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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

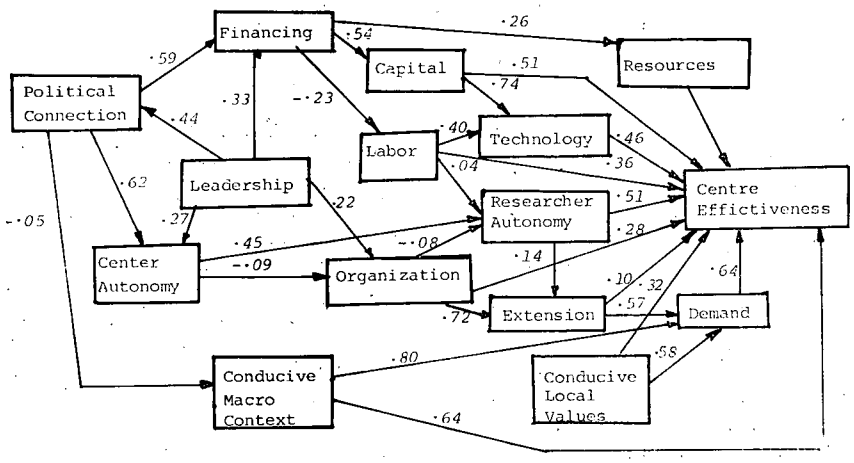
Agricultural research centres share with other productive organizations many requirements for success in achieving their goals, namely a conducive environment, demand for their services, skilled and motivated personnel, adequate financing and equipment, appropriate organizational structure, effective 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.*	*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, counducive 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	Number	1–3 ———
2. Centre Location	Region	4 ———
3. Centre Date of Founding	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 1 2 — average 3 4 5 — exceptionally much or high 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 av. 3 4 5 high 6 7 — 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

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