Sri Lanka Journal of Agrarian Studies 3 (2), 1982, 96-109.

A STUDY OF THE FINANCIAL AND HUMAN RESOURCES IN PLANTATION CROPS RESEARCH IN SRI LANKA

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INTRODUCTION

The plantation crops sector in Sri Lanka comprises tea, rubber, coconuts, cashew, sugarcane and forestry of which the first three crops are the most important by virtue of their contribution to Gross National Product, foreign exchange earnings and employment. Plantation crops research in Sri Lanka is conducted mainly by public institutions since there are no private or international organizations carrying out biological research in the plantation sector. The most important institutions are the tea, rubber and the coconut research institutes each of which has several departments conducting and supervising research in numerous fields (Table 1).

Table 1—INSTITUTIONS CONDUCTING RESEARCH IN THE PLANTATION CROPS SECTOR

Tea Research Institute (5 experimental stations including the main station at Talawakelle).
Rubber Research Institute (4 experimental stations including the main station at Agalawatta)
Coconut Research Institute (3 experimental stations including the main station at Lunuwila)
Cashew Research Institute (1 station at Kondachchi).
Sugarcane Research Station (2 experimental stations including the main station at Kantalai).
Forestry (Research Division in Colombo with trials in different locations).

The Tea Research Institute (TRI) was established in 1928 to conduct research into the problems that affect the tea industry. Initially tea research was conducted in separate locations, but since 1930 all research was carried out in the TRI at Talawakelle. Several more smaller stations were established in 1963. The TRI at Talawakelle now has seven research divisions namely Agricultural Chemistry, Agronomy, Biochemistry, Entomology, Pathology, Physiology and Technology. In addition it has other supporting divisions, such as statistics, few smaller stations (see Table 3) and an advisory division.

The Rubber Research Institute (RRI) originated in 1909 as a committee that agreed to contribute to a scheme to provide funds and research facilities for the rubber plantation industry. The scheme so originated was reorganised in 1913, and the headquarters of the scheme was transferred to Dartonfield in 1936. Many other smaller sub-stations were established since then. In 1980, the RRI had seven research divisions namely: Biochemistry, Genetics and Plant Breeding, Intercropping, Plant Science, Plant Pathology, Rubber Chemistry, and Soils and Plant Nutrition. In addition it has other supporting divisions such as statistics, advisory and library services.

The first proposal to set up a separate institute for research in the coconut industry was made in 1912. Over the years these initial efforts have blossomed into a full fledged Coconut Research Institute (CRI) which is now under the jurisdiction of the Ministry of Coconut Industries. In 1980, the institute comprised seven research divisions namely: Agrostology, Biochemistry, Chemistry, Crop Protection, Genetics, Plant Biology, Processing and Soil Chemistry. In addition it has other service divisions such as advisory, statistics and administration.

For many years research on sugarcane was co-ordinated by a committee under the direction of the Director of the Research Division in the Department of Agriculture. In 1981 legal enactments were passed to develop an independent Sugar Research Institute. For cashew research also a full-fledged research institute is being contemplated.

Since their inception, the three major commodity research institutes on tea, rubber, and coconuts were under the Ministry of Agriculture. After the creation of a new Ministry of Plantation Industries in 1970, these three institutes and the Cashew Research Institute were brought under the new Ministry. The Sugarcane Research Institute continues under the Ministry of Agricultural Development and Research while forestry research comes under the Ministry of Lands and Land Development.

The government has become more and more concerned in the development of the plantation crops with special emphasis being placed on sectors that were hitherto neglected such as the smallholders. It has been increasing its contribution of funds and personnel involved in order to facilitate smooth progress in these institutions.

The different areas of emphasis originate from the research institutes themselves. In general there is no mechanism at present for co-ordination of these programmes and national policy has been rather general with no specific priorities to guide resource allocation. The treatment of research and extension within an economic framework is important. A compilation of data on expenditure and personnel on plantation crops research in Sri Lanka is made in the following sections in this paper to provide a better perspective of research investment on the plantation sector. The allocation of expenditure on agricultural research has been examined elsewhere (Senanayake and Herath 1981).

Data on Plantation Research Expenditure and Manpower

The data on research expenditure in tea were gathered from the programme budgets maintained by the Tea Research Institute, Talawakelle. The expenditure is classified under specific research projects and these different projects were classified by the authors into broad disciplines. The projects in tea and their approximate classification into the different disciplines are given in Appendix 1. All items classified under the different subsections under research were totalled to represent research expenditure.

The expenditure data for rubber were obtained from the annual programme expenditure reports maintained by the Rubber Research Institute of Sri Lanka. Annual expenditures were classified into four programmes namely: (1) research promotion, (2) advisory services, (3) group processing centres, and (4) plantation division (vested estates). Expenditure under programme (1) was classified under sixteen divisions. Total annual expenditures were classified under these categories as research, administration and advisory. The divisions coming under research, administration, advisory and extension and others are given in Appendix 2. The fund allocations were provided both as recurrent and capital for each division.

The research expenditure data for coconuts for the years 1975–80 were obtained from the annual draft estimates of the Coconut Research Institute of Sri Lanka. The data were classified into three classes research, extension and training, and administration. The divisions coming under each category are listed in Appendix 3 under their respective headings. The fund allocations were provided both as recurrent and capital expenditure in each division. It was noted that the 'motor vehicle working account' is common to all three categories and 5 percent of its expenditure was allocated to research, 5 percent to extension and training and the rest was allocated to administration on the advice of authorities in the institute.

The research expenditure for cashew, sugarcane and forestry were obtained directly from these respective institutes. In most cases the data refer to actual expenditure.

Investment of Funds on Plantation Crops Research

The research expenditures for tea, rubber, coconuts, sugarcane, cashew and forestry are given in Table 2 for the period 1975–1980. The current expenditures were deflated by the cost of living index in order to examine the expenditure in real terms*. In 1975, the expenditure for research in tea was Rs. 4.98 million. This has declined in 1976 and 1977 but shows an upturn in 1978 and 1979 with 1979 showing an expenditure of Rs. 5.75 million. The expenditure has again declined in 1980 to Rs. 4.51 million. In rubber, the real expenditure on research over the years 1975–80 has varied slightly with 1978 recording the highest of Rs. 4.44 million. For coconuts a fluctuating trend is noticeable during the 1975/78 period. In general research expenditure for coconut is lower than either for tea or rubber excepting the tail end of the period under scrutiny. The highest expenditure was Rs. 3.47 million in 1979. For sugarcane, there is a monotonic decline in the research expenditure after 1976. The expenditure for cashew is the lowest in all crops examined but shows an increasing trend. For forestry the real expenditure shows a stable trend hovering slightly above Rs. 0.40 million.

* The cost of living index reflects the effect of price changes over a period of time. Thus the research expenditure was deflated by the cost of living index. This method of deflation has been used by Peterson (1967) and Kikuchi and Hayami (1975).

Table 2—PLANTATION RESEARCH EXPENDITURE (IN MILLIONS OF RUPEES) IN SRI LANKA (IN MILLIONS OF RUPEES AT CONSTANT 1974 FACTOR COST PRICE) [1]

Commodity/Commodity group	1975	1976	1977	1978	1979	1980
Tea [2]	4.98 (5.15)	4.59 (5.14)	3.73 (5.06)	4.36 (6.84)	5.75 (9.87)	4.51 (10.36)
Rubber [3]	3.05 (3.16)	3.20 (3.59)	3.26 (4.42)	4.40 (6.91)	2.74 (4.72)	3.13 (7.20)
Coconut [4]	2.57 (2.67)	2.54 (2.85)	2.25 (3.05)	2.58 (4.05)	3,47 (5.96)	3.08 (7.09)
Sugar [5]	2.17 (2.25)	2.50 (2.81)	1.92 (2.61)	1.89 (2.97)	1.70 (2.94)	1.27 (2.93)
Cashew [6]	Nil —	Nil —	0.02 (0.04)	0.05 (0.08)	0.06 (0.11)	0.06 (0.14)
Forestry [7]	0.42 (0.44)	0.42 (0.47)	0.48 (0.65)	0.40 (0.64)	0.41 (0.69)	0.35 (0.80)

1. Total of Recrurrent and Capital Expenditure.
2. Source: Projects of TRI of Sri Lanka, Talawakelle, 1975–1980.
3. Source: Programme Expenditure of RRI of Sri Lanka, Agalawatta, 1975–1980.
4. Source: Annual Draft Estimates of CRI of Sri Lanka, Lunuwila, 1975–1980.
5. Source: Sri Lanka Sugar Corporation, Colombo.
6. Source: Sri Lanka Cashew Corporation, Colombo.
7. Source: Forest Department, Colombo.

N.B.—Expenditure in current market prices is given in parantheses.

Manpower in Plantation Crops Research

The total manpower engaged in some form of plantation related research activities was estimated for the above institutions to be in the vicinity of 300. These include all the senior research officers and also other technical staff grades who assist the research officers. The extension and advisory personnel are not included. In general, the individual crops research institutes recruit personnel through budgetary provisions made by the respective ministries. The criteria adopted in determining the personnel requirements have not been ascertained in this study. The total number of research officers and technical personnel in each department of the research institutes–Tea, Rubber and Coconuts, in 1980 is given in Table 3. The numbers refer to the total cadre which would best reflect the desired investment on personnel development. It would have been insightful to examine the temporal variation of research staff in these institutions. This has been done for some crops (Gunasekera and Peiris, 1976). The variation of staff during 1975–80 is not high and thus only the 1980 position is discussed in detail.

Perusal of Table 3 reveals that in tea, the Technology Division has six research officers, and six technical officers. The Physiology and Low Country Station has five research officers each with 11 and 13 technical staff respectively. Most of the other departments have 3–4 research officers with technical officers ranging from 3–12.

In rubber, the Rubber Chemistry Division has the largest number of research and technical personnel than any other department. Plant Science has four research officers with 12 technical staff. The departments of Soils and Plant Nutrition, Plant Pathology and Genetics, each had three research officers with 17, 11 and 8 technical personnel respectively. The institute as a whole has 26 research officers and 79 technical personnel in its research cadre.

Table 3—NUMBER OF RESEARCH AND TECHNICAL PERSONNEL IN EACH DEPARTMENT OF TEA, RUBBER, AND COCONUT RESEARCH INSTITUTES, 1980

Division/Department	*Tea Research Institute*		*Rubber Research Institute*		*Coconut Research Institute*	
	Research Personnel	*Technical Personnel*	*Research Personnel*	*Technical Personnel*	*Research Personnel*	*Technical Personnel*
Agronomy ...	3	9	—	—	—	—
Agrostology ...	—	—	—	—	4	6
Biochemistry ...	4	9	1	2	—	—
Biometry and Statistics ...	—	3	—	3	4	3
Chemistry ...	3	6	—	—	4	9
Crop Protection ...	—	—	—	—	4	6
Entomology ...	3	12	—	—	—	—
Genetics and Plant Breeding	—	—	3	8	5	4
Intercropping ...	—	—	1	3	—	—
Physiology ...	5	11	—	—	—	—
Plant Pathology ...	3	3	3	11	—	—
Plant Science ...	—	—	4	12	—	—
Processing ...	—	—	—	—	1	—
Rubber Chemistry ...	—	—	11	23	—	—
Soils and Plant Nutrition ...	—	—	3	17	4	10
Technology ...	6	6	—	—	—	—
Kottawa Sub-station ...	—	3	—	—	—	—
L/C station ...	5	13	—	—	—	—
M/C station ...	1	4	—	—	—	—
Institute ...	33	79	26	79	26	38

In coconut the number of research officers in each division is more equitably distributed than in rubber. The Genetics and Plant Breeding division has five research officers with four technical personnel. All the other departments have four research officers each with technical personnel showing some variation. The total number of research officers in the institute is 26 with 38 technical personnel.

Comparatively tea has the largest number of personnel both in research and technical grades. It is worth noting that personnel allocation for technology in tea and chemistry in rubber is high. These two departments focus on product preparation. The emphasis given to this area may be due to the importance of product quality in marketing these crops where consumer acceptability plays a significant role. In coconut, however, this aspect is not emphasised.

The average number of research personnel available to a research officer in each department is given in Table 4 for the three crops. In tea, the relative number of technical personnel per research officer is fairly balanced amongst the different departments with Entomology having four technical personnel per research officer. Overall the institute has an average of 2.3 technical personnel per research officer. For rubber, the Soils Division has 5.6 technical officers per researcher which is very high. The Plant Pathology, Plant Science and Intercropping Divisions have also three technical personnel per research officer. The institute as a whole has an average of 3.03 technical persons per research officer. The figures for coconut research appear to be fairly low in relation to tea and rubber. The Soils and Plant Nutrition, and Chemistry Divisions, have 2.5 and 2.25 technical personnel per research officer respectively. In all these departments the number is very low. The institute average is only 1.45 technical personnel per research officer. In forestry, the total number of research officers was four with five technical personnel giving an average of 1.25 technicians per researcher.

Table 4—MEAN NUMBER OF ASSISTANT STAFF OFFICERS PER RESEARCH OFFICER, 1980

Division/Department	*Tea Research Institute*	*Rubber Research Institute*	*Coconut Research Iustitute*
Agronomy ...	3.0	—	—
Agrostology ...	—	—	1.5
Biochemistry ...	2.25	2.0	—
Biometry and Statistics ...	—*	—*	0.75
Chemistry ...	2.0	—	2.25
Crop Protection ...	—	—	1.5
Entomology ...	4.0	—	—
Genetics and Plant Breeding ...	—	2.6	0.8
Intercropping ...	—	3.0	—
Physiology ...	2.2	—	—
Plant Pathology ...	1.0	3.6	—
Plant Science ...	—	3.0	—
Processing ...	—	—	—*
Rubber Chemistry ...	—	2.09	—
Soils and Plant Nutrition ...	—	5.6	2.5
Technology ...	1.0	—	—
Kottawa Sub-station ...	—*	—	—
L/C station ...	2.6	—	—
M/C station ...	4.0	—	—
Institute ...	2.39	3.03	1.46

Source: Questionnaire Survey, 1980
* Indicates the absence of any senior research staff.

Research Expenditure per Scientist

The average research expenditure per scientist man year in 1980 was 0.13, 0.12, 0.09, 0.08 million rupees for tea, rubber, coconuts and forestry respectively. When computing these figures, only the expenditure for research was considered. If the administrative expenditure is also considered the ratio would tend to be slightly higher. The figures obtained here are lower compared with 0.21 and 0.19 for South and South East Asia (Isarangkura 1981). The number of personnel hardly changed during the five year period 1975–80 and any change in the expenditure per scientist would be due to changes in overall research expenditure over time which also did not change to any significant extent (Table 2). Since the salaries of the research staff increased during this period it is possible that expenditure per scientist increased slightly in 1980.

Time Allocation by Research Personnel

The allocation of time by research personnel in all three institutes was investigated by collecting individual responses through a mailed questionnaire survey. The response to the mailed questionnaire was of the order of 50 percent or less.** Any analysis made using such a sample may not reflect the true picture on time allocation. However, within limits it is felt that some generalisations could be drawn from this data. The time allocation is studied both on an activity and discipline-wise basis. Seven broad activities namely, research, communications, extension/advisory, administration/management, teaching, consultancy and other were identified. The allocation according to activity is given in Table 5. The relative importance

** Although we would have liked a better response, usually mailed questionnaires do not elicit a great response even in the developed countries. From this perspective 50 percent appears reasonable.

of the different activities can be compared by taking account of the number of personnel indicated in the table for any activity and the percentage time devoted by each. On this basis research as an activity received the largest allocation of their time. Approximately 70, 80 and 82 percent of total time of personnel were devoted to research. Extension and advisory came second according to time allocation in tea research. However, administration and management came second for both rubber and coconut research. Communications came third in terms of time allocation in all three institutes. Administration and management came fourth in tea research whereas extension and advisory came fourth in both rubber and coconut research.

Table 5—ALLOCATION OF TIME FOR DIFFERENT ACTIVITIES BY RESEARCH PERSONNEL

	Percent of Time											
	100	90–99	80–89	70–79	60–69	50–59	40–49	30–39	20–29	10–19	1–9	0
Tea Research Institute												
1. Research ...	8	3	2	3	–	3	–	1	1	1	–	–
2. Communications ...	–	1	–	–	–	–	–	–	1	3	7	–
3. Extension/Advisory	–	–	–	–	–	3	–	1	1	–	6	–
4. Administration/management	–	–	–	–	1	–	1	1	–	1	5	–
5. Teaching ...	–	–	–	–	–	–	–	–	–	–	5	–
6. Consultancy ...	–	–	–	–	–	–	–	–	–	–	5	–
7. Other ...	–	–	–	–	–	–	–	–	–	–	–	–
Rubber Research Institute												
1. Research ...	2	–	2	2	2	–	–	–	–	–	–	–
2. Communications ...	–	–	–	–	–	–	–	–	–	–	1	3
3. Extension/Advisory	–	–	–	–	–	–	–	–	–	–	–	3
4. Administration/management	–	–	–	–	–	–	–	2	–	1	1	–
5. Teaching ...	–	–	–	–	–	–	–	–	–	–	2	–
6. Consultancy ...	–	–	–	–	–	–	–	–	–	–	1	–
7. Other ...	–	–	–	–	–	–	–	–	–	–	2	–
Coconut Research Institute												
1. Research ...	2	7	4	–	–	2	–	–	–	–	–	–
2. Communications ...	–	–	–	–	–	–	–	–	1	–	9	–
3. Extension/Advisory	–	–	–	–	–	–	–	–	–	2	5	–
4. Administration/management	–	–	–	–	–	1	–	–	1	–	7	–
5. Teaching ...	–	–	–	–	–	–	–	–	–	–	2	–
6. Consultancy ...	–	–	–	–	–	–	–	–	–	–	4	–
7. Other ...	–	–	–	–	–	–	1	–	–	1	2	–

The allocation of time of research personnel on a discipline-wise basis is given in Table 6. Again if the number of personnel and the percentage time allocated is taken into account nutrition is the discipline to which most time is allocated in tea research. The other important areas in descending order of importance are physiology, entomology, processing and agronomy. In rubber, genetics and plant breeding received the largest share of the time. The other disciplines in descending order of importance are botany, and pathology. In coconut, biometry appeared most important in terms of time allocation. Next in importance are entomology and agronomy. The importance of disciplines in terms of time allocation may appear contradictory to the allocation of funds and personnel, discussed earlier. This could be due to the low response rate to the mailed questionnaire. If a few members of a given discipline fail to respond to the questionnaire, the analysis may reflect a low status for that discipline despite more funds and personnel being available. This limitation should be borne in mind in using the results.

Table 6—ALLOCATION OF TIME FOR DIFFERENT DISCIPLINES BY RESEARCH PERSONNEL

Institute and percent time	Agronomy	Agricultural Economics	Biometry	Botany	Entomology	Genetics and Plant Breeding	Pathology	Physiology	Processing & Technology	Nutrition	Soil Chemistry	Soil & Water Conservation	Biochemistry
Tea Research Institute													
75–100					3		2	1	3	4	1		1
50– 74	1							2					
25– 49	4							2		1			
0– 25	1		1				1			1			
Rubber Research Institute													
75–100				1		2	1						
50– 74	1												
25– 49				1		1			1	1	1		
0– 25	1							1					
Coconut Research Institute													
75–100	1		2	1	1	1	1		1	1			
50– 74					1								
25– 49	1												
0– 24													1

Research Expenditure as a Percent of Value of Production

The expenditure on research as a percent of total production value of the respective commodities is presented in Table 7 for the period 1975–80. In the case of tea, only 0.26 percent of total value of production was spent on research in 1975. Whilst this is comparatively low and does not amount to even 1 percent, which is the figure for many countries, the corresponding figures for the year 1976/78 are even lower. The expenditure as a percent of total value declined monotonically until 1978. It increased to 0.18 percent in 1979 with a slight decline in 1980. For rubber the percentages are much higher than for tea and amounted to 0.46 percent in 1975. The trend is fluctuating however, but the minimum percentage observed is 0.17 for 1979. For coconut the ratio is slightly higher than for tea the highest percentage being 0.29 in 1975. Since 1975, the percentage was generally declining but has picked up in 1980 to 0.22 percent. Allocation of research expenditure appears to bear no relationship to the quantitative importance of the individual commodities. For example, tea is quantitatively more important than rubber but the research expenditure as a percent of production value is lower than even for rubber.

Table 7—RESEARCH EXPENDITURE PER COMMODITY EXPRESSED AS A PERCENTAGE OF TOTAL PRODUCTION VALUE OF EACH COMMODITY (IN MILLION RS.) AT CONSTANT (1974) FACTOR COST PRICE)

Commodity	1975		1976		1977		1978		1979		1980	
	TPV	*REPV*	*TPV*	*REPV*	*TPV*	*REPV*	*TPV*	*REPV*	*TPV*	*REPV*	*TPV*	*REPV*
Tea	1876.1	0.26	1903.8	0.25	2819.1	0.13	4131.6	0.11	3105.5	0.18	2739.0	0.16
Rubber	661.3	0.45	852.2	0.37	721.8	0.45	1368.9	0.32	1584.5	0.17	1184.7	0.26
Coconut	864.3	0.29	955.4	0.27	1414.0	0.16	1726.3	0.15	2109.2	0.16	1392.8	0.22

Source: Review of Economy, Central Bank of Ceylon, 1975–1980.

1. Production value was computed by adding export earnings and value of local production.
2. TPV—Total Production Vaue.

   REPV—Research Expenditure as a percent of Production Value.

Research Output of TRI, RRI and CRI

The allocation of resources to research inevitably leads to research output. Although not related to the main objective, it is useful to highlight the significant research developments witnessed during the last two decades. Some of these achievements are discussed in this section for TRI, RRI, and CRI.

The TRI since its establishment has made a number of contributions to the present state of the industry. The control of Blister Blight is a remarkable achievement that can be attributed to research on tea. The control of Tea Tortrix caterpillar is of equal significance. It was controlled using a parasite introduced from Java. The TRI has now evolved a new integrated pest management system based on cultural practices such as pruning. This has rendered the use of insecticides for pest control superfluous. Improved fertilizer practices and management techniques have also been developed. Vegetative propagation of tea which was pioneered by the TRI has provided a quick means of increasing production. Several recommendations by the TRI for tea processing such as the use of withering troughs, rotovane and fluid bed driers etc, which consume less energy have led to the lowering of costs. These achievements are not exhaustive but helps to obtain an insight in to the contribution of research (Wettasinghe 1980).

Significant developments have been achieved through research on rubber. New clones such as those of the RRIC 100 series were developed by hand pollination to introduce characteristics such as disease resistance, quick bark renewal etc. In particular, the RRIC 121 and RRIC 130 produce very high yields and these clones are also resistant to South American Leaf Blight. Research on tapping systems that facilitate a larger tapping task has shown positive results although further work is considered necessary before these innovations are disseminated. Experiments conducted on yield stimulatns have shown that Ethrel applications at a lower dosage reduce the quick declining effects on yield observed with high concentrations of stimulants. Many leaf diseases such as *Oidium, Phytophthora* have been controlled except during periods of bad weather. The new varieties developed are resistant to most diseases. Experiments on soils and fertilizers have provided results on the optimal fertilizer applications. The work at RRI has shown that certain common management practices give long term benefits on the growth and yield of rubber (Peries 1980). In processing, rubber research has made significant contributions in the methods of preservation, concentration and dialysis of natural rubber latex.

The CRI developed two strains CRIC 60 which is suitable for growing in all coconut areas and CRIC 65 which is an early flowering and a high-yielding variety but more sensitive to soil and climate. A great effort is made in the biological control of pests and the coconut caterpillar (*Nephantis Serinoma*) was controlled by using a pupal parasite. One of the most notable successes of the research efforts of the CRI relates to the control of the coconut leaf miner (*Promecotheca cumingi*) which appeared in the 1960s. This was effectively controlled using parasites. Many other dividends were paid for efforts at control of pests and diseases (Pethiyagoda 1980).

Concluding Remarks

The main purpose of this study is to contribute to the data base so that further studies could be conducted on fund and personnel allocation for research in the plantation sector. A prerequisite for sound policy analysis is an adequate data base.

At present the data are collected and recorded by individual agencies with little co-ordination amongst them. The data used may have been subject to some error since records are poorly kept.

The research in the plantation sector should be adequately monitored to ensure that the proper priorities are assigned and any underfinancing is corrected and that the type of research work is geared to solve relevant and practical problems. To improve the above features the availability and utilization of existing research scientists at various research institutes should be assessed and recommendations should be made for research manpower management. The recording system for agricultural research projects should be improved so that progress could be monitored and achievements evaluated. Criteria should also be developed for assigning priorities for research work and considerable importance be given to conducting studies in evaluating the economic returns to agricultural research.

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APPENDIX I

ITEMWISE CLASSIFICATION OF ANNUAL EXPENDITURE TEA RESEARCH INSTITUTE OF SRI LANKA * 1975-80

RESEARCH

(1) **Agronomy**

A/DIVR	—	Optimisation of agriculture including diversification.
A/SHAD	—	Effects of trees in tea fields.
A/PRUN		Pruning tea.
A/WEED	—	Weed management in tea.
A/PLUCK	—	Harvesting practices.
B/WATU	—	Consumptive water use by tea in relation to weather, plant density, shade and practices and soil physical properties.
B/WCKP	—	Weather-crop studies.
B/DROT	—	Minimizing drought effects on tea.
D/AGRY	—	Agronomy (Up-country).
D/AGLC	—	Agronomy (Low-country).
A/WATU	—	Maximizing of water use by plant of tea estates.
B/ESMA	—	Estate management techniques.

(2) **Agricultural Chemistry**

A/FERT	—	To imporve fertility and productivity of tea soils.
D/AGVH	—	Agricultural Chemistry.
D/BIOC	—	Biochemistry.

(3) **Processing**

A/PDDV	—	Product development.
A/STOR	—	Storage of tea.
A/MICD	—	Microbiology of tea leaves.
B/CPCO	—	Development of methods of continuous pre-conditioning.
B/PROT	—	Extraction of protein from tea.
B/PSLG	—	Production of small leaf grades.
B/EDRY	—	Reducing the cost of tea drying.
B/GRNT	—	Green tea.

Instant tea factory.

(4) **Plant Protection**

A/TERM	—	Management of low country livewood termites.
B/VIRUS	—	Diseases in tea.
B/PECO	—	Pest ecology in tea.
B/SHBO	—	Pest ecology and productivity of tea lands.
D/ENTO	—	Entomology and nematology.
D/PLPA	—	Plant pathology.

(5) **Botany**

A/CLON	—	Development of new tea clones.
D/PHYS	—	Plant physiology, plant propagation and plant breeding.
(6) C/STAT	—	Statistical service.
(7) A/SOCY	—	Sociological factors influencing work output on tea estates.
(8) D/TECH	—	Technology.

(9) **Other Maintenance Services**

B/ANAL	—	Development of central analytical facilities.
C/ANAL, A/ANAL (Residue)		Central analytical services.
C/INST	—	Instrument Maintenance.
C/METS	—	Meteorological services.
C/STOR, D/STOR		Central chemical and material stores.
C/ENGW	—	Engineering workshop services.

(10) **Other subsidiary research stations and Experimental Estates**

S/LCST — Low-country station.
S/UVST — Uva station.
S/LOTT — Kottawa station.
S/MIDC — Mid-country station.
C/ESTA — Experimental estates.

(11) **Library, Publications and Photography**

C/LIBR — Library.
C/PGOT — Photographic service.
C/PUBL — Publications.

EXTENSION AND ADVISORY

(1) A/ADEX — Provision of a good advisory service to industry including factories.
(2) C/PREL — Public relations and publicity.
(3) C/EXTNT — Extension centres—Ratnapura, Hantane, Kottawa, Passara.
(4) D/EXTS — Extension.

ADMINISTRATION

(1) C/ADMN — Administration.
(2) C/ADFI — Finance and internal audit.
(3) D/HDOF — Head Office.

OTHER (UNSPECIFIED) SERVICES

(1) A/PROD —
(2) B/SMLG —
(3) C/SEMS —

APPENDIX 2

ITEMWISE CLASSIFICATION OF ANNUAL EXPENDITURE RUBBER RESEARCH INSTITUTE OF SRI LANKA 1975-1980

1. **Research**

a. Scientific Research on Botany.
b. Scientific Research on Plant Pathology.
c. Scientific Research on Genetics and Plant Breeding.
d. Scientific Research on Soils.
e. Scientific Research on Rubber Technology.
f. Central Specification Laboratory.
g. Repair and Maintenance Service (1/3 of total expenditure).
h. Kuruwita Sub-station.
i. Dartonfield Group Charges to Research.
j. Statistical Service.
k. Library and Publications Service.

2. **Advisory and Extension**

a. Repair and Maintenance Service (1/3 of total expenditure).

3. **Administration**

a. Staff services Director's Office.
b. Staff services—Board Office.
c. Staff and Administration Services.
d. Dartonfield Group.
e. Internal Audit Office.
f. Accounts and Stores Services.
g. Repair and Maintenance Service (1/3 of total expenditure).

4. **Others**

   a. Vested Estates.
   b. Plantation Division.
   c. Group Processing Centres.
   d. Dartonfield Mature area.
   e. Dartonfield Replantings.

APPENDIX 3

ITEMWISE CLASSIFICATION OF ANNUAL EXPENDITURE COCONUT RESEARCH INSTITUTE OF SRI LANKA 1975-1980

1. **Research**
   a. Chemistry Division.
   b. Botany Division.
   c. Division of Soils.
   d. Agrostology Division.
   e. Crop Protection Division.
   f. Biometry Division.
   g. Division of Intercropping.
   h. Coconut Processing Research Division.
   i. Working account—Motor Vehicles (5% of total expenditure).

2. **Administration**
   a. General Administration.
   b. Estate working account.
   c. Planting and supply of seedlings.
   d. Working account—Motor Vehicles (90% of total expenditure).

3. **Extension and Training**
   a. Advisory and Extension Services and Documentation.
   b. Toddy Tappers Training Scheme.
   c. Coconut Information Centre.
   d. Planting Division.
   e. Working account—Motor Vehicles (5% of total expenditure).