing fields for their cattle was also cleared for rice farming by commercial producers. Some peasants were forced to sell their cattle for want of open land. Others began to kee theirs far away from the village and drive them into the fields when needed.

Despite the fact that there was no more new land to be cleared in the village, the inflow of landless peasants, particularly from the plantation districts continued. Since most land owners had already abandoned share-cropping in favour of commercial farming, the newcomers had no prospect of at least becoming tenants. They had no option but to become wage labourers. Landlessness was further aggravated by the tenurial changes that followed the tenancy legislation enacted by the central government in the late 1950s (cf. Joshi 1974:329). For example, the Paddy Lands Act of 1958 was intended to protect the tenants and safeguard their interests. Land owners reacted negatively to this piece of legislation by evicting their tenants (Peiris 1976:24). They began to cultivate their land either by employing wage labourers or through unofficial tenants on a short-term/seasonal basis. The second mode effectively denied the tenants their rights defined by legislation.

In the early 1960s, Niltanne became segmented into distinct agrarian classes (See Table I). The capitalist entrepreneurs engaged in commercial farming continued to acquire more and more land through diverse means (Hettige 1980). Poor peasants who were dependent on the above entrepreneurs for various needs such as credit and agricultural machinery lost some of their land to the latter either through mortgage or sale. In the mid 1970s three such land owners controlled nearly half of the total area of cultivated village land (See Table II).

Table I—LAND OWNERSHIP PATTERNS

Size of Holding (acres)	*Agricultural Families*			*All Families*		
	%	*No.*	*Persons*	*%*	*No.*	*Persons*
25 and over	1.7	2	9	1.1	2	9
10 and over	2.5	3	18	1.7	3	18
5 and over	11.2	13	66	10.1	14	88
1 and over	14.7	17	101	12.5	21	118
Less than 1	10.3	12	78	8.9	18	92
Landless	59.0	69	370	65.4	110	607
Total	99.4	116	642	99.7	168	932

Table II—DISTRIBUTION OF PRODUCTIVE RESOURCES IN NILTANNE

Capitalist	Agricultural Land %	Tractors (4 wheel) %	Tractors (2 wheel) %	Plough cattle %	Pump Sets %	Sprayers %	Rice Mills %	Lorries %	Cars %	of the total agricultural families %
Land owners ...	45.5	66.6	33.33	—	66.6	50	33.3	100	60	2.50
Rich peasants ...	34.5	33.3	66.6	55.5	33.3	25	16.6	...	20	12.93
Poor peasants ...	16.0	—	—	44.5	—	—	—	—	—	25.0
Agricultural labourers ...	0	—	—	—	—	—	—	—	—	41.37
Others ...	6.0	—	—	—	—	25	50.0	—	20	—

Since tenants were not treated here as land owners, they have been deliberately excluded from the above Table.

A few peasant families made use of the new opportunities and became well-to-do peasants enjoying better living conditions, but the overwhelming majority of the peasants remained poor struggling to survive in the face of strong competition from the capitalist farmers for more land and more profit. The size of their holdings is becoming smaller day by day through fragmentation in the process of inheritance of property by family members. Some family holdings are too small to be partitioned among its members. Those who do not inherit land often become landless labourers.

The tendency for commercial farming encourages the land owners to do away with share-cropping. When the actual tiller of land is a tenant, the land owner does little or nothing to raise the productivity of his land but receives a fixed share of the production. On the other hand, the tenant has little inducement to increase production because more productivity means more expenditure in terms of costs and land rent. When the owner cultivates his land himself, he controls the entire process of production; for him increased productivity means increased profit.

The traditional practice of share-cropping (*ande*) was replaced partly by a new land-leasing system. The main feature of the new mode is that it is a short-term commercial transaction between the owner of a parcel of land and its lessee. Unlike the traditional tenant, the new lessee is often a well-to-do villager who could raise sufficient finance not only to pay the land rent in advance but also to meet the cultivation expenses. On the other hand, the new lessor is usually a poor peasant who is either unable to cultivate his land for one reason or the other or in need of a lump sum of money to cope with an emergency. When a peasant surrenders a part or whole of his holding in return for a lump sum of money, the lessee makes use of the land during the prescribed period.

Having done away with share-cropping and co-operative labour, land-owning peasants and capitalist farmers began to rely heavily on agricultural labourers. These entrepreneurs worked entirely by wage labourers: peasants employ workers in varying numbers depending on the extent of additional labour required to run their family farms. Many poor peasants who own small plots employ no paid workers.

As mentioned before, along with the changing tenurial practices and production relations, the physical process of production has also been changing dramatically over the last few decades. Niltanne peasants, largely following the footsteps of the entrepreneurial farmers, have incorporated new methods into the cultivation process. Instead of buffaloes, most of them now use tractors, either four or two wheel, for land preparation. Instead of sowing broadcast, many of them transplant seedlings. Peasants no longer use traditional varieties of seed (see Tables III, IV, V and VI). Unlike in the past fertilizers, pesticides and weedicides are commonly used in the village. All these have helped increase paddy yields to all island record levels.[4] While productivity increases have induced many of these practices, the adoption of some practices is also required to avoid unpleasant consequences of conflicting usages. For instance, when one field is sprayed with pesticide, the adjacent fields are often required to be sprayed in order to avoid the latter being affected by the pests leaving the former. Since the water for all plots are released from the same outlet (sluice) according to a fixed time table, peasants have to carry out their tasks in keeping with the general irrigation schedule.

Table III—WEEDING PRACTICES BY ACREAGE

	By Hand	Mech. Weeder	Chemicals	Total
Maha 75/76	20	10	90	120
Yala 1976	15	05	90	120

Table IV—USE OF HIGH YIELDING VARIETIES BY ACREAGE

Modern HYVV Type			*Traditional Non-HYVV Type*		*Total*
	BG 11 3*LL*	*BG*34/8	*BG*34/6		
Maha 75/76	140	32	—	—	172
Yala 1976	30	130	12	—	172

Table V—FIELD PREPARATION FOR PADDY BY ACREAGE

	Buffaloes (ploughing)	*Tractors*	*Mamoty*	*Total*
Maha 75/76	30	140	2	172*
Yala 1976	32	140	0	172

Table VI—SOWING AND TRANSPLANTING BY ACREAGE

	Sowing Broadcast	*Transplanting (normal)* +	*Transplanting (in rows)* +	*Total*
Maha 75/76 ...	2	162	8	172
Yala 1976 ...	65	107	—	172

The adoption of modern farming practices involves substantial cash expenses. Poor peasants whose families subsist on their small parcels of land find it almost impossible to meet these expenses without resorting to financial assistance from either private or institutional sources. Their holdings are uneconomical and, therefore, they produce little surplus which is often not sufficient to settle loans and meet the subsistence requirements of the family. Many of them depend on private money lenders who charge very high interest rates because they are not eligible for institutional credit due to their failure to settle previous loans owing to financial hardships. Most of them derive no income from any other source. Even though they now produce more owing to new farming practices, increased production means very little to them because of higher costs of production and living, and the burden of usury.

Except for a few well-to-do peasants, the capitalist farmers are the only category of farmers who could adopt new farming technology conveniently. Not surprisingly, they are the first to go for latest techniques because they not only could afford them but also could take financial risks. They possess largest farms (see Table VII), agricultural machinery and substantial finance and, therefore, rising charges for equipment work in their favour. In addition to their agro-business, they also make use of almost every other means of economic advancement available in the countryside such as rice

* Figures were available only for 172 acres of village fields. Since this figure is not substantially less than the total given in the registers (188 acres), "the distribution of data can be treated as reasonably representative.

\+ normal transplanting.

processing, transport, shop-keeping, supply of agricultural equipment and credit, and purchase and distribution of agricultural produce. In short, these rural capitalists who were encouraged by the signs of a coming green revolution now play a leading role in the continuing process of agrarian change. The important fact is that their involvement in the process has been responsible for the direction in which many changes are taking place.

Table VII—FARM SIZES (in acres)

			Average	*Largest*	*Smallest*
Rich peasants	...	...	4.6	10	3
Poor peasants	...	...	1.1	2.5	.125
Capitalist land owners	...	...	29	45	12
Tenants	...	...	1.4	3.5	.125

Their power is substantial so much so that most villagers depend on them in varying degrees for various needs. Most dependent among them are the landless labourers. The entrepreneurial farmers employ the largest number of paid workers at a time because their business activities are diverse. They also employ migrant workers in large numbers for such activities as transplanting of paddy. There is a tendency among the entrepreneurial farmers to prefer itinerant workers for a number of reasons. Migrants stay away from their families and work longer hours for less pay. For instance, they were paid R. 4.00 per day as against Rs. 5.00 paid to a village labourer in 1976/77. Since migrants have no routine family involvements and stay in temporary huts in close proximity to the fields, they spend more hours at work. When the seasonal workers are brought in to the village in large numbers, the work available to the local worker is automatically reduced and the latter's claim, despite rising costs of living, their earnings have been stagnant for many years.

In Niltanne, capitalist farmers have also taken over the cultivation of other subsidiary food crops such as chillies, lentils and other vegetables which fetch higher prices in the outside market. When the nearby bush was cleared for cultivation and settlement purposes the local peasants had to give up chena cultivation and depend entirely on rice farming. Those who want to cultivate these crops have not only to travel far away from the village but also to invest substantial capital. This is feasible only for the well-to-do farmer. They grow these crops in large quantities and transport them to outside markets where they fetch very high prices.

CONCLUSION

So far I have attempted to outline the recent changes in the agrarian structure of a Sinhalese village in the North-Central Sri Lanka. I sought to focus attention upon entrepreneurial farmers who began to occupy a dominant position in the village economy. In short, their role since then has been to transform peasant agriculture which was basically subsistence-oriented into a source of economic power and social dominance. This role is evident in the spheres of physical and social organisation of production and the distribution of fruits of economic growth at the local level.

The increasing participation of entrepreneurial farmers in paddy production and related activities has led to a concentration of land and other productive resources including finance in the hands of a few. This has in turn resulted in a polarisation of the village into distinct agrarian classes based on differential property rela-

tions. The resultant commercialisation of paddy production has helped not only to replace old agricultural practices with modern ones but also to disintegrate traditional relations of production.

The concentration of land and other forms of production wealth in the hands of a few has led to a skewed distribution of income in the village. This is clearly reflected in the patterns of consumption among different segments of the village community. Furthermore, these divergent patterns of consumption have led to the formation of distinct status groups in Niltanne.

The concentration of land in few hands has meant the rapid growth of landlessness among villagers. The rising cost of production and the burden of usury have brought many peasants down to the level of absolute poverty. Apart from a few rich peasants and those who rely on non-agricultural incomes, the villagers in general depend on the few entreprenurial farmers for various needs such as employment, credit, agricultural machinery. The dependent relationship is so significant that a majority of the villagers whose destinies are now in the hands of the few entrepreneurs forsee no prospect of being independent in the near future.

Notes

1. The entreprenurial farmers are distinguished from the other categories of peasants in that they (1) do not engage in the process of physical production themselves, and (2) produce solely for an external market. Furthermore, commercial farming is one among many areas of their investment in the rural sector. Their land is worked by wage labourers.

2. Niltanne is a pseudonym for the village under study. This is a tank-based *purana* village in the Polonnaruwa district.

3. Administration Report, Assistant Government Agent, N.C.P. (1947.)

4. Highest yield recorded in Niltanne is nearly 100 bushels per acre in 1976.

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FACTORS RELATED TO THE SUCCESS OF AGRICULTURAL RESEARCH CENTRES IN SRI LANKA

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INTRODUCTION

The purpose of this study is to determine what characteristics of agricultural research centres and their environments are the most highly associated with the effectiveness of the centres. During June and July 1983 thirteen of the fifteen agricultural research centres for crops in Sri Lanka were visited by the principal investigator (all except the centres at *Bandarawela* and *Kilinochchi*) and fixed questionnaire interviews were conducted with the top administrator (titled Deputy Director in most cases, titled Director in a few cases and called in this report the Centre's Director) or his assistant and one researcher. The questionnaire asked 17 questions on various kinds of outputs and on several measures of overall performance, 30 questions on characteristics of the centre and its functioning, 3 questions on beneficiaries, 5 questions on the national context. The selection of questions was based on a theoretical framework which derives from two sources: interviews with several Sri Lankan experts on agricultural research centres and previous research by the principal investigator on various types of development projects involving sponsorship by the United States Agency for International Development. In general the study substantiated the theoretical framework.

THEORETICAL FRAMEWORK

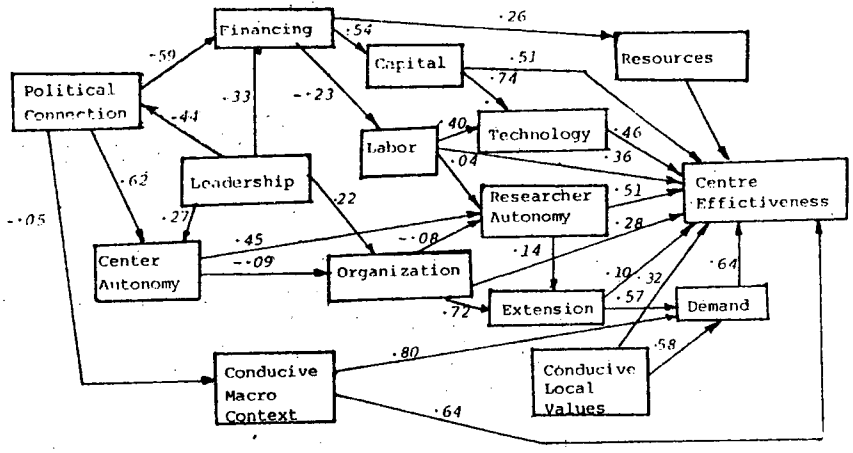
Agricultural research centres share with other productive organizations many requirements for success in achieving their goals, namely a conducive environment, demand for their services, skilled and motivated personnel, adequate financing and equipment, appropriate organizational structure, effective management and good leadership. Unique to agricultural research centres is their dependence on effective extension work for their success. They serve the agricultural sector of the economy by providing new varieties, new methods, and information on farmers' problems which must be transmitted to the farmers by the extension service of the Department of Agriculture in most cases.

Four other factors are hypothesized to contribute significantly to centre effectiveness but their connection to success is less certain in current theory. They are: availability of foreign aid, autonomy of the centres, autonomy of the researchers, and government connections of the centres.

The hypothesized role of all of the above factors in the success of an agricultural research centre is diagramed in Figure 1 along with correlation coefficients which are discussed in a later section.

Central to the diagram are the five factors of production: capital, labor, technology, resources and organization. Also central to centre effectiveness are the extension activities and the response of beneficiaries. Two factors with important indirect influences on centre success are leadership and a conducive macro context.

Figure 1. Diagram of the Theory of Centre Effectiveness with Pearson Zero Order Correlations Among Factors Contributing to Centre Effectiveness based on 13 Agricultural Research Centres in Sri Lanka. 1983.



NOTE: The decimals listed with the arrows in this figure are zero order correlations. Normally betas (or partial correlations) are listed but the number of cases is too small to compute meaningful betas in multiple regression equations.

METHODOLOGY

The major data gathering method used in this study is a predominently closed ended questionnaire (see Appendix A) which the respondent filled out as the interviewer explained it and probed for explanations of answers. In thirteen centres both the centre's director and one researcher completed the questionnaire. The majority of variables are assessed by the informant on subjective scales. The use of two informants with different perspectives is an effort to reduce bias. By correlating the set of researchers' scores with the set of directors' scores we obtain a rough estimate of the degree of reliability of the assessments on various variables. (See Tables 1 and 2). However, even when agreement is high between directors and researchers, correlations between subjective variables based on only 13 cases must be viewed cautiously and conclusions drawn from them must be considered very tentative.

Table 1—THE CORRELATIONS OF FOUR MEASURES OF OVERALL EFFECTIVENESS WITH VARIOUS MEASURES OF ACHIEVEMENTS OF SRI LANKAN AGRICULTURAL CENTRES, AND THE CORRELATIONS BETWEEN THE DIRECTOR'S SCORES AND THE RESEARCHERS' SCORES. 1983 (n=13).

Measure of Centre's Achievements (Director's and Researcher's scores combined unless specified otherwise)	*Correl. Dir. & Res.*	*Overall Effectiveness Evaluators*		*Dir. & Res.*	*Scored by Dir.*	*Scored by Res.*
		r	*p*	*r*	*r*	*r*
Overall Effectiveness: Evaluators	—	—	—	.80	.40	.73
Overall Effectiveness: Combined	.30	.80	.001	—	.71	.87
Overall Effectiveness: Director	—	.40	.080	.71	—	.26
Overall Effectiveness: Researcher	—	.73	.002	.87	.26	—
Overall Success: Evaluators	—	.90	.000	.63	.53	.48
Overall Success: Combined ...	.04	.58	.020	.44	.39	.33
Overall Success: Director ...	—	.10	.371	.07	.06	.09
Overall Success: Researcher	—	.60	.015	.61	.62	.40
Goal Attainment ...	.60	.56	.048	.62	.17	.74
Overall Output ...	.12	.73	.002	.67	.52	.55
New Varieties ...	.39	.85	.000	.77	.54	.67
New Methods ...	.30	.65	.009	.59	.11	.73
Training ...	.84	.15	.317	.11	.16	.04
Post Graduate Training ...	.52	.42	.076	.34	.46	.14
Contribution to Training ...	.77	.38	.102	.49	.26	.49
Publications ...	.85	.59	.017	.53	.41	.43
Contribution to Basic Science	.39	.44	.067	.42	.33	.35
" to Practical Agric. Knowledge	.41	.66	.007	.78	.45	.74
,, to Sri Lankan Agriculture	.14	.54	.029	.64	.73	.36
Improvement in Agriculture	.52	.50	.040	.55	.47	.42
On Farm Implementation ...	—	.41	.083	.49	.69	.18
Rate of Growth ...	.47	.05	.437	−.15	.11	−.28
Future Prospects ...	−.41	−.54	.030	−.47	−.48	−.30
Reputation of Centre ...	.22	.78	.001	.70	.57	.55

Table 2—CORRELATIONS OF FOUR MEASURES OF OVERALL CENTRE EFFECTIVENESS WITH CHARACTERISTICS OF THE CENTRES AND THEIR CONTEXTS. MOST CORRELATIONS ARE BASED ON 13 CENTRES. THE DEGREE OF AGREEMENT BETWEEN RATINGS BY DIRECTORS AND RESEARCHERS OF EACH FACTOR IS ALSO PRESENTED, 1983

Characteristics or Contexts of Centres	*Correl. Dir. & Res.*	*Overall Effectiveness: Evaluators*		*Dir. & Res.*	*Scored by Dir.*	*Res.*
		r	*p*	*r*	*r*	*r*
Incentives and Motivation of Beneficiaries ...	.18	.64	.010	.60	.66	.35
Effects of Government Policies	.42	.64	.012	.49	.38	.41
Distance from Colombo or Kandy	—	−.63	.008	−.73	−.76	−.45
Desirability of Services for Beneficiaries ...	.64	.59	.016	.53	.71	.23
Difficulty of Obtaining and Keeping Agricultural Workers ...	.30	−.58	.019	−.64	−.43	−.58
Relative Size of Administration	.34	.56	.023	.51	.28	.51
Adequacy of Facilities ...	.66	.51	.038	.21	.26	.11
Autonomy of Researchers ...	.41	.51	.037	.42	.41	.29
Date of Founding ...	—	−.50	.033	−.45	−.26	−.40
Sophistication of Research Technology ...	.74	.46	.059	.28	.05	.35
Maintenance of Facilities ...	−.03	.45	.063	.42	.58	.16
Researchers' Government Connections ...	.16	.40	.090	.45	.66	.15
Difficulty of Obtaining and Keeping Researchers ...	.17	.39	.092	−.68	−.35	−.69
Skills & Motivation of the Staff	.27	.36	.113	.51	.39	.43
Power of the Director ...	−.38	−.36	.125	−.29	−.37	−.14
Benefits from Government Priorities ...	−.36	.33	.135	.34	.25	.29
Salary Scale ...	—	.32	.134	.16	−.23	.38
Conducive Local Values ...	.55	.32	.142	.15	.24	.03
Commitment of National Government ...	.61	.31	.155	.35	.29	.27
Director's Government Connections	.46	.29	.167	.44	.64	.15
Overall Quality of Operation	.24	.28	.177	.50	.28	.49
Adequacy of Financing ...	.63	.26	.192	.36	.57	.09
Conducive Market Factors	.21	.26	.194	.48	.44	.35
Foreign Aid ...	—	.25	.194	.30	.25	.19
Quality of Director's Leadership	—	.21	.247	.57	.71	.27
Ph.Ds per 10 researchers ...	—	.20	.278	.42	.63	.13
Skill & Resources of Beneficiaries	.02	.19	.264	−.01	.18	−.14
Number of Departments ...	—	−.18	.295	−.01	−0.1	.03
Number of Researchers ...	—	.17	.286	.02	.18	−.12
Number of Employees ...	—	.15	.307	.17	.39	−.03
Number of Ph.Ds ...	—	.10	.381	.11	.42	−.14
Centre's Autonomy ...	.30	.10	.369	.17	.42	−.07
Extent of Diffusion by Extensive Service ...	.54	.10	.369	.02	.37	−.23
Understanding with Relevant Agencies ...	.26	.07	.408	.03	.22	−.12
Size of Budget ...	—	.07	.405	.27	.13	.26

The interview generally took from 20 to 40 minutes and often lead to extensive comments which are helpful in understanding the operation of agricultural research centres in Sri Lanka. In addition, numerous experts on Sri Lankan agriculture or agricultural research have contributed to this study through formal and informal discussions.

Most of the subjective judgements are registered on a seven point scale ranging from 1=exceptionally low to 7=exceptionally much or high with 4=average for Sri Lankan agricultural research centres. The informant was asked to compare his or her research centre with the other research centres in Sri Lanka and indicate the degree and direction of its deviation, if any, from the average. Obviously, people tend to be biased in favour of their own institutions and some findings must be discounted somewhat for this reason. We point out, however, that the presence of bias is likely to weaken correlation coefficients, not strengthen them, so that many correlations probably should be stronger than they are.

Most of the data is analyzed in terms of the Pearson product movement coefficient. Since the 13 research centres constitute almost the entire population of research centres dealing with agricultural crops in Sri Lanka, the results are descriptive for Sri Lankan agricultural research centres except for the measurement error contained therein which may be substantial. For the purpose of generalizing to other research centres, however, the sample is biased and its size is small. With a sample size of only 13, only correlations exceeding r=.48 attain the .05 level of significance and only one quarter of the correlations with overall effectiveness are this high. The study, therefore, should be viewed as only suggestive for research centres generally. Nevertheless, so little comparative data on a range of characteristics of research centres exists that this study is a considerable advancement on the existing knowledge base.

RESEARCH FINDINGS

The focus of this study is on the effectiveness of agricultural research centres. We did not impose our own definition of success and effectiveness but let the respondents judge "overall effectiveness" and "overall success" in their own terms. We have selected the combined overall effectiveness scores by two experts on agricultural research centres in Sri Lanka as our main measure of "overall effectiveness". Table 1 presents the correlations of this and three other measures of overall effectiveness with 23 measures of centre outputs or success. According to Table 1, the outside evaluators identified overall effectiveness most closely with the development of new varieties and overall output of the centres, the researchers identified it most closely with the development of new methods and contribution to practical agricultural knowledge, and the centres' directors identified it most closely with contribution to Sri Lankan agriculture and on-farm implementation of the centre's technology. Therefore, the outside evaluators seem to identify effectiveness with indicators of performance which are fairly visible outside of the centres, the researchers with more nuts and bolts performances, and the directors with higher order impacts. It seems appropriate that researchers, centres' directors and outside evaluators have these differing perspectives. We also notice that the judgements of the outside evaluators coincide quite closely with the reputation of the centre as judged by directors and researchers.

When we compare the judgements of the two outside evaluators, the thirteen directors and the thirteen researchers with each other on overall effectiveness and overall success, we find that the overall assessments by the directors are the least

well correlated with the overall assessment by the others and the assessments by the outside evaluators are the most highly correlated with the others. We also notice that the combined assessments by the directors and researchers seem superior to the assessment by either directors or researchers singly.

Table 1 also provides the correlation between the judgements by directors and judgements by researchers as a crude estimate of the degree of agreement between them. The agreement seems to be least on the most general evaluations (overall effectiveness, overall success, and overall output) which suggests that directors and researchers tend to base their overall judgements on a different set of priorities for specific sub-dimensions. The differences between the last two columns reflect these differential emphases.

1. FACTORS CONTRIBUTING TO CENTRE EFFECTIVENESS

The major focus of the study is on the factors which contribute to centre effectiveness, and the major findings of this study are presented in Table 2. All findings are very tentative. To the degree that directors and researchers answered the questionnaire honestly, perceptively and without bias, the results would accurately reflect the strength of association between effectiveness and various characteristics of the centres and their contexts for these particular 13 research centres. The findings, however, cannot be reliably generalized to agricultural research centres in general because they are based on only 13 cases. Nevertheless, 13 cases are enough to provide the basis for tentative findings. The study should be considered a pilot study and particular findings should be tested more thoroughly on more cases.

The major factors contributing to centre effectiveness in Sri Lanka seem to be the attitude of the beneficiaries toward the services of the centre along with certain contextual factors. The two overlapping attitudinal characteristics of beneficiaries (incentive to use the centre's technology and desirability of the service of the centre) had two of the highest correlations with overall effectiveness.

Three contextual factors had the other three highest correlations with overall effectiveness: beneficial government policies, distance from Colombo or Kandy and difficulty of obtaining and keeping agricultural workers (note: keeping researchers is another variable). It is not absolutely clear why these variables are highly correlated with overall project effectiveness. We often do not know for certain which government policies contribute to centre effectiveness, how proximity to Colombo or Kandy aids effectiveness, nor why agricultural workers leave or stay. It is also possible that these high correlations are misleading. Each of these contextual factors correlates highly with "incentives and motivation of the beneficiares" ($r = .80$, .80, and .69 respectively), so much of their high correlation with effectiveness could be due to the covariation which they have with beneficiaries motivation. We notice that when we controlled incentives and motivation of beneficiaries, the partial correlations of centre effectiveness with government policies, distance from Colombo and Kandy and difficulty of obtaining and keeping agricultural workers are $r = .26, -.41$ and $-.01$ respectively. These findings suggest that difficulty keeping agricultural workers probably is not directly related to centre effectiveness while government policies and distance from Colombo and Kandy are not as strongly associated with centre effectiveness as Table 2 suggests.

In general, contextual factors are only moderately related to center effectiveness: $r = .33$ for benefits from government priorities, $r = .32$ for conducive local values, $r = .31$ for commitment of national government, $r = .26$ for conducive market factors,

and r= .25 for foreign aid. In addition the ability of the centre to influence its context was not highly related to overall effectiveness. This statement is reflected in the low or negative correlations of effectiveness with understanding with relevant agencies, centre's autonomy, director's government connections, and power of the director.

The next set of factors which are moderately or highly related to centre effectiveness deal with the structure, resources, and personnel of the centre. Effective centres seem to require relatively large administrations, adequate and maintained facilities, autonomy for the researchers, sophisticated research methods, the ability to obtain and retain researchers, and a research staff which is both competent and motivated. Salary scale is not too important for effectiveness in Sri Lanka because most centres have the same salary scale. Five centres do not come under the Department of Agriculture so some of them have somewhat different salary scales. Earlier disparities between these centres, however, have been declining in the past few years.

Many of the above findings are not surprising but some are unusual. It is generally assumed that the skills, motives, and autonomy of researchers and the adequacy and maintenance of facilities are important to centre success. It is not so obvious that a relatively large administration would also contribute to centre success. Further unexpected results dealing with centre characteristics are found in the lower part of the table where we find surprisingly modest or low correlations of centre effectiveness with the following variables: the quality of the operation of the centre, the adequacy of financing, the quality of the leadership of the centre's director, Ph.Ds per 10 researchers, departmentalization, and size. It must be remembered that the small number of cases means that we should not put a great deal of confidence in these findings but these findings should not be ignored either.

One of the above variables, the quality of the leadership of the centre's director, has some unique measurement features which cast doubt on its reliability and the accuracy of findings based on it. First, the centre's director did not score this variable for obvious reasons, so it is the only subjective variable to be based on the judgement of only one informant in each centre. Secondly, it had little variance because all but one researcher gave their director a high score on his leadership. Variables with little variance are unlikely to correlate highly with other variables with much more variance. Finally, the average score was higher on this variable than on any other variable in the study. There are two plausible explanations for this. First, the scorings are accurate and all but one of the centres had very capable directors. If so, then both the effective and uneffective centres had capable leaders and variations in centre effectiveness would be due almost entirely to other factors. The second explanation is that researchers having less capable directors are not scoring them lowly. Perhaps they are overly impressed by their directors. Perhaps they do not want to embarass their directors. Or perhaps they fear negative consequences because their directors may learn what they said. We cannot choose between these explanations on the basis of data on hand. In sum, the findings in this study concerning the quality of the leadership of the centre's director must be treated with extreme caution.

In general, Table 2 supports the theoretical model presented in Figure 1 but not perfectly. It provides support for 22 out of 30 hypotheses (arrows in Figure 1) at the .2 level of significance. The model hypothesizes that ten factors contribute directly to centre effectiveness: capital, labor technology, resources, organization, researchers' autonomy, conducive local values, extension efforts, conducive macro

context and demand for the centre's services by beneficiaries. The last factor had the highest correlation with effectiveness, the local and macro contexts had modest correlations, and at least some variables in all of the other categories except extension efforts had moderate to high correlations with effectiveness. The one exception extension service, increases demand but does not directly contribute to centre effectiveness.

Figure 1 also hypothesizes that several other factors contribute indirectly to centre effectiveness by contributing to the above factors. These factors are financing, political connections, director's leadership, centre's autonomy and conducive macro context. These hypotheses are supported by the relevant correlations which are presented in Figure 1.

We have pointed out that 22 out of 30 hypotheses in Figure 1 are supported at the not very demanding level of significance of .2. What about the eight hypotheses in Figure 1 which are unsupported even at the .2 level of significance? We will discuss them briefly. The first is that the directors with good government connections improve the conduciveness of the macro context. We speculate that this hypothesis is temporarily inoperative because recent government emphasis is on establishing new regional research centres. They have less well connected directors but are being favoured momentarily.

Second is that autonomy for the centre contributes to the quality of the operation of the centre. This proposition derives from American organisational theory and does not seem to apply to the Sri Lankan situation.

The autonomy of researchers is involved in the next three unsupported hypotheses. The capabilities of the researchers are expected to contribute to the autonomy of researchers, the quality of the operation of the centre is expected to contribute to the autonomy of researchers, and the autonomy of researchers is expected to be negatively related to the extent of extension services. We tentatively conclude that autonomy of researchers (just like autonomy of the centre) operates very differently in Sri Lanka than it would in the United States. The negated hypotheses were based on the U.S. experience.

The sixth unsupported hypothesis is that extension service contributes significantly to centre effectiveness. Extension service correlates with effectiveness at only .10 so it does not seem to have much direct effect on effectiveness. Nevertheless, it seems to indirectly increase effectiveness by increasing the demand for the centre's services which in turn improves centre effectiveness.

The lack of support for two additional hypotheses is particularly noteworthy: adequate financing should improve the capabilities of researchers and quality of leadership should improve the quality of the operation of the centre more than they do. With regard to the former, we suggest that the use of the same salary scale in nine out of the thirteen centres prevents adequacy of funding from having much effect on the capabilities of researchers. With regard to the latter we pointed out earlier that quality of leadership is one of the most poorly measured variables. So findings which use this variable are not very reliable. Furthermore, a deeper analysis suggests that the quality of the operation of the centre has more to do with the quality of the staff than with the quality of the director's leadership. For example, quality of operation correlates with motivation and capabilities of the researchers at r=.71, with difficulty keeping researchers at r=.60 and with difficulty keeping agricultural workers at r.—.72.

Even though eight specific hypotheses (arrows) were not substantiated by this study all of the variables in Figure 1 seem to have some role in the model. In other words they have either some direct or some indirect effects on centre effectiveness in these thirteen cases. The variables with the highest direct correlations with centre effectiveness are beneficiaries demand for the centre's technology, researcher autonomy, sophistication of technology and adequacy of facilities. We caution that other factors may be equally important but not demonstrate high correlations with centre effectiveness because of greater measurement error. These results, therefore, are tentative and must be further tested on other data sets and with less subjective measures.

II FACTORS CONTRIBUTING TO SELECTED FEATURES OF CENTRES

The dependent variable throughout the previous section is centre effectiveness. In this section we make certain other factors the dependent variable and look at the factors which contribute to them.

1. *Factors Contributing to Beneficiaries' Demands for Centre's Technology*

The factor which is the most highly correlated with centre effectiveness is the incentive and motivation of beneficiaries to use the centre's technologies (beneficiary motivation), but what are the factors which contribute to beneficiary motivation? One would expect the following five factors to contribute to beneficiary motivation: skill and resources of beneficiaries, extent of diffusion of centre's technology by extension service, value of the technologies, conducive local values and conducive macro context. The results of correlation analyses support four of these expectations, but unexpectedly, skill and resources of beneficiaries correlates at only $r=.11$ (not significant) with beneficiary motivation. Two of the four supported hypotheses involve variables for which the study had only one indicator. Beneficiary motivation correlates with extension service at $r=.57$ and with conducive local values at $r=.58$. The several indicators of the conduciveness of the macro context as judged by directors and researchers correlate with beneficiary motivation as follows: conducive government policies ($r=.80$), national government commitment ($r=.29$), conducive market factors ($r=.28$) and national government priorities ($r=.27$). Thus, the conduciveness of the macro context helps centre effectiveness but not very much except for government policies.

The final factor expected to contribute to beneficiary motivation is value of the technologies. Two measures of the value of the technology produced by the centre are degree of success of the centre in developing new varieties and degree of success in developing new agricultural methods. New varieties correlated with beneficiary motivation at $r=.44$ and new methods at $r=.26$. In summary, beneficiary motivation gains considerably from an active extension service, favorable local values, and providing useful technologies. A conducive national context is moderately helpful.

Next we report on the unexpectedly high correlation of beneficiary motivation with autonomy of researchers ($r=.51$). Western observers would expect research autonomy to be associated with basic rather than applied research, and therefore, to be negatively correlated or not correlated with beneficiary motivation to use the centre's technologies. In Sri Lanka, however, the evidence, both quantitative and qualitative (unstructured conversations), suggests, that many agricultural researchers have as their primary goal serving the technological needs of growers. When researchers have these goals, increasing their autonomy should increase beneficiary motivation to use the centre's technology.

2. *Factors Affecting the Overall Quality of the Operation of the Centre*

It is surprising that the overall quality of the operation of the centres seems to have so little to contribute to centre effectiveness. This may be due in part to the low reliability of the measure as reflected in the low correlation between the scorings of directors and researchers. On the other hand, several variables had even lower correlations between directors' and researchers' scorings and yet exhibit expected patterns of correlations. The strange patterns of association for quality suggests that extreme caution in interpreting these results is in order.

Usually quality operation is the goal of the centre's director in order to increase the centre's output and success. In fact, quality of operation is correlated with total output at $r = .62$ and with centre success as judged by directors and researchers combined at $r = .24$. Because quality of operation is a major goal of those who are responsible for research centres, it is worthwhile to notice the other organizational characteristics of centres which are correlated with quality of operation. Its highest correlations are with aspects of the staff, i.e. with skill, abilities and motivation of the staff at $r = .71$, difficulty keeping agricultural workers at $r = .72$, and difficulty keeping researchers at $r = .60$. It is also highly correlated with the relative size of administration ($r = .54$) and good maintenance of facilities ($r = .50$) and modestly correlated with number of Ph.Ds ($r = .34$), number of researchers ($r = .33$), number of employees ($r = .24$), budget ($r = .24$), adequacy of financing ($r = .30$) and sophistication of technology ($r = .35$).

In sum, the quality of the overall operation of the centre seems to be aided by the quality and low turnover of the staff. It also is aided by having a large administrative component of the centre and by having adequate financing.

3. *Factors Affecting the Adequacy of Financing*

Table 3 presents the Pearson zero order correlations of the adequacy of financing with five variables which might contribute to the adequacy of financing, thirteen variables which involve factors of production and should benefit from adequate financing, twelve variables which might indicate other consequences of adequate financing, and three other variables. Four observations on Table 3 should be noted. First, government commitment and government connections of researchers and connections of researchers and the director seem to help generate adequate financing more than does the leadership and power of the director. Second, good financing enables some centres to obtain and maintain good facilities and obtain and retain good staff. It also enables some centres to be large, have large administrations, be fairly autonomous, and operate fairly smoothly. Third, adequate financing usually makes centres successful, their success is more likely to be based on new, varieties than on new methods and training and to involve more basic research than performed in the other centres. Nevertheless, the better financed centres contribute more to Sri Lankan agriculture than the less well financed centres. Finally, the new centres tend to be underfinanced and these tend to be away from Colombo and Kandy. They also tend to receive more foreign aid as a percent of their budget.

Table 3—PEARSON PRODUCT MOMENT ZERO ORDER CORRELATIONS OF ADEQUACY OF FINANCING WITH VARIABLES CONTRIBUTING TO FINANCING, FACTORS OF PRODUCTION, CONSEQUENCES OF FINANCING AND OTHER VARIABLES FOR THIRTEEN SRI LANKAN AGRICULTURAL RESEARCH CENTRES, 1983

Variables	*Correl. with Financing*	*Variables*	*Correl. with Financing*
Factors Possibly Contributing to Financing		**Factors of Production**	
Government commitment	.61	Maintenance of facilities	.76
Connections of researchers	.60	Capability and motivation of staff	.65
Connection of directors	.59		
Quality of leadership	.33	Ph. Ds/researchers	.61
Power of centre's director	.11	Number of researchers	.58
		Adequacy of facilities	.54
Consequences of Financing		Number of employees	.53
		Autonomy of centre	.52
Overall effectiveness: evaluators	.26	Relative size of administration	.45
Overall success: director and researcher	.62	Difficulty in keeping agricultural workers	−.39
Degree of goal attainment	.63		
Overall: output	.70	Autonomy of researchers	.35
Output: new varieties	.40	Quality of overall operation	.30
Output: training	.29	Sophistication of technology	.23
Output: new methods	.08	Difficulty of keeping researchers	−.23
Improvement in agricultural production			
Deriving above outputs	.55	**Other Variables**	
Publication per researchers	.58		
Contribution to basic science per researcher	.49	Date of founding	−.53
		Distance from Colombo or Kandy	−.41
Contribution to practical agri. knowledge per researcher	.21	Contribution of foreign aid	−.32
Contribution to Sri Lankan agri. per researcher	.27		

4. *The Role of the Extension Service*

The extent of diffusion of the centre's technology by the extension service is strongly related to the motivation of beneficiaries to use the centre's technology as seen in Table 2 (its correlation with motivation of beneficiaries to use centre's technology is r =.57, with desirability of centre's services to beneficiaries r =.47, with extent of on-farm implementation of centre's technology r =:69 and with contribution to Sri Lankan agriculture r= .42). Extensive extension service activity is also correlated with favourable local values (r =.39). On the other hand it has a low correlation with centre effectiveness because it is negatively related to several variables which contribute to centre effectiveness. For example, it is negatively related to bureaucracy and an emphasis on sophisticated technology at agricultural research centres (its relation with relatively large administration is r—.36, with sophistication of centre's technology r—.43, with publications per researcher r—.39, and with contribution to basic science per researcher r—.36).

The extension service had several other significant correlations. It is more effective for older centres (r =.38) and is negatively related to distance from Colombo or Kandy (r—.35). It is also associated with growing centres (r =.57). Good extension service work is probably the major factor considered when respondents judged the degree of cooperation and understanding with relevant agencies (r= .72).

SUMMARY AND INTERPRETATION OF QUANTITATIVE FINDINGS

The previous sections present many details which are difficult to remember and interpret. In this section we review some of the highlights and identify some of the apparent lessons from this study.

The study is most readily summarized by Figure 1 which shows that many factors contribute to centre effectiveness. The most important factor seems to be the demand by the beneficiaries for the services of the centres. Centres serve the farmers and growers and must develop technologies which help them improve their production. Another important contributor to centre effectiveness are helpful government policies. One example is the threat of nationalization of the tea industry which has undermined incentives for the private tea plantations to invest in the development of the industry. The resulting decline in the industry and the loss of experienced managers when the takeover did occur have adversely affected the Tea Research Institute.

Most of the characteristics of research centres which normaly are expected to contribute to centre effectiveness, do in fact so contribute in the case of these thirteen centres. Centres need adequate and well maintained facilities, capable staff, good technology and autonomy for researchers. This study also found that a large administration is conducive to centre success and the quality of the operation of the centre is moderately correlated with centre effectiveness.

We also look at why farmers and growers are enthusiastic about adapting the technologies of research centres. Enthusiastic adoption seems to occur when the technologies are valuable, the extension service is effective, the government policies are favourable to raising the crops which the centre focusses on, and the researchers are relatively autonomous in establishing their research goals and conducting their research. Evidently they use their autonomy to effectively serve the farmers and growers.

This study also probes into the factors which are highly associated with the quality of the overall operation of the centres. Quality operation is highly associated with the quality of the researchers, the ability of the centre to keep turnover low, the size of the administration and the adequacy of financing.

Next the study looks at the factors which seem to contribute to adequacy of financing. Not surprisingly the main factors are political, i.e. government commitment and the government connections of the centre's director and researchers. We also look at the characteristics of centres which result from adequacy of financing. Adequate financing seems to translate the most directly into good staff and facilities and ultimately into high productivity for the centre.

SUMMARY OF UNSTRUCTURED DISCUSSIONS WITH INFORMANTS

In addition to the quantitative findings which emanate from the structured interviews we obtained information from unstructured discussions with the informants. This information is more impressionistic but may well include some of the most valuable insights of the study. We summarize the more important and stronger of these findings below.

1. The informants expressed very positive attitudes toward the success of the centres in the light of the resources with which they have to work and numerous other problems (even discounting for informant bias the centres seem relatively successful).

2. Some of the informants expressed very positive attitudes toward the work of the extension services for giving researchers a grasp of the problems

of farmers and feedback on the results of their suggestions and for communicating the centre's technologies to the farmers. The monthly meetings with extension agents are highly praised.

3. Disappointment is usually (but with some major exceptions) expressed about the extent to which farmers apply the centre's technologies.

4. The centres focus on applied problems rather than on basic research. Very good mileage per research dollar seems to have resulted. As outside observers, however, we wonder if more basic research may be needed for long term growth in agricultural production.

5. Two major problems are commonly identified: (a) inadequate financing and (b) obtaining and retaining qualified personnel. Inadequate financing results in inadequate equipment, inadequate laborers' work days for experiments and many problems in conducting good research. The personnel problems result from low salaries, competing opportunities and less attractive living conditions in many centres. The lack of senior experienced research officers in many centres is the result.

6. A less frequently mentioned but clearly evident problem is the administrative rules and procedures governing research centres. These make it difficult to get things done quickly and efficiently and often to get things done at all.

APPENDIX A

EVALUATION QUESTIONNAIRE FOR AGRICULTURAL RESEARCH CENTRES

		Col.
1. Centre Name		
2. Centre Location	Number	1–3 ____
3. Centre Date of Founding	Region	4 ____
	19xx	5,6 ____

CENTRE'S CONSEQUENCES

4. Centre's Purposes ____

5. Degree of Attainment of Purposes: 1=0–24%, 2=25–49%, 3=50–74%, 4=75–100%, 5=100+% 10____

NOTE: Most of the remaining questions ask you to evaluate the centre in terms of a 7 point rating scale by circling the best answer. The centre is to be compared to the average centre of its size. Use the following scale:

	exceptionally little or low		average			exceptionally much or high		
	1	2	3	4	5	6	7	
6. How successful do you consider this centre						low av. high		
A. What are its major problems?						1 2 3 4 5 6 7		11____
B. What are its major strong points?								
7. Benefits								
A. Direct Outputs of the centre: overall (factors of production)						1 2 3 4 5 6 7		12____
1) Success in developing new varieties						1 2 3 4 5 6 7		13____
2) Amount of training of farmers & agricultural service workers						1 2 3 4 5 6 7		14____
3) Success in developing new methods of farming						1 2 3 4 5 6 7		15____
B. Which of the above factors is emphasized by the centre?						1 2 3 4		16____
C. Amount of improvement in agricultural production derived from the above factors						1 2 3 4 5 6 7		17____
8. Centre effectiveness (total benefits/costs score) Scale 0–10 from very unworthy to very worthy						0 1 2 3 4 5 6 7 8 9 10		18–19____

OPERATION OF THE CENTRE

9.	Understanding and Communication Between involved Agencies	low 1 2 3 4 5 6 7 high	20
10.	Quality of the operation of the centre: Overall	1 2 3 4 5 6 7	21
	A. Skill, capabilities, & motivation of the staff	1 2 3 4 5 6 7	22
	B. Incentive & motivation of beneficiaries if relevant	1 2 3 4 5 6 7	23
	C. Adequacy of the skill, knowledge or resources of the beneficiaries if relevant	1 2 3 4 5 6 7	24
	D. Desirability of the goods, services or benefits of the centre.	1 2 3 4 5 6 7	25
11.	Maintenance of Constructed Facilities	1 2 3 4 5 6 7	26
12.	Adequacy of Financing	1 2 3 4 5 6 7	27

CHARACTERISTIC OF THE CENTRE

13.	A. Type of Research Institute: 1=large centre, 2=small centre, 3=sub station, 4=university department, 5=others		28
	B. Does it have sub-stations? 0 =No; If so, how many?	0 1 2 3 4 5 6 7 8 9	29
14.	A. Number of researchers		30,31
	B. Total number of employees		32,34
	C. 1982 total budget in US dollars		35,39
15.	Crop emphasized: 1=tea, 2=coconut, 3=rubber, 4=rice, 5=minor export crops, 6=fruit crops, 7=animal husbandry, 8=other food crops, 9=mixture of the above		40
		low av. high	
16.	A. Adequacy of facilities and equipment	1 2 3 4 5 6 7	41
	B. Salary scale	1 2 3 4 5 6 7	42
17.	A. Extent of diffusion of centre's technology to growers by extension agents	1 2 3 4 5 6 7	43
	B. Extent of on-farm implementation of centre's technology	1 2 3 4 5 6 7	44
		low av. high	
18.	Percentage of budget contributed by foreign aid	1 2 3 4 5 6 7	45,46
19.	A. Degree of autonomy of the centre *vis a vis* government ministry and funding agencies	1 2 3 4 5 6 7	47
	B. Degree of autonomy of the researchers in choice, design and execution of research	1 2 3 4 5 6 7	48
	C. Number of departments within the centre		49
	D. Power of the director	1 2 3 4 5 6 7	50
	E. Size of the administration relative to rest of organization	1 2 3 4 5 6 7	51
20.	A. Degree of sophistication of research technologies	1 2 3 4 5 6 7	52
	B. Extent of Post Graduate training provided	1 2 3 4 5 6 7	53
21.	Ministry responsible to		54
22.	Prediction about future prospects for growth or decline; —3=much decline, 0=stable, +3=much growth	-3-2-1 0 +1+2+3	55
23.	Number of researchers with Ph.D.'s		56
24.	Rate of growth in last 5 years: -3=much decline 0=stable, +3=much growth	-3-2-1 0 +1+2+3	57
25.	Cultivation zone served: 1=wet lowlands, 2=wet highlands, 3=dry lowlands, 4=dry highlands, 5—intermediate between wet & dry zone 6=both 1+2, 7— both 3+4, 8=3 or more zones		58
26.	Type of farm most directly served; 1=plantations, 2=large farms, 3=small farmers, 4=tenant farmers, 5=other, 6= 1+2 7= 3+4		59
		low av. high	
27.	Reputation of the centre	1 2 3 4 5 6 7	60
28.	Quality of leadership of the director	1 2 3 4 5 6 7	61
29.	A. Degree of difficulty in obtaining and retaining qualified researchers	1 2 3 4 5 6 7	62
	B. Degree of difficulty in obtaining and retaining skilled agricultural workers	1 2 3 4 5 6 7	63

SUCCESS OF AGRICULTURAL RESEARCH CENTRES

30.	Extent centre benefits from government planning/priorities	1 2 3 4 5 6 7	64
31.	Extent of contacts of the director with other governmental organizations	1 2 3 4 5 6 7	65
32.	Extent of contacts of the researchers with other governmental organizations	1 2 3 4 5 6 7	66

OUTPUTS OF THE CENTRE

		low av. high	
33.	Extent of publications per researcher	1 2 3 4 5 6 7	67
34.	Extent of contribution to basic scientific advancement per researcher	1 2 3 4 5 6 7	68
35.	Extent of advancement of practical agricultural knowledge per researcher	1 2 3 4 5 6 7	69
36.	Extent of contribution of Sri Lankan agriculture per researcher	1 2 3 4 5 6 7	70
37.	Extent of training relative to size of Centre	1 2 3 4 5 6 7	71