Explorations of Agricultural Economics in Sri Lanka

Selected Works of Professor Thambapillai Jogaratnam

1964 - 2012

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Foreword

I am pleased, indeed proud, to have the opportunity to write these words introducing this compendium of scholarly papers of Professor Thambapillai Jogaratnam, the father of agricultural economics in Sri Lanka. He was the principal force behind introducing the subject to the university curricular as the first lecturer and the foundation professor of the Department of Agricultural Economics at the University of Peradeniya. He was an excellent teacher committed to giving training to students that could compare with the best in the world. Through his close professional links with the Agricultural Development Council and his Alma Mater, Cornell University, he engaged a number of world-renowned scholars in course designing and teaching. He played a pivotal role in shaping agricultural development policy in the country by authoring numerous policy reports and, more importantly, by mentoring a large number of high-calibre policy makers and administrators.

This volume, a team effort of the Department of Agricultural Economics and Business Management at the University of Peradeniya, is a fitting tribute to the life's work of this truly distinguish scholar, teacher and institution builder. It comprises eighteen selected scholarly papers of Professor Jogaratnam thematically arranged under five subheadings: agriculture and economic development of Sri Lanka; domestic food sector; food security, malnutrition and poverty; land reform and irrigation projects; agricultural research, followed by his retirement speech made in 1998. The eighteen papers are high-quality works of applied economics that combine sound economics with real-world judgement. I would like to comment briefly on some 'gems' among these papers to whet the reader's appetite.

Professor Jogaratnam's first publication (1964), *Plantation Agriculture and Economic Development in Ceylon* (Chapter 1 in this volume) is by far the best chapter-length analytical narrative that I have read on the role of plantation agriculture in the process of economic transformation in Sri Lanka in the colonial era. I find that Chapter 3: *Socio-economic Factors in Agricultural Development* is more prescient than the author could have imagined: today reading of it is like opening a time capsule, sent from the past with a plea for the present and the future. The key message of this paper is that the rate of agricultural progress depends largely on the mobilisation of active farmer participation in development programs and

that the conventional approach to agricultural planning that places attention solely on production, without paying attention to the problems of farmers, increases social tension. Chapter 4: *Food in the Economy of Ceylon*, based on his doctoral research at the Cornell University, is a pioneering attempt to use consumption data as a check on energy content of food intake estimated by means of a food balance sheet. The empirical analysis of the paper involves estimating expenditure elasticities for twelve food categories and the construction of the first food balance sheet for Sri Lanka. The key finding of the paper that the conventional food balance sheet approach results in underestimating energy intake by 10 to 15 per cent has had a significant impact on the methodologies developed subsequently by the FAO, the World Bank and the US department of Agriculture for quantifying the extent of global hunger. Chapter 13: *The Accelerated Mahaweli Development Programme: Its Implications for the Economy of Sri Lanka*, which evaluates the program during the first decade of its implementation (1981-1990), is an important contribution to the literature on investment in major irrigation projects in developing countries. Chapter 18: *The Role of Economist in Agricultural Research* makes compelling case for broadening the agricultural research agenda to include inputs on health, nutrition, environmental effects, going beyond the traditional confines of increasing productive capacity of the resources used in Agriculture. Professor Jogaratnam's retirement speech, *Of years gone by*, is an excellent ending to this compendium of essays. After walking down the memory lane of over 45 years, the great teacher ends the speech with the following word of advice to younger colleagues: '…. give our students the highest priority. We all learn from our students. We are what we are because of them'.

The share of agriculture in gross domestic product of Sri Lanka has declined from about 40 per cent in the early 1960s, when Professor Jogaratnam penned his first research paper, to about 7 per cent in 2017. However, the latter figure understates both the actual growth potential of agriculture and the significance of the agricultural sector in the national economy. This abnormally low figure presumably reflects the policy bias against agriculture as vividly illustrated in a number of papers in this volume, the strong monocrop (rice) emphasis and trade protection that constrained structural adjustment of agriculture in line with evolving domestic and global demand patterns, and massive non-tradable bias created by a construction boom in recent years. Even if we take the figure at face value, in reality agriculture plays a much more important

role in the national economy. Over 70 per cent of the population finds livelihood in the rural economy. Since poverty tends to be concentrated disproportionally in rural areas agricultural growth is an important element of the nation's anti-poverty effort. Moreover, as the recent literature on the agriculture-growth nexus has brought into sharp relief, there are two channels through which agriculture impact on economic growth: saving-investment channel and nutritional channel. As the average household spends 50 to 70 percent of income on food, the stability of food prices impacts on economic growth through domestic saving and investment. The nutritional linkage operates through the health of the labour force. In this context, the publication of this volume provides an opportunity to reflect upon the wisdom of Professor Jogaratnam for devising policy and strategies to rejuvenate agriculture in the Sri Lankan economy.

Premachandra Athukorala, FASSA
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Preface

Professor Thambapillai Jogaratnam
His Life and Work
A Personal Reflection

Professor Thambapillai Jogaratnam is the 'Father of Agricultural Economics in Sri Lanka'. He was among the first in the field and made pioneering contributions in the study and teaching of agricultural economics. He was responsible for furthering university education in agricultural economics and made significant contributions to the formulation and evaluation of agricultural policy. He was indeed the pioneer in the field of agricultural economics in Sri Lanka.

It was indeed my privilege and good fortune to be associated with him for over one half century. He had an indelible influence on my life and work over these many years and was a much valued friend. This brief personal reflection on his life and work can hardly cover the many faceted contributions he has made.

I first met Joga in early 1967, a short time after I returned from Canada after my Master's degree in Agricultural Economics. It was at the National Planning Secretariat Galle Face, when we were visiting a mutual friend of ours, Annesley Fernando, another agricultural economist.

That very first day he asked me to apply as a lecturer in the Faculty of Agriculture at the University of Peradeniya. However, I was late by one day and could not persuade the Vice Chancellor to accept my application. Had I come to Peradeniya our lives would have been much more intertwined. In any event, from then onwards it was a close professional association that blossomed into a close personal friendship.

That same year, we formed the first Agricultural Economics Society. Although there were very few agricultural economists at that time, economists interested in agriculture gathered together at the residence of Dr G. Uswatte Arachi at Gregory's Rd. Colombo 7 to form the Ceylon Agricultural Economics Society (CAES). Among those present were Dr Lal Jayawardena, Dr Annesley Fernando, Professor F.R. Jayasuriya, Mr. Eric de Silva, Professor A.V. de. S Indraratna and Dr. K. Gunasingham.

Dr. Jogaratnam was elected President and I was elected the Secretary. The Ceylon Agricultural Economics Society (CAES) had a very active program of lectures, seminars and discussions for about five years. Professor Rainer Schickele, Visiting Professor of Agricultural Economics at Peradeniya, an Agricultural Development Council (ADC) Associate, was a tower of strength. Unfortunately the CAES faded away around 1971, as most active members left for post graduate studies abroad.

A brief recounting of his life and work illustrates the many faceted contributions he made in the field of education and to agricultural economics in particular. The other contributions to this volume would elaborate these.

Early academic career

Soon after young Jogaratnam graduated in 1953 with honours in the Special degree in Economics, Professor H.A. de S. Gunasekera recommended him to teach economics at the Department of Agriculture and Veterinary Science at the then University of Ceylon, Peradeniya. No doubt Professor Gunasekera considered Joga his most suitable student to teach economics to agriculture students. There was no subject called agricultural economics at the university then.

Professor Jogaratnam's teaching of economics in the Faculty of Agriculture must have been the reason why he decided to specialise in agricultural economics in his postgraduate studies. So began a new chapter in Sri Lanka's university education. It was the genesis of agricultural economics in the country.

In 1961, Professor Jogaratnam obtained a Scholarship to study agricultural economics at the Ontario Agricultural College in Guelph that was a campus of the University of Toronto. His thesis on the marketing of potatoes in Ontario was supervised by Professor Stewart Lane. He returned to the Faculty of Agriculture in 1963 after completing the M.S.A. in Agricultural Economics from the University of Toronto. That was the beginning of the journey to expand the teaching of agricultural economics in Sri Lanka.

Dr. Jogaratnam recruited staff and expanded the teaching of agricultural economics and raised agricultural economics to a specialisation in the B.Sc. degree in Agriculture. He was appointed the first Professor of Agricultural Economics in Sri Lanka in 1970 and became

the first Head of the Department of Agricultural Economics and Farm Management, when it was established in 1972.

Professor Jogaratnam taught varied subjects ranging from principles of economics to agricultural development and policies, with relative ease. His students say his lectures were very well organized, simple and clear in presentation.

Role in postgraduate training

Professor Jogaratnam played a vital role in furthering postgraduate training abroad. If not for the persuasive role he played, the university would not have had faculty trained at the highest level at internationally recognized universities. He was responsible for the quality academic staff that the university has had over the years, as he insisted that the UGC policy of only allowing postgraduate education abroad for a Master's degree was short sighted and opened up opportunities for Ph.D. studies.

Professor Jogaratnam had a clear vision that university teachers should be trained to the highest level at the best universities to ensure high academic standards for a knowledge-based agricultural system in the country.

His initiatives towards this end include an agreement with the Agricultural Development Council (ADC), New York, to sponsor Ph.D. level training abroad. He was also responsible for a USAID funded Agricultural Education Development Project, which improved teaching facilities at the Faculty of Agriculture and trained 38 academics, who, among others, laid the foundation for modern agricultural education in Sri Lanka.

Postgraduate Institute of Agriculture (PGIA)

He gave Professor Appadurai immeasurable support to establish the Postgraduate Institute of Agriculture (PGIA) of the University of Peradeniya. In 1978, Professor Jogaratnam became the second Director of the Postgraduate Institute of Agriculture (PGIA) of the University of Peradeniya. He served in this capacity until he resigned from the service of the University of Peradeniya in 1986 to accept an international assignment in Nigeria as the Agricultural Planning Coordinator for a World Bank funded Agricultural Development Project in Nigeria.

Reappointed Professor of Agricultural Economics

On his return to Sri Lanka in 1989 he rejoined university service and was once again appointed as the Professor of Agricultural Economics in 1991. His invitation to rejoin and become the Professor of Agricultural Economics was a recognition of his preeminence in the field and indispensability to the university.

He retired in 1998 and was appointed a Professor Emeritus and a member of the Council of the University of Peradeniya. Despite his departure from active university services, he continued to serve the Department of Agricultural Economics and Business Management and the Postgraduate Institute of Agriculture. He was a visiting lecturer, undertook research supervision and was a member of Boards of Studies at the PGIA.

Research

His research interests were wide and policy-oriented. They covered agricultural development, land policies, food and nutrition policy, food demand, land settlement, research management, institutional building and environmental issues. I benefitted much from his researched insights.

This volume represents only some of his research output as he made seminal and definitive contributions to official reports on land policy, surveys on colonization and land settlement and reviews on research. These have been published as official reports, survey reports and unpublished research reviews.

In recognition of Professor Jogaratnam's contribution to teaching, research and economic policy he was conferred an honorary D.Sc. Degree by the Eastern University of Sri Lanka and another from the Ruhuna University.

The Administrator

Professor Jogaratnam was very much of a democratic administrator. He consulted everyone and discussed issues before making important decisions. He relied more on kind words and rewards rather than on punishments to motivate the staff. He was therefore a much loved leader and superior.

I am told Professor Jogaratnam always took a personal interest in arranging places and securing financial assistance for postgraduate

studies of probationary academic staff. He is recognized as one who always fought for the rights of academic staff, not only of his Department, but also of the entire Faculty of Agriculture.

His Personality

Generations of students and colleagues at the University of Peradeniya venerate him for his academic excellence, his devoted teaching, his clear thinking and precision of expression. Students who were supervised by him are enormously grateful for his painstaking and meticulous supervision. Many a student may not have graduated without his patient and painstaking supervision. I am personally aware of students who are ever grateful for his devoted advice and supervision.

The Person

He was a simple person who performed his tasks without publicity and without seeking any plaudits from anyone. He was totally committed to serving his students, of assistance to friends and devoted to his university that he served with much commitment and devotion for over half a century. His life and work made a seminal difference to the University of Peradeniya and to the study of Agricultural Economics in the country. In his academic pursuits he attempted to achieve excellence, but did so modestly and without publicity. The University of Peradeniya, the discipline of agricultural economics and higher education in the country were enriched by his contributions.

As a friend and colleague of Joga, above all these multifaceted achievements, the enduring memory I have of him is his humanity, humility and integrity. In his life he embodied sound humane values and a belief that any good thing he could do, he would do. His friendship was one of the richest blessings of my life.

Nimal Sandaratne
Former Senior Research Fellow
Postgraduate Institute of Agriculture, University of Peradeniya

Introduction

Explorations of Agricultural Economics in Sri Lanka

Agriculture had a singular role in the economic development of local economy. This was particularly true during the decades following independence from British rule, when both the structure of the agricultural sector and its relations to the other sectors of the economy were significantly influenced the colonial economic footprint. A blooming plantation sector has taken root in the mid country and uplands. Tea cultivation has replaced most of the coffee plantations of the 19th century and asserted a crucial role as the backbone of the export economy of the country. Non-plantation sector has been overlooked under the colonial rule and nearly half of the local demand for staples was met by imports. The post-colonial government had to accommodate the needs to restructure the economy in its gradual departure from the colonial agenda while retaining the strengths thus far created by the agriculture-based exports. Ironically, this is a conundrum that still continues to dominate the discourse of development in the country. In an article published in 1964[1], Professor Jogaratnam narrates the transition from the colonial agricultural sector to the peasant agriculture-plantation sector dual economy of the post independent Sri Lanka. The peasant agriculture sector, he claims, failed to release surplus labour to the more productive plantation sector due to a host of structural reasons. Thus, a classic two-sector model, as visualized by Arthur Lewis[2], did not materialize and dynamics of economic growth did not discover the necessary impetus. Professor Jogaratnam further laments that plantation labour did not seem to have benefited in any way from the rapid expansion and rising levels of productivity within the sector itself. Thus, both sectors failed to generate welfare to the respective local participants. Domestic agriculture had its strides in productivity but potential benefits from a reciprocal impetus were also stifled due to poor linkages between sectors. Were it not so, an increase in the productivity of the domestic

1 "Plantation Agriculture and economic development in Ceylon"

2 W.A. Lewis, "Economic Development with Unlimited Supplies of Labour," *Manchester School of Economic and Social Studies*, Vol. XXII, No. 2, May 1954.

sector could have led to an increase in real wages to the plantation sector.

Returning to transformations of the Sri Lankan economy during the self-government, one sees the continuing rift between the export sector and the domestic sector. In the plantation based export economy, large expansions occurred within the space of few decades to position Sri Lanka on the global commodity maps of tea, rubber and coconut. In spite of this, Professor Jogaratnam, cautions that, while the demand for any single country's exports is likely to be less inelastic than for the product in general and it would therefore pay to make exports more competitive in world markets, such developments are unlikely to lead to any dramatic increases in earnings in the immediate future. In a considerable portion of his writings, Professsor Jogaratnam attempts to understand how the structure of the local food sector could serve the expectations of other sectors in terms of food demand, especially from a rapidly growing export sector. Such an understanding will not be complete without evidence-based forecasts of the outlook for food commodities. In the article titled "Food in the Economy of Ceylon" published in 1969, he provides a detailed econometric basis to the calculation of demand for different classes of food. The information needs of food balance sheets and commodity outlook have their roots in modeling of demand both on short term basis and long term basis.

Closer to the challenges of the local food sector was, and still is, the productivity of paddy cultivation. In the aftermath of agricultural resettlement and large scale irrigation efforts under the Mahaweli development project, paddy productivity was associated with a decline in real prices and real incomes, an increase in real wages and a decline in labor engaged in paddy production. Such a transition, limited as it is in many ways, has poverty implications in the rural sector. Professor Jogaratnam discusses such implications and their connection to poverty in his numerous analyses of paddy productivity. He concludes that the real price declines were not necessarily a local phenomena since agricultural commodity real prices were declining along with the boosts in productivity. The net outcome was an increase of welfare for the buyers and partly a significant substitution of imports of food (especially in Sri Lanka).

In spite of large improvement of paddy productivity and release of high yielding varieties during the 1970s, the yield gaps continued to bother rice scientists. Given that farmers in other countries were

experiencing lower yield gaps, it was surmised that part of the reason may be the socioeconomic realities affecting the Sri Lankan farmer. In a field experiment conducted in 1977, Professor Jogaratnam investigates how the socioeconomic factors could affect the yield gaps. Ironically, some of the findings are salient even in today's rural context, more than 40 years later. For instance, the study finds that, while all farmers were aware of the advantages of transplanting, only few reported practicing it. The reason attributed for not following recommendations was the additional cost and labour needs of recommended practices. Interestingly, nearly all farmers reported using chemical fertilizers, but there were wide variations in the timing of application. Farmers did not appear to understand the need for split application. Nearly 40 percent reported using more fertilizer than the recommended rate, often based on the perception that the recommenced rate was too low. We can only be alarmed as to how such beliefs persisted for over three decades to what we experience today in terms of misuse of agro-chemicals.

Staying on the theme of production agriculture, the late professor's work in the area of land policy and irrigation has been extensive, especially during 1970s. In several research reports, he discusses the socioeconomic aspects of new high yielding varietal (HYV) adoption in the Dry Zone. With reference to colonization schemes of 1970s, he casts a gloomy picture on paddy farming. Dry zone farmers of the surveyed areas expressed difficulty in adhering to recommendations owing to extremely wet conditions in Maha and lack of water supply in Yala. The research evidence points out that farm Incomes were mainly influenced by farm size (and to a lesser extent by cropping intensity and yields per acre). His survey findings report yields per acre as associated more with levels of fertilizer application than with variety planted, questioning the superiority of new HYVs . He further concludes that there is an absence of any clear relationships between yields, environmental factors, input availability and management practices.

Professor Jogaratnam's work on colonization schemes provide indispensable evidence of transitions and behavioral changes of farmers and shifts in management practices. If it were not for these well-timed studies (the credit for which should be shared with various government and international agencies who solicited such studies at various points of time), we would not be familiar with how, during a gap of two years around 1970, farmers moved back from tractors to buffaloes, ammonium sulphate to urea and hired labour to family labour. On a non-paradoxical

note, his surveys revealed that the rates of transplanting have risen considerably from negligible levels to 40 percent of area cultivated, and weed management to nearly 70 percent. All of these discontinuities of farmer behaviour would have gone unrecorded and unnoticed, if not for the timely evaluations carried out. The rapid adoption of BG varieties and IR varieties and corresponding yield rises in paddy did not necessarily translate to farmer welfare. For instance, in the intensive agricultural development schemes of Kandalama, Elahara, Giritale and Nachaduwa, Professor Jogaratnam's evaluation reports highlight that farmers selling 100 bushels or less constituted 23 percent but accounted for only 7 percent of total sales. While the percentage of farmers selling less than 100 bushels has decreased by about half, their share of total sales has decreased by even more indicating a relative worsening of their position. Therein lies the early hints at widening income disparity accompanying agricultural intensification.

Poverty is another theme that dominated Sri Lankan explorations in agricultural economics, specially after 1970s. Initially, Sri Lankan scholars paid substantive attention to explore and explain the impact of the open economy regime of 1978. In contrast to the closed and socialistic ethos of the 1970s, 1980s were marked by openness and structural adjustments to the economy due to the inevitable exposure to global market forces. The rift between rural and urban sectors materialized in numerous poverty and distributional implications. In the 1990s, the forces of globalization and liberalization reached our shores, making the analytical study of poverty impacts of restructuring of the economy more salient. With this backdrop, his work on income and consumption poverty in 2003 was an extension to the influential work in these areas by Gunawardena (2000)[3] and World Bank (1995)[4]. In fact, he reflected on the limitations of the above analyses of income and consumption and argued for a holistic approach to poverty assessment. The premise underlying his argument is the observation that despite increases in per capita consumption expenditures, per capita energy intake has remained stable. In newly industrialized countries of South East Asia, indicators of poverty, food

3 Gunewardena, Dileni. 2000.Consumption poverty in Sri Lanka, 1985-1996. A technical report prepared for a policy framework for poverty reduction in Sri Lanka. Colombo: Ministry of Finance and Planning

4 World Bank (1995). Sri Lanka poverty assessment. The World Bank, Washington, D.C.

insecurity, and malnutrition have improved simultaneously while the Sri Lankan experience showed that these three aspects do not always move in unison (more importantly, sometimes move in opposite directions) . Professor Jogaratnam identifies this phenomenon as a Sri Lankan Dilemma on the lines of the South Asian dilemma, where incomes, per capita food availability, and health and environmental quality are higher in South Asia than in Sub-Saharan Africa, while the share of malnourished children is not lower in comparison.

Economic analysis of the research process itself marks a distinct aspect of Sri Lankan Explorations. In the classical agricultural economics literature, evaluation of return to research (investments) was a trendy topic. In fact, there is a genre of early literature pioneered by Zvi Grilliches and other well-known agricultural economists in the land grant system of US universities. Such evaluations were crucial in the light of vast endowments of resources that were entrusted on the university research centers and affiliated government bodies. Further, especially in the land grant university system, research agencies were mandated with the responsibility of informing the industry and the industry also had significant reliance on the findings of public research. Whether we consider special mandates such as land grant universities or individual research agendas, research efforts (and research outcomes) are a public good where the benefits permeate the boundaries of any given person or institution. Thus, informed and cautious ex-ante analysis can, at the very least, minimize misallocation of costly investments. In his article titled "Planning, Monitoring and Evaluation of Agricultural Research", a guideline and a rationalization is offered focusing on the research outlays of the Department of Agriculture. His recommendations are founded on the incidence of the crops, trends in production and consumption, and the presence of commodity-based research centers. In other co-authored work, factors affecting the performance of agricultural research centers based on the hard evidence (of performance indicators) and the perceptions of the stakeholders are triangulated. Echoing the 1982 work by Vernon Ruttan who lists three major mandates for the agricultural economist, namely, evaluation of programs, study the research allocation and individual driven research of professional interest, Prof Jogaratnam adds a fourth item to the list, namely data collection to service programs of the institution. In a cautionary reflection on the profession, he reminds that the economist carries the unenviable mantle of carrying forward a theory driven framework, more often than not, abstracting from the realities of day-today life. His article titled "Role of economist in

agricultural economics research" is essentially a call for pragmatism and an admonition to be guarded against the external ideologies and 'political economics' of research.

In conclusion, it is only fitting that this short essay ends with a quote from Professor Jogaratnam:

"While the problems of development arc common to most of the countries in the region, we must recognize the micro-heterogeneity of agriculture and avoid generalizations which may lead to inaccurate and harmful conclusions. This is especially important because our primary concern is with the problems that confront farmers as individuals in bettering their conditions."

DV Pahan Prasada
Senior Lecturer
University of Peradeniya

Agriculture and Economic Development of Sri Lanka

CHAPTER 1

Plantation Agriculture and Economic Development in Ceylon [1]

Plantation agriculture represents a comparatively recent development in Ceylon. As in most other under-developed countries, the traditional system of peasant agriculture is characterized by small and often uneconomic holdings, primitive methods of production, and low levels of productivity. Plantation agriculture, on the other hand, is a form of large-scale cultivation that utilizes considerable amounts of capital and labour in the production of crops primarily meant for export. The rapid development of the plantation system, since its introduction into Ceylon in the early decades of the nineteenth century, has contributed considerably towards the economic development of the country. In this chapter, an attempt is made to consider some of the effects of the growth of the plantation industry on the rural economy in particular and its contribution to economic development in general.

The development of plantation agriculture in Ceylon dates back to the time when the British gained control. Though Ceylon had long been famous for her spices, and this had brought the Portuguese and Dutch to her shores, there had been no organized cultivation as such. Even cinnamon, in which Ceylon had a virtual monopoly prior to the nineteenth century, was mainly gathered from the jungles where it grew wild. The Dutch, who had ousted the Portuguese and taken possession of the coastal tracts in 1695, found this method of cultivation so unsatisfactory that a few sporadic attempts were made to open up plantations.[2] These did not make much progress, however, and it was not until after the arrival of the British and the passing of the control of the entire Island into their hands in 1815

[1] Reproduction from International explorations of agricultural economics: a tribute to the inspiration of Leonard Knight Elmhirst, edited by Roger N.Dixey. Ames: Iowa States University press, 1964, p.97-108.

[2] See: Lennox A. Mills, *Ceylon Under British Rule,* 1795-1932. Oxford University Press, 1933.

that the plantation system began to make headway. By then cinnamon had lost its monopolistic position and trade was declining. But another crop, coffee, was becoming attractive, and Ceylon was found well suited for its cultivation.

The Dutch had attempted to foster the cultivation of coffee, but it was found to thrive only at high elevations which were not under their control. This difficulty was overcome with the arrival of the British. The conquest of the Kandyan Kingdom in 1815 gave them control over the entire Island. The British gave all possible encouragement to coffee cultivation such as abolishing the export duty on coffee in 1825 and waiving the land tax on coffee plantations for a period of twelve years beginning in 1829. Despite such incentives, coffee still remained a smallholders' crop, being confined for the most part to the small gardens surrounding peasant homes. The few attempts made to open up plantations did not prove successful. Difficulties of transport and the preference given to West Indian coffee in the British market made things difficult for the planter. The situation changed in 1835 when the duties on Ceylon and West Indian coffee were equalized. Also, with West Indian costs showing a sharp increase owing to the abolition of slavery, the Ceylon product suddenly found itself in a competitive position. This was further strengthened by the steadily increasing demand for coffee in the European market,[3] Coffee cultivation in the Island soon began to attract the attention of (foreign) investors.

The interest created in coffee production was so great that it is usual to refer to developments in the early 1840's as the "coffee mania." The area expanded rapidly, and within a period of about thirty years more than 300,000 acres of virgin jungle land had been cleared and brought under coffee. This rapid growth was reflected in the demand for land. Sales of crown land which stood at only 146 acres in 1833 shot up to over 78,000 acres in 1841. In all, a total of 258,072 acres of crown land were disposed of during the period 1833-43. The coffee mania was at its height in the early 1840's and, though land sales subsequently did not reach the earlier levels, the

[3] Vanden Driesen, "Coffee Cultivation in Ceylon." *The Ceylon Historical Journal,* July 1953, pp. 31-61; and October 1953, pp. 156--72.

coffee industry continued to expand. It is estimated that during the period 1833-86 more than 1.1 million acres of crown land were disposed of at very nominal rates, and of this, nearly 230,000 acres were sold during the years 1840-43.[4]

There is no direct statistical information on the area under coffee and the role of the plantations in this development. All available evidence, however, tends to show that coffee owned and operated by the British played by far the major role.[5] The early pioneers in the field of plantation agriculture were the British government officers and military men stationed in the Island. Once the success of coffee cultivation was assured, there was a steady inflow of capital from the United Kingdom. Thus, the governor of the Island during the period 1841-47, estimated the inflow of British capital to be well over £100,000 a year during his time.

The industry reached the height of its development by 1870 but its subsequent decline was as rapid as its ascent. Within a decade or so it lay in ruins, the plants having succumbed to a fungus disease. Such a catastrophic fall, however, did not mean the end of the plantation system. In the frantic search for new crops, the planters came upon two that were new to the Island, tea and rubber. They also started organizing coconut cultivation, which had long been a smallholders' crop, on a plantation basis. Tea, rubber, and coconuts in a small way, took over from coffee, and the plantation system continued to develop rapidly (See Table 1.1).

Tea, which accounted for scarcely 1,000 acres in 1875, expanded rapidly thereafter and by 1900 had come to occupy more than 400,000 acres. Rubber was introduced only around 1900 and it came to occupy another 400,000 acres within the next twenty-five years. Tea, rubber, and coconut continued to expand steadily despite unstable prices in the twenties of the present century. With the onset of the great depression of the 1930's, however, Ceylon's export

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[4] Vanden Driesen, "Plantation Agriculture and Land Sales Policy in Ceylon-The First Phase 1836-1886," Part 1. *The University of Ceylon Review,* Jan.-April 1956.

[5] Vanden Driesen, *op. cit.,* pp. 43-44.

products suffered a steep decline in prices. Attempts made at the international level to arrest this decline culminated in the International Tea Agreement of 1932 and the International Rubber Regulation Agreement of 1934. Though the agreements were primarily intended to restrict acreages, the plantation crops in Ceylon had almost reached the limit of their expansion as very little new land was available. The expansionist phase in the history of the development of the plantation industry thus came to an end.

Table 1.1: Area under plantation crops, 1875-1958* (in acres)

Year	Coffee	Tea	Rubber	Coconut
1875	249,604	1,080	–	n.a.#
1885	167,677	120,628	–	550,300
1900	-	405,405	1,750	846,000
1914	–	486,536	168,178	973,500
1925	-	440,000	438,950	881,000
1938	-	555,452	604,111	1,100,000
1948	–	555,083	655,108	1,070,950
1958	–	572,706	664,836	1,070,000≠

* Source: Ceylon Blue Book (Series) 1875-1925, Colombo: Government Printer, Ceylon. Statistical Abstract of Ceylon (Series) 1938-1958, Dept. of Census and Statistics, Govt. Publications Bureau, Colombo.

Not available.

≠: 1954 figures.

Within a period of about a hundred years, more than a million acres of jungle had been developed and brought under plantation crops. This had been achieved by the large-scale inflow of foreign capital and foreign labour. The rapid spread of the plantation system, with its emphasis on large-scale methods of cultivation involving the heavy use of capital and labour and producing primarily for the export market, was of tremendous significance to the future course

of an economy that was still largely feudal in character. The paddy economy of the isolated and self-contained village was now overwhelmed by a virile commercial agriculture serving the export markets in Europe. Plantation agriculture, being the main factor responsible for the break-up of the feudal organization, contributed in a large measure towards the transition from a feudal to a modern economy.

Nothing served to break down the traditional isolation that characterized a feudal economy so much as the system of roads and railways that developed alongside the growth of the plantations. An adequate system of transport was a necessary condition, in fact, for the development of the plantation industry, and the insistent demands made by planters for more and better roads could not be ignored by a government that was becoming increasingly dependent on coffee for its own finances. Even as early as 1850, coffee accounted for more than a quarter of the total revenue of the Island.[6]

The few roads that existed at the time the British arrived were restricted to the larger towns and to a broad tract running along the coastal areas. The British set about building more roads to connect the towns for military reasons and a road to Kandy was undertaken in 1820 and completed in 1832. With the development of the plantations, however, the road policy of the government changed. The construction of roads was now undertaken primarily with a view to helping planters to transport their produce to Kandy. Very soon the Kandyan areas, where most of the plantations were located, came to be covered with a network of roads. By 1860 more than 3,000 miles of roads, either wholly or partly macadamized, had been constructed and most of them served the plantation areas.[7] This represents a substantial achievement when it is remembered that

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[6] Vanden Driesen, "Some Trends in the Economic History of Ceylon in the 'Modern' Period." *The Ceylon journal of Historical and Social Studies,* Jan.-June 1960, pp. 1-17

[7]G.C. Mendis, *Ceylon Under the British.* Colombo: The Colombo Apothecaries *Co.,* Ltd., 1944, p. 58.

they were mostly in the hill country running along steep gradients and crossing innumerable streams and rivers.

Roads did not solve all the transport problems of the planters. The mode of conveyance by road, the bullock cart, was found to be slow and costly and the demand arose for quicker transport. The construction of a railway was undertaken from Colombo to Kandy, and the first railway in Ceylon was completed in 1867. With the development of the roads and railways, came the postal and telegraph facilities which served not only to bring the different parts of the Island together but also linked it with foreign countries. The rapid development of internal transport served to highlight the inadequacy of the port of Colombo in moving the produce of the plantations to the western markets. The provision of a satisfactory harbour was undertaken, and the construction of the port of Colombo was completed in 1882.

While the rapid expansion of the plantation industry served to break down the isolation of the economy and opened it to modernizing influences, it had an unsettling effect on the village economy. The expansion of coffee cultivation brought with it a greatly increased demand for land and labour. The government, in its anxiety to foster the growth of the coffee industry, embarked on a land sales policy that was to have lasting repercussions. Much of the land that was suitable for coffee lay in the jungles of the recently occupied Kandyan Kingdom. Under traditional usage jungle land could be periodically cultivated by what was known as the *chena* system-a form of shifting cultivation, with the land being allowed to revert back to jungle after a couple of seasons. The government was quick to see the consequences of such claims to jungle land and brought in legislation requiring legal title to chena lands.

The Crown Lands Encroachment Ordinance of 1840 thus had the effect of depriving peasants of their needs of forest lands for chena cultivation and pasturing cattle. The denial of a legitimate source of income created such strong resentment that it was an important factor leading to the rebellion against British rule in 1848. It was quite easily suppressed and the interests of the planters were safeguarded. But the peasants were left with only the valley bottoms in which to eke out a living. The rapid extension of the acreage under coffee had other effects. The indiscriminate felling of forests led to a good deal of soil erosion and silting up of tanks and rivers, thereby

impoverishing the peasants further. Faced with uncertain titles to land and diminishing yields, many of them took the easy way out and sold their lands to the planters, creating a class of landless peasants. Much of the present day problem of landlessness and poverty amongst the peasants of the Kandyan areas can be traced to the development of the plantations. An indication of the extent of landlessness in the plantation districts is given by the Report on the Survey of Landlessness, 1952. While the incidence of landlessness amongst agricultural families amounted to 26.3 per cent for the Island as a whole, the figures were very much higher for some of the plantation districts (See Table 1.2).

Table 1.2: Incidence of Landlessness in Plantation Districts in Ceylon

Districts	Land Area (Acres)	Area Under Plantations* (Percent)	Agricultural Families Landless# (Percent)	Agricultural Families Owning Less Than 1 Acre of Land# (Percent)	Av. Size of Paddy Holding ≠ (Acres)
Kandy	584,912	41	19	59	.59
Matale	493,040	13	38	74	.55
Nuwara Eliya	493,040	13	38	74	.55
Badulla	2,076,880	7	23	75	.75
Ratnapura	800,320	20	32	56	1.06
Kegalle	410,880	31	21	47	.79
Ceylon (total)	15,997,904	9	26.3	54.1	1.17

* *Census of Agriculture,* 1952, Government Press, Ceylon, 1956.

Report of the Survry of Landlessness, Sessional Paper XIII, 1952.

≠ *Census of Ceylon,* 1946, Ceylon Government Press, 1948.

While the development of the plantations led to the appropriation of land to which the peasants had a traditional claim, it could not provide any relief by affording alternative avenues of employment. The plantation industry owed its development mainly to foreign capital and foreign labour and the Ceylonese as such played only a very small part. The role of British capital at the height of the coffee mania has already been referred to. British capital continued to flow into Ceylon despite the coffee crash and was

largely responsible for the opening up of the tea and rubber plantations. Thus by the 1930's it was estimated that about 80 per cent of the plantations under tea and more than 50 per cent under rubber belonged to British companies.[8] Since World War II however, there have been signs of a withdrawal of British capital. The Census of Agriculture, 1952, reported that 50 percent of the acreage under tea plantations and 38 percent of the acreage under rubber plantations were owned by foreign companies or non-citizens. It should be noted here that 80 percent of the acreage under tea and 50 percent of the acreage under rubber were in plantations, the rest being in smallholdings belonging mainly to Ceylonese. Coconut, with more than 80 percent of the acreage being in smallholdings, was almost entirely Ceylonese owned.

It is true that the rapid expansion of the coffee industry created a tremendous demand for labour. But the peasant was too much tied to his land and village to be induced to seek employment in the plantations for a money wage. The age-old system of service tenure was abolished in 1832, and it was hoped that this would release labour for the plantations. Such labour however was not forthcoming and the planters were forced to turn to south India to meet their requirements. Thus began the large-scale importation of southern Indian labour. The annual rate of entry varied from around 30,000 in the 1840's to about 100,000 by the 1880's depending both on the economic conditions prevailing in south India and on the state of the plantation industry in Ceylon.[9] While some of this labour returned home, most eventually settled in Ceylon.

Today the Indian labour population numbers nearly a million, about 88 percent of whom are employed in the tea plantations, the rest in rubber. Although the employment of Ceylonese labour on plantations has increased of late, 75 percent of the workers on plantations are of Indian origin.[10] Such a large concentration of foreign labour in certain areas of the Island, the plantation districts, has given rise to a number of problems. It has prevented the

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[8] Lennox A. Mills, op. cit., p. 253.

[9] H. Vanden Driesen, op. cit., pp. 7-8.

[10] *Statistical Abstract of Ceylon,* 1959. Dept. of Census and Statistics. Govt. Publications Bureau. Colombo.

absorption, on any large scale, of the indigenous rural population on the plantations. An important channel by which the development of the plantation industry could have benefited the peasant sector was thus cut off. With increasing population and rising unemployment, it has naturally created a good deal of resentment amongst the local population. The fact that the Indian labour population has preserved its separate racial identity - speaking a different language and following a different religion, customs, and habits - has served to worsen the situation. This so-called Indian problem is reflected in the citizenship laws passed by a national government soon after the attainment of independence. A large majority of the Indian labour population was denied citizenship status.[11] It is also reflected in the proposed legislation to limit all future employment in the plantations to Ceylon nationals.

While the development of the plantation industry has given rise to a number of problems, it has come nevertheless to occupy a predominant position in the economy of the Island today. It represents the only major source of productive activity. Tea, rubber, and coconut occupy nearly two-thirds of the total cultivated area and account for one quarter of the gainfully employed population. About a third of the national income is derived from the plantation crops, with tea alone being responsible for more than 20 percent. Peasant agriculture, which is primarily concerned with paddy production, contributes about 7 percent and 13 percent respectively to income and employment while industry accounts for another 8 percent and 9 percent respectively. To an export-import economy that is dependent on its exports to finance the imports of nearly half its requirements of food and most of its requirements of textiles and other manufactured goods, what is perhaps more significant is that tea, rubber, and coconut account for more than 95 percent of the total export earnings (See Table 1.3).

Table1.3: Annual Export and Import Trade of Ceylon *

[11] Under the Indian and Pakistani Residents (Citizenship) Act No. 3 of 1949. Only about 132.000 individuals were registered as citizens. (From Ceylon Administration Reports.)

Year	Total Value of Exports of Ceylon Produce (Rs. Million)	Exports of Tea, Rubber, and Coconut as Per Cent of Total Exports (Per cent)	Total Value of Imports Into Ceylon (Rs. Million)	Imports of Food, Drink, and Tobacco as Per Cent of Total Imports (Per cent)
1936-38	273	95.6	231	44.9
1948-52	1,337	95.1	1,290	48.3
1952-56	1,629	94.6	1,559	45.9
1957	1,588	95.5	1,804	40.8
1958	1,651	96.0	1,717	41. 7
1959	1,692	96.1	2,005	40.5

* Source: Ceylon Customs Returns (Series).

Since World War II, plantation agriculture has shown substantial increases in productivity. Per acre yields of tea and rubber have risen by about 70 percent and 50 percent respectively during the twenty year period 1938-58,[12] Comparable figures are not available for coconut because of the preponderance of smallholdings. Nor are accurate figures available to make an assessment of the productivity of labour. However, the labour population on the estates as a whole has remained substantially the same. The total labour employed on plantations increased by only 5 percent during the period 1942-44 to 1956-58.[13]

The existence of an export industry of major dimensions and high levels of productivity in the plantation sector is of considerable significance. It has enabled Ceylon to earn a large volume of foreign

[12] *Statistical Abstract of Ceylon* (Series) 1938-1958. Dept. of Census and Statistics, Govt. Publications Bureau, Colombo.

[13] Statistical Abstract Of Ceylon, 1959, op. cit,

exchange and this explains, in a large measure, Ceylon's favourable economic position today. Thus, Ceylon with a per capita income of about Rs. 492 comes next to Malaya and the Philippines in the south-east Asian region.[14] Such relatively high levels of living have been sustained by the imports of large quantities of food, textiles and other manufactured products. During the period 1946-56 annual imports of consumption goods have accounted for an average of nearly 75 percent of the earnings of foreign exchange.[15] But what is more significant to a predominantly agricultural economy is that more than 40 percent of the foreign exchange earnings are utilized on the imports of food, as shown in Table 1.3. This is a direct consequence of the inability of the peasant sector to increase its levels of productivity.

The peasant or subsistence sector of the economy has primarily concerned itself with the production of food crops. In Ceylon this has meant a concentration on paddy to the almost total exclusion of other subsidiary food products. Under foreign rule the attentions of the government were mainly directed towards the revenue-earning export crops. Thus the peasant sector was in a virtual state of stagnation and neglect resulting in a growing dependence on imports to meet the country's requirements of paddy and the other foodstuffs.

The peasant sector today is characterized by small and uneconomic holdings, heavy rural indebtedness, primitive methods of production, and low levels of productivity. The Report on the Survey of Landlessness, 1952, estimated that 26 percent of the agricultural population have no land and that 42 percent have less than half an acre. The Survey of Rural Indebtedness, 1957, revealed an incidence of indebtedness among 54 percent of the population. The low levels of income, estimated by the Economic Survey of Rural Ceylon, 1950-51, at an average of Rs. 97 per family per month explains the high incidence of indebtedness.

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[14] Ceylon National Planning Council, *The Ten Year Plan.* Ceylon Government Press, 1959, p. 5.

[15] *Ibid.,* p. 37

The relative poverty of the peasant sector has attracted attention for a long time. Even the colonial governments attempted a policy of land settlement by restoring some of the ancient irrigation tanks in the relatively unpopulated dry zone. But land settlement as a means of relieving the poverty of the peasants did not make much headway till after 1931 when a measure of self-government was attained under the Donoughmore Constitution.[16] With the granting of independence in 1948, the development of the peasant sector received urgent consideration at the hands of the government. An accelerated programme of land development and peasant settlement cost the government an average of nearly Rs. 45 millions a year during the period 1956-59.[17] The scheme of producer subsidy on paddy involved the government in an average expenditure of nearly Rs. 100 millions a year in the same period.[18] In addition, the government has introduced measures to encourage the development of co-operatives, provide credit and marketing facilities, and regulate tenancy relationships. **In** recent years, balance-of-payments difficulties and a greater awareness of the role of agriculture in economic development have invested the programme of rural development with a much greater sense of urgency.

Despite vigorous attempts to develop the peasant sector, levels of productivity still remain very low. While there have been some significant increases in the per acre yields of paddy, Ceylon still has one of the lowest yields among paddy-producing countries.[19] **In** fact, agricultural production as a whole recorded an increase of only 2.5 percent per annum during the periods 1952-53, 1954-55 to 1957-58, and 1959-60,[20] Population, on the other hand, continues to increase at the very high rate of 2.7 percent per annum. Thanks to modern science, Ceylon in the space of a couple of decades has

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[16] See: B. H. Farmer, *Pioneer Peasant Colonization in Ceylon.* Oxford University Press, 1957, pp. 116-60.

[17] Based on statistics from *The Ten Year Plan, op. cit.*

[18] Based on statistics from *The Ten Year Plan, op. cit.*

[19] Economic Survey of Asia and the Far East, 1961, p. 14.

[20] Ibid., pp. ll-13.

reduced death rates from about 37 per thousand to less than 10 per thousand. Birth rates have remained stable at over 35 per thousand, giving Ceylon one of the highest rates of population increase.

Peasant agriculture thus presents a picture that is in marked contrast to that of the plantation sector and does not seem to have benefited in any way from the progress that has been achieved there. Despite more than a century of capitalist development in the plantation sector, accompanied by large-scale development of roads, railways, ports, post and telegraph, banking and commercial facilities, Ceylon presents all the characteristics of an under-developed economy.

The emergence of a highly productive commercial agriculture operated on capitalist lines and existing side by side with a subsistence sector of low productivity presents a good example of a dual economy. Development in such economies, in Professor Lewis's view, is a process of cumulative expansion of the capitalist sector leading to the absorption of surplus labour from the subsistence sector.[21] The cumulative expansion, made possible by the reinvestment of profits, continues until the surplus labour in the peasant sector is completely absorbed. Thereafter expansion is made possible only by an increase in the real wage level in the capitalist sector. The peasant sector therefore stands to benefit by an expansion in the capitalist sector to the extent that the capitalist expansion reduces the surplus labour available in the peasant sector. In the case of Ceylon, however, no benefits accrued to the peasant sector though the plantation sector has continued to expand. This is because the subsistence sector did not provide the surplus labour. The existence of an unlimited reservoir of cheap labour in south India prevented the participation of local labour and maintained a subsistence wage level. It was only in 1939 that the importation of foreign labour was banned, but since that time the labour requirements of the plantations have not shown any appreciable increases.

The presence of a labour population of over a million in the plantation sector could have been expected to benefit the

[21]W.A. Lewis, "Economic Development with Unlimited Supplies of Labour," Manchester School of Economic and Social Studies, Vol. XXII, No. 2, May 1954.

subsistence sector indirectly through the greatly increased demand for food. But an increase in the price of food would only have led to a reduction in the level of profits, and this was not in the interests of the plantation sector. Large-scale imports of rice helped feed the plantation workers and were also instrumental in lowering prices to the paddy producers. It was only after the attainment of independence that the government regulated the imports of rice and introduced a system of guaranteed prices for paddy with the object of increasing prices to the producers.

If the plantation labour had participated in the progress of industry, such benefits would have made themselves felt on the rest of the economy through increased demand for a wide variety of commodities. Higher incomes for plantation labour could have provided a basis for a rising demand for manufactured goods on which a programme of industrialization could have been based. But the plantation labour itself does not seem to have benefited in any way from the rapid expansion and rising levels of productivity of the plantation sector. Though it has enjoyed medical and educational facilities which were not always available to the indigenous population, its levels of living are below those of the rural population. Thus the Survey of Consumer Finances carried out by the Central Bank of Ceylon in 1954 revealed that the average income per head of the population in the estate sector was only Rs. 58.5 as against a figure of Rs. 121.8 for the non-estate sector. Profits from plantations, on the other hand, reached very high levels. It has been estimated, for instance, that most of the foreign tea companies in Ceylon paid out more than 100 per cent of their issued capital in dividends over the ten-year period 1948-57 alone.[22]

Another factor of importance is that not all the profits derived from the plantation sector were re-invested within the country. The fact that it owed its development to foreign capital and imported labour meant that a substantial part of the earnings of the plantation sector accrued to the foreigners and was sent out of the country. It is difficult to find any accurate figures of the outflow of capital in the pre-war period. During the period 1950-59, however, an average of

[22] *Agricultural Plan,* Ministry of Agriculture and Food, 1958, p. 173.

Rs. 215 millions was sent out of the country annually.[23] This represents nearly 15 percent of the average annual export earnings.

While the expansion of plantation agriculture has contributed substantially towards the economic development of the Island and made possible, in a large measure, standards of living higher than for most under-developed countries, it does not seem to have had any beneficial effects on the peasant sector. As Professor Lewis points out, large-scale importation of labour and export of capital only served to keep down the level of wages.[24] It also cut off the channel by which the plantation sector could have directly benefited peasant agriculture. Since an increase in the productivity of the peasant sector may have led to an increase in real wages to the plantation sector, which was not in its interests, it meant the comparative neglect of peasant agriculture by a government which was bent on safeguarding the interests of the planters. Additionally, in the early years, the development of the plantation sector led to the appropriation of land to which peasants had a traditional claim. It has thereby contributed largely to the problems of landlessness and uneconomic holdings which beset peasant agriculture in Ceylon. These factors help to explain the relative poverty and stagnation of the peasant sector, when the plantation sector itself was showing rapid expansion and high levels of productivity.

[23] Based on statistics from the Annual Reports of the Central Bank of Ceylon.

[24] W. A. Lewis, *op, cit.*

CHAPTER 2

Agriculture in Sri Lanka: Meeting the Challenges Ahead[1]

1. Introduction

I consider it a great privilege to be invited to present the first R.R. Appadurai Memorial Lecture. I have known him as a schoolmate of a few years standing, as a student in my first year of teaching at the University of Peradeniya, and as a close colleague of over 20 years till his death in 1978. It is unfortunate that it has taken another 20 years to pay tribute to an outstanding teacher, scholar and institution builder, but appropriate that at least in this Golden Jubilee year we remember him as one of those who played a key role in laying the foundation for the dynamic growth and development of the Faculty of Agriculture of the University of Peradeniya that we have witnessed over the last 25 years.

The late Professor Appadurai entered the University in 1951 and completed the B.Sc. Agriculture degree programme in 1954. Securing First Class Honours. He proceeded immediately thereafter to Texas A&M University, U.S.A. on a Fullbright scholarship where he completed his M.Sc. Studies in 1956 and on his return was selected to the staff of the Department of Agriculture, in the Faculty of Agriculture and Veterinary Science of the then University of Ceylon. He proceeded to the University of London for Ph.D training and worked with Professor Holmes, one the leading agrostologists of the time. By the time he returned, the Department of Agriculture had moved from the house by the river to more spacious buildings, which included the Agricultural Research Laboratories, gifted by the Canadian, and the present Crop Science Building, gifted by the Americans.

Appadurai's contribution to teaching, research and the development of the Faculty can best be understood against the backdrop of the facilities for University level teaching in Agriculture existing at the time he was recruited. It had no buildings, no farms and virtually no teaching staff when it commenced activities in 1947. It draw heavily in visiting staff from the Government Department of Agriculture and utilised whatever farm facilities it was given by the Department at Gannoruwa.

[1] Reproduction from the First R.R. Appadurai Memorial Lecture – 1998.

Students admitted to follow the Agriculture course spent the first year with the Faculty of Science following the first in Science programme and were exposed to only two years of agricultural training, with very little or no exposure to laboratory and practical farm training. That students could proceed abroad to some of the best known Universities and come with flying colours is a tribute to the calibre of the students who entered the Agriculture stream.

It is to this environment that Appadurai refund from postgraduate training. Conditions had somewhat improved by them, but agriculture continued to receive step motherly treatment in relation to the Faculties of Arts, Science, Engineering and, later the Faculty of Medicine. Even the semi permanent buildings into which the Faculty of Medicine moved into in 1962 or thereabout were imposing compared to the facilities enjoyed by Agriculture. This provided the challenge to which Appadurai responded vigorously.

About thirty years ago, in 1967, the late Professor Appadurai, in the first Stapleton Memorial Lecture presented overseas and held in Colombo, spoke on "Grass and Cattle in the Agricultural Development of Ceylon". I would therefore consider it appropriate that the theme I propose to take up today, namely "Agriculture in Sri Lanka: The Challenges Ahead" would be in him with his own interests. It will also be of relevance in the context of Sri Lanka's goal of achieving the newly industrialized country (NIC) status in the shortest time possible and the dynamic role that agriculture will be called upon to play in this regard.

2. The Role of Agriculture

Developing countries are characterised by the predominance of agriculture as a source of output, incomes, employment and foreign exchange earnings. However, with development, structural changes take place and the agricultural sector comes to occupy a relatively minor role in the economy. Changes in production structure are explained by the well known Engel's law, which states that the proportion of income spent on food diminishes with increases in incomes. While structural change may be ascribed to economic growth, the possibility of causality in the opposite direction also cannot be ruled out. To these changes must be added the tendency for a long term decline in real prices of non-oil primary products and the possibility of a secular decline in the growth of the developed economies. Such observed regularities are associated with

sharp increases in agricultural productivity. The conventional role of agriculture in economic development is couched in terms of meeting the increased requirements of food associated with increases in population and incomes, providing the capital for industrialization, releasing labour for industry, earning foreign exchange required to support enhanced imports, especially of capital and intermediate goods, and providing the markets for manufactured goods resulting from industrialization.

The so-called East Asian miracles provide a good example of such a transformation. The contribution of agriculture to output and employment decreased from around 50 percent in the early sixties to about 10 percent in the eighties. The decline in the importance of agriculture is even sharper in the more advanced countries. Thus in Japan for instance the contribution of agriculture is estimated at seven percent of output and two percent of employment in the early nineties (World Bank, 1995).

The relative decline in the importance of agriculture was associated with increases in agricultural productivity. The experience of Taiwan provides some insightful evidence. There was a spurt in agricultural production in the sixties and seventies, with rates of growth of well over 4.0 percent per annum. Such increases are attributed to several factors including infrastructural development, mainly irrigation, agricultural extension, research, and heavy investments in rural areas, among which rural electrification and rural roads appear important. But more than anything else, it was land reform which spurred the egalitarian and efficient growth of agriculture. The stability associated with the massive redistribution of land also appears to have been important (World Bank 1993).

The net result of the land redistribution exercise was to create a nation of small farmers. It is estimated that by 1970, about 90 percent of all farms were under two hectares in extent and about 80 percent of the agricultural population were owner cultivators. It was inevitable therefore that farmer organisations and irrigation associations would begin to play an increasingly important role. First established under the Japanese occupation, they were noted for the use of coercive powers by the state to promote modernized scientific farming. They were now further strengthened. The use of the police to force modern techniques was continued under the nationalist governments. In time the farmer organisations came to organise agricultural extension, credit, input supplies, marketing and exports (Amsden 1989; Wade 1990).

Equally noteworthy was the manner in which a surplus was extracted from the agricultural producers. The net real capital outflow which averaged nearly 4.0 percent per annum between 1911 and 1940 rose to 10.0 percent between 1951 and 1960. The government through its control of fertilizers and credit gained a considerable degree of leverage over farmers. The transfer of the real net surplus was achieved in diverse ways, such as the barter of fertilizer for rice at prices highly unfavourable to farmers, land taxes, compulsory rice purchases, loan repayments etc. Surplus extraction however did not impoverish the farmers. Living standards improved, and provided the market for manufactured foods (Amsden ibid; Wade ibid). Thus the rapid increase in agricultural productivity enabled agriculture in Taiwan to perform satisfactorily the conventional role.

3. The Structure and Performance of Sri Lankan Agriculture

The intriguing question is how well has Sri Lankan agriculture performed in the same time span as of Taiwan. As that there has been a structural change of sorts is illustrated by Table 2.1. But that this has not lead to any sharp increases in incomes, as happened in the East Asian countries is equally clear (see Table 2.2). This section takes a close look at agriculture. Table 2.3 shows paddy has been a relatively star performer. The performance of the major plantation crops has been disappointing. There has not been much dynamism shown by other field crops and other export crops, either. Equally intriguing is to find out why the rural sector, substantially dependent on paddy, failed to benefit from the increases in paddy production. In seeking answers to such questions, we will have to understand the characteristics of Sri Lankan agriculture, including its structure and land use patterns.

Table 2.1: Agriculture in the economy of Sri Lanka

Item	1958 - 62 (Average)	1988 - 91 (Average)
Share of GNP (percent)[1]	44.7	23.5
of which		
Tea	13.5	2.3
Rubber	3.5	0.6
Coconut	5.5	2.5
Paddy	22.4	4.7
Other Agricultural		9.9
Share of Export Earning (percent)	94.6	35.7
Value of food imports, as percent of total imports, by value (percent)	45.0	18.8
Value of food imports as percent of total exports, by value (percent)	48.0	26.2
Share of employment	52.5	46.0

Source: Central Bank of Sri Lanka, Annual Reports (various issues). Employment figures from Dept. of Census and Statistics, Census of Agriculture 1946 and Central Bank of Ceylon, Report on Consumer Finance and Socio Economic Survey, 1986/87.

1. Taken from Snodgrass, D.R. 1966. The data may not be strictly comparable as the basis of computation differs, but could be taken as indicative of rough orders of magnitude.

Structural Characteristics and Land Use: The distribution of agricultural holdings, by size classes, is shown in Table 2.4. It is based on the 1982 Census of Agriculture and more recent data is unfortunately not available. The highly skewed size distribution is to be noted. Nearly 65 percent of all holdings were under 2 acres in extent and occupied about 16 percent of the total cultivated area. At the other extreme, 32 percent of the cultivated area was in holdings (estates) of 20 acres and above and numbering less than one percent of all holdings. The total number of agricultural holdings increased by 90 percent between 1946 and 1982, but the increase in area cultivated was only 25 percent. The average extent cultivated declined from about 2.0 ha in 1946 to 1.0 ha in 1982 and is likely to have further declined since then. There are however wide regional variations, with wet zone districts reporting 60 percent and over of all holdings under one acre and districts in the Northern, North Central and Eastern provinces reporting less than 10 percent of such holdings,

with Jaffna however being the exception, with 42 percent of all holdings under one acre.

Table 2.2: Average per Capita Income in Selected Countries of South and Southeast Asia, 1959 and 1990

Country	Income (US dollars)	
	1959	1988
Malaya	207	1940
Philippines	185	630
Sri Lanka	122	420
Taiwan	98	n.a
Thailand	75	1000
India	64	340
Pakistan	52	350
Burma	50	n.a
S. Korea	n.a	3600

Source: United Nations, Statistical Yearbook, 1962; World Bank, Development Report 1991.

n.a = not available

Table 2.3. Paddy: Growth rates in area, production and yield, 1950 - 90

Period	Area	Production	Yield
1950-90	1.5	4.3	2.9
1950-80	1.7	5.3	3.2
1980-90	0.7	1.2	1.9

Source: Department of Census and Statistics, Statistical Abstracts (Various Years)

Table 2.4: Distribution of the number and area under agricultural holdings by size classes, 1982

Size Class	No. of Operators	Percent	Area	Percent
Less than ½ Acre	461,680	25.6	91,820	2.0
½ to 1 Acre	307,510	17.0	185,060	3.8
1 to 2 Acres	387,900	21.5	484,950	10.4
2 to 5 Acres	478,170	26.6	1,371,000	28.3
5 to 10 Acres	128,230	7.0	793,330	16.3
10 to 20 Acres	27,470	1.4	353,450	7.6
20 Acres and above	17,301	0.9	1,543,582	32.0
Total	1,808,261	100.0	4,823,192	100.0

Source: Sri Lanka Census of Agriculture 1982

Agricultural land is traditionally classified into lowland, highland, and homegardens. Smallholdings, that is all holdings under 20 acres in extent, may be classified as single component, two component or three component, depending on whether they operate one or more of the lowland, highland, homegarden components. The distribution of smallholdings by single component farms in show in Table 2.5. Nearly 40 percent of all holdings are classified as homegarden and are generally under one-eighth of an acre in extent. If homegardens are excluded, and by definition they are subsistent in character, single component farms are unimportant.

Land use in agricultural holdings, other than homegardens, is shown in Table 2.6. Nearly 70 percent of such holdings were estimated in 1982 to have had a paddy component. About equally large numbers of holdings reported other field crops, other tree crops and coconut. But numbers of smallholdings reporting tea and rubber were in comparison very small. Average extents reported were above one acre except for other tree crops which cultivated in extents averaging half an acre. The size distribution of smallholdings reporting major crops is shown in Table 2.7. A majority of the holdings were under 2 acres in extent, except for rubber holdings.

Table 2.5: Distribution of small holdings operating single component farms, 1982

Category	Number	Percent	Area (acres)	Percent
Home gardens only	707,870	39.3	428,220	12.3
High lands only	186,850	10.4	627,480	18.0
Paddy lands only	68,510	3.8	139,650	4.0
Sub Total	963,230	53.5	1,195,350	34.3
Total (all 3 components)	1,798,970	100.0	3,493,160	100.0

Source: Sri Lanka Census of Agriculture, 1982

Table 2.6: Land use in agricultural holdings, by number and area, 1982

Crops	Small holdings		Estate	
	Number	Area (acres)	Number	Area (acres)
Paddy	736,630	1,221,080	-	21,236
Other Temporary Crops	765,530	759,710	-	11,680
Tea	79,290	106,630	1,973	416,677
Rubber	97,060	181,590	2,358	275,982
Coconut	708,920	781,020	6,230	254,832
Other Permanent Crops	853,530	424,110	-	80,526
Total		3,474,140		1,330,032

Source: Sri Lanka Census of Agriculture, 1982.

Table 2.7: Distribution of the number of small holdings reporting major crops, by size classes, 1982

Size Class	Tea	Rubber	Coconut	Paddy	All
Less than 2	51.5	40.0	58.7	67.4	64.3
2 - 5	36.3	42.0	28.7	7.0	26.7
5 - 10	8.4	12.6	9.6	4.3	7.1
Over 10	3.8	5.4	3.0	1.3	1.9
Total	100.0	100.0	100.0	100.0	100.0

Source: Sri Lanka Census of Agriculture, 1982

Recent Trends in Agricultural Production

As indicated in Table 2.3, there has been a slowdown in agricultural activity in recent years. So much so, that it would appear almost fashionable now to talk of a plateauing off of rice yields, a cost-price squeeze in agriculture, a stagnant agriculture and an agriculture in crisis. The next few sections present the available statistical information in relation to the different sub-sectors.

The Rice Economy

Information on trends in the area, production and imports of rice is given in Table 2.8. The striking increase in production and decrease in the level of imports is to be noted. A rate of growth in production of over 4.0 percent per annum over an extended period of time of about 40 years can be considered a striking achievement. The production increases can be attributed to increases in both area and yield, with the importance in area becoming less important with time and the land frontier being reached. As previously noted, a cause for concern is the decline in yield increases in recent years.

Table2.8: Rice Trends: Area, production and imports, selected years, 1950 - 1990

Year	Asweddumized Extent (000 ha)	Production (000 mt)	Imports (000 mt)	Yield/harvested area (mt/ha)
1950	410	428	633	n.a
1955	449	613	661	1.1
1960	478	864	739	1.34
1965	519	989	710	1.65
1970	583	1409	523	2.11
1975	632	1400	602	2.00
1980	681	2062	271	2.56
1985	715	2455	220	3.05
1990(3)	730	2330	304	3.10

Source: Aluvihare and Kikuchi 1991; Central Bank of Sri Lanka, 1991. Annual Report.

n.a = not available

Much of the increase in area cultivated came through the rehabilitation and development of major irrigation systems in the dry zone. The area under major irrigation schemes increased from about 100,000 ha in the early fifties to over 300,000 ha in the late eighties. The rainfed area increased by about 40 percent and the area under minor irrigation schemes increased by less than 15 percent. Currently, major irrigation schemes account for about 43 percent, minor schemes for about 26 percent, and rainfed areas for about 31 percent of the total cultivated area under rice.

The increase in irrigated area facilitated the spread of the new seed-fertilizer rice technology. The new improved seed varieties, which started replacing the traditional varieties in the fifties, had by the mid-eighties covered more than 90 percent of the rice area. The diffusion of the new varieties was thus not constrained by access to irrigation. The spread of the new varieties was associated with the increased use of fertilizers. Fertilizer use in terms of nutrient content is estimated to have increased from 2.6 kg/ha in the early 1950s to over 110 kg/ha in the mid-eighties. Rice yields increased from about 1.0 mt/ha to about 3.5 mt/ha over the same period. But that yield potentials are not being reached is also evident (Jogaratnam et al. 1982).

A disappointing feature in the whole rice scenario has been the relatively slow progress in improving cropping intensities and exploiting potentials for crop diversification. Cropping intensities are still relatively low, reaching 130 units even in the major irrigation schemes. Crop intensities are estimated at around 100 units in the minor schemes, but reach 175 units and above in the rainfed wet zone.

However, increased rice production has brought with it much greater reliance in domestic production. The self-sufficiency ratio has increased from about 35 percent in the fifties to about 90 percent in the mid-eighties. During this same period population more than doubled, and per capita consumption of rice, as pointed out in a subsequent section, showed little change. Self-sufficiency would have little meaning if it is not associated with improvements in living standards.

Other Field Crops

A variety of Other Field Crops (OFCs), most of which belong to the food crops category, are also cultivated. These include manioc, sweet potatoes and potatoes amongst the tubers; cowpea, green gram and black gram amongst the pulses; chillies and onions amongst the condiments; maize, kurakkan and sorghum amongst the cereals; and sesame and soya amongst the cereals; and sesame and soya amongst the oil seeds. The extents cultivated are shown in Table 2.9. Only maize, green gram, big onion, potatoes, cowpea and black gram show somewhat of an increasing trend, in terms of extents cultivated. There have been no major changes in yields over the period 1975-79 to 1990-94. These crops are of interest as some of them, especially the so-called high value crops like chillies, onions and potatoes are being promoted as part of the crop diversification programme.

Table 2.9: Other Field Crops (OFCs): Average annual extents cultivated (000ha)

Crop	1972-74	1975-79	1980-84	1985-89	1990-94	1995
Maize	34.3	31.2	37.8	40.2	46.7	45.9
Chillies	37.1	34.2	28.2	31.3	37.3	28.1
Red Onions	6.6	6.8	8.7	9.4	7.9	7.6
Ground Nut	7.2	6.9	11.8	10.0	11.1	12.5
Green Gram	8.4	11.4	22.3	27.8	38.3	24.0
Soyabean	0.9	1.3	9.4	5.7	2.9	3.0
Big Onion	0.2	0.2	0.1	0.5	3.6	4.4
Potatoes	2.5	3.4	6.0	7.4	6.5	9.0
Sesame	14.4	25.6	25.6	15.3	12.4	5.0
Cowpea	5.9	25.5	35.3	27.7	25.0	21.3
Black Gram	1.7	11.9	15.9	13.2	11.8	15.0

Major Export Crops

The changes in tea, rubber and coconut production in the period since 1950 is shown in Table 2.10. The cultivated area show a decline, most marked in the case of rubber. Productivity increases in the case of tea and rubber have offset the decrease in extents cultivated.

Table 2.10: Area, production and yield of major export crops, annual averages, 1951-1990

Crop and Year	Area ('000 ha)	Production (Mn.kg)	Yield kg/ha	Export Rupee Value (Rs. Mn.)	Earnings Dollar Value ($ Mn)
Tea					
1951-53	231	149.2	548.6		
1961-63	238	212.0	710.9		
1971-73	241	213.6	704.7	1189.0	194.9
1981-83	239	192.3	752.3	7027.0	315.3
1988-90	221	222.3	n.a	15261.8	372.8
Rubber					
1951-53	266	101.5	312.2		
1961-63	272	101.5	388.0		
1971-73	229	145.0	597.6	388.0	63.6
1981-83	205	129.6	597.6	2687.7	120.6
1988-90	199	115.7	743.6	3299.3	80.6
Coconut		(Million nuts)	(Nuts/ha)		
1951-53	434	2360.0	n.a		
1961-63	466	2653.6	892		
1971-73	451	2502.6	898	226.7	37.16
1981-83	419	2363.6	908	1311.0	58.81
1988-90	n.a	2314.3	924	2395.3	58.51

Source: Central Bank of Sri Lanka, Annual Reports (Various Issues)

n.a = not available

Coconut production and yield have remained relatively stable. It is the general perception that Sri Lanka has lost the competitive edge in

respect of these crops. This is brought out by the fact that over the period 1970-90, Sri Lanka's share of world exports fell from about 35 percent to 18 percent in the case of tea, from about 6.0 percent to under 2.5 percent in the case of rubber, and from about 10 percent to less than 1.5 percent in the case of coconuts.

Other Export Crops

As in the case of the other food crops, the data base is relatively poor. Production is carried out in very small holdings and homegardens and characterized by highly diversified cropping. While circumspection has to be used in interpreting area figures, export data, as a proxy for production data, can be regarded as fairly reliable. While there has been some increase in export volume and export value, this sector can hardly be called dynamic (see Table 2.11).

Table 2.11: Trends in production and exports of other export crops, 1978-1990

Year	Area (ha)	Export Volume (mt)	Export Value Rs. Mn.	Us# Mn.
1978	41,319	11,423	722.8	46.6
1979	n.a	n.a	887.9	57.5
1980	46,590	9,555	878.4	48.8
1981	n.a	13,674	1,397.5	68.0
1982	51,412	12,945	1,495.2	70.1
1983	n.a	11,145	1,485.7	59.4
1984	57,010	14,995	1,391.1	52.9
1985	57,938	17,335	1,364.6	49.8
1986	59,808	12,680	1,499.8	52.3
1987	62,377	11,860	1,714.2	55.7
1988	64,245	15,550	2,561.3	77.5
1989	65,271	11,380	2,408.4	60.2
1990	58,159	11,557	3,199.3	79.5

Source: Central Bank of Sri Lanka, Annual Reports (Various Issues); and Department of Export Agriculture, Administration Reports (Various Issues)

n.a = not available

The Livestock Sector

Surprisingly, livestock play a relatively unimportant role in Sri Lankan agriculture. Based on the 1982 census data, only a third of all farms are estimated to have maintained livestock, with the animal-permanent crop farm type predominant. Cattle accounted for about 60 percent of the livestock population. The distribution of smallholdings by number, area and type of livestock are given in Tables 2.12 and 2.13, while the data pertaining to estates is given in Table 2.14.

Table 2.12: Number and Area of Operational Holdings in the Small Farm Sector, 1982

Category	Number	Percent	Area (acres)	Percent
Holdings with crops and livestock	557,200	31.0	1,427,830	40.5
Holdings with crops only	1,196,390	66.5	2,030,000	58.1
Holdings with livestock	45,380	2.5	35,330	1.0
only All holdings	1,798,970	100.0	3,493,160	100.0

Source: Department of Census and Statistics, Census of Agriculture, 1982

Table 2.13: Percent of smallholdings reporting livestock, by type and average numbers per holding reporting, 1982

Category	Percent Reporting	Average Numbers per Holding Reporting
Cattle only	15.3	3.7
Buffalo only	3.1	4.0
Cattle and Buffalo	3.2	4.5
Goats	3.4	4.0
Pigs	0.4	3.1
Sheep	0.1	6.5
Poultry	15.1	13.9

Source: Department of Census and Statistics, Census of Agriculture, 1982

Table 2.14: Livestock numbers in the Estate Sector, and average numbers per estate by Livestock Category, 1982

Category	Total Number	Average per Estate
Cattle	92,680	10.0
Buffaloes	14,060	1.5
Goats	38,954	4.2
Sheep	11,924	1.3
Pigs	8,069	0.9
Poultry	731,649	78.7

Source: Department of Census and Statistics, Census of Agriculture, 1982

Patterns of Consumption

Production structures will be largely influenced by the pattern and level of food consumption. In fact, underlying the structural changes are changes in consumption, and such changes associated with development are perhaps the best and longest established. The relationship between income and food consumption is summarized in Engels law which states that the proportion of income spent on food declines with increases in incomes. There is also the well established fact that as incomes increase, the demand for starchy staples increase by less than the increase in demand for preferred foods such as milk, meat, eggs and vegetables. In fact, there may even be a fall in demand for the so called inferior foods such as coarse cereals and yams and tubers. The converse can also occur, that is as living standards deteriorate, there can be a shift back to starchy staples.

Food availabilities for selected years over the period 1965-95 are presented in Table 2.15. What attracts attention is the remarkable stability in the consumption patterns. Incomes over this period were certainly not stagnant, but one searches in vain for the expected changes in consumption patterns. This is in marked contrast to what happened in the East Asian countries. An explanation can be sought only in terms of the relative rates at which Taiwan and South Korea grow, namely Sri Lanka averaging a growth rate of 2.0 percent per annum over most of this period compared to the 8 to 10 percent posted by Taiwan and South Korea (See Table 2.16).

There is evidence to suggest that food supplies have been sufficient to meet average requirements of the population at large. The food

balance sheet data indicate an average supply of about 2,220 kilocalories and 50 grams protein per head per day. This is in line with average food requirements of 2,220 Kilocalories and 45 grams protein at the physiological level as computed by the Sri Lanka Medical Research Institute. The overall adequacy of supplies meeting requirements is however misleading. One cannot assume an even distribution, and what is likely to occur is under consumption by the poor and overconsumption by the rich. What one needs to know is how serious such under consumption is and identify the groups that are affected. That there is serious under consumption by a section of the population is brought out by Table 2.17. Fully 50 percent of the population do not appear to be meeting their energy requirements, although the situation seems to have improved marginally over the period 1980/81 and 1990/91.

Inadequate energy intake is not without implications for the nutritional status of the population. Children are most sensitive to nutrition and the results of two nutritional surveys undertaken in recent years attest to a considerable degree of under nutrition in the country. Thus Gunasekera (1966) concludes that "among children 3 to 59 months of age, 38 percent are underweight to a moderate or severe degree, and a further 25 percent to a mild degree. Nearly 63 percent of children are affected by one form or another of protein-energy malnutrition to degrees varying from mild to severe. Inadequate energy consumption is largely a problem of poverty, low incomes, unemployment and underemployment.

The magnitude and incidence of poverty has received considerable attention in Sri Lanka. Estimates of poverty vary widely ranging anywhere from 30 to 50 percent of the population. A recent World Bank (1993) study suggesting that poverty has decreased since 1985 has evoked controversy (see Table 2.18). Dunham and Edwards (1997) in a searching assessment of the underlying situation contest the World Bank findings. The Governments own assessment of the situation, in implementing its programmes of food stamps, and Janasaviya and Samurdhi benefits point to a higher levels of incidence, though there is always the problem of leakages.

Table 2.15: Per capita availabilities of major food commodities, by selected years

Commodity	Quantity (kg/yr)		
	1965	1985	1995
Rice	103.7	104.7	96.0
Wheat Flour	26.0	29.2	36.0
Pulses	6.7	5.5	6.0
Sugar	20.4	20.2	26.0
Meat	1.9	1.9	3.0
Eggs	1.9	2.3	3.0
Fish	9.4	10.1	11.0
Milk	14.5	13.1	15.0

Source: Department of Census and Statistics, Food Balance Sheets (Various Years)

Table 2.16: Some development indicators for selected countries, 1993

Country	GNP/ Capita	Av. Annual Growth Rate 1980-93	Ag. Share of GNP	Urban Pop. as % Total Pop.	Infant Mortality Rate	Low Birth Weight Babies
Low Income						
Sri Lanka	600	2.7	25	22	17	22
Lower Middle Income						
Indonesia	740	4.2	19	33	56	-
Philippines	850	-0.6	22	52	-	-
Thailand	2,110	6.4	26	19	36	10
Upper Middle Income						
Malaysia	3,140	3.5	-	52	13	8
South Korea	7,660	8.2	25	78	11	-
High Income						
U.K.	18,060	2.3	2	89	7	-
U.S.A.	29,740	1.7	3	76	20	7
Japan	31,490	3.4	6	77	14	6

Source: World Bank, 1996

Table 2.17: Average calorie consumption per capita per day, by capita expenditure deciles, 1980/81 and 1990/91

Decile	Calories per Capita per Day	
	1980/81	1990/91
1 (lowest)	1221	1369
2	1590	1700
3	1788	1892
4	1964	2048
5	2113	2165
6	2303	2281
7	2519	2363
8	2666	2472
9	2971	2541
10 (highest)	3261	2614

Table 2.18: Changes in selected indicators of poverty in selected countries

Economy	Year	Percentage of Population below the Poverty Line			Number of Poor (millions)		
		First Year	Last Year	Change	First Year	Last Year	Percent Changes
Indonesia	1972-82	58	17	-41	67.9	30.0	-56
Malaysia	1973-87	37	14	-23	4.1	2.2	-46
Thailand	1962-86	59	26	-30	16.7	13.6	-18
India	1972-83	54	43	-9	311.4	315.0	1
Pakistan	1962-84	54	23	-31	26.5	21.3	-19
Sri Lanka	1963-82	37	27	-10	3.9	4.1	5

Source: Extracted from World Bank, 1993

CHAPTER 3

Socio-Economic Factors in Agricultural Development[1]

Concern was expressed as recently as 1967 that the race between population growth and food supply was being lost (The White House, 1967) Developments since then indicate that many countries are gaining ground toward self-sufficiency in food production and that others will attain this position before long (UN, 1969). This dramatic change in the Asian Agricultural scene is attributed to the technological breakthrough referred to as the 'Green revolution' or the 'Seed –Fertilizer Revolution'. This development may be interpreted by some as a breathing space in which advances in the field of population control would help bring about some equilibrium between population growth and food supply. To others, the green revolution is not based on a single set of innovations that would raise production to a new plateau only to level off again. Rather, it is viewed as a process that will provide an accelerated rate of increase in agricultural production into the indefinite future (Mellor, 1969). Similar hopes have been expressed in the past. But looking back on the period since the close of World War 2 and with the benefit of hindsight, one can point to many developments which did not live up to the early promises. As we move into the 70's the magnitude and urgency of these problems will increase and it is even more necessary that progress should not be slowed down because of a lack of knowledge of the production problems of small farmers or an improper understanding of the factors that hinder the modernization process.

Problem and processes of agricultural development and the techniques and experience of countries at various stages of development have all been dealt with at length by a voluminous and growing literature. However, while a great deal is known of the various factors affecting growth and development, there is a dearth of information which wood help pin-point the particular factors or combination of factors that should be stressed in a given situation and under particular set of circumstances.

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[1] Reproduction from a National agricultural research systems in Asia: Report of the regional seminar held at the India International Center, New Delhi India, March 8 .13,1971.Edited by Albert M Moseman. New York: Agricultural Development Council (1972). 20-22.

A wide variety of programs have been initiated over the years with the intention of improving the condition of the farmers. But success stories seem confined principally to pilot projects. Our main concern should therefore be to identify and explain the factors which seem to prevent farmers from responding favourably to such programmes.

This paper attempts to review some of the factors considered critical to the growth and development of agriculture in the context of current developments. It relies heavily on Ceylon's own experience with agricultural development programmes. While the problems of development are common to most of the countries in the region, we must recognise the 'micro-heterogeneity' of agriculture and avoid generalizations which may lead to inaccurate and harmful conclusions. This is especially important because our primary concern is with the problems that confront farmers as individuals in bettering their conditions.

Development strategy

The critical role of agriculture in the growth and development of the low income countries is widely recognized (Johnston, 1961). Agriculture is an industry of major proportions in many of these countries, providing employment for the bulk of the population, contributing to a major share of the national income and accounting for a substantial proportion of the foreign exchange earnings. What is done or left undone about agriculture will critically effect the ability to provide for the rapidly increasing populations of these countries and to contribute to the development of the other sectors of the economy.

Development strategy in these countries would, however, seem to give agriculture rather limited role. Most countries in the region depend on agriculture to sustain arising inflow of essential imports for their programmes of industrialization. Simultaneously, a sizeable proportion of their imports consists of agricultural commodities, much of which could be produced domestically. The primary purpose of agricultural development could thus be the earning and saving of foreign exchange and emphasis is, therefore, given to the achievement of the fastest rate of growth of agricultural production (Ojala, 1969).

It is becoming increasingly evident that development plans must also have several other objectives in view. In the words of Dudley Seers, 'A

plan which conveys no targets for reducing poverty, unemployment and inequality can hardly be considered a development plan' (Seers, 1969). Similarly, the Report by the United Nations Committee on the Second Development Decade headed by Jan Tinbergen concludes that while the First Development Decade of the 1960's focused upon production per se, the Decade of the 1970's must focus upon the abolition of poverty. Thus, agricultural development programmes must also have amongst their objectives the achievement of employment, improvements in income distribution and minimum levels of nutrition. The factors relevant to agricultural development must therefore be considered in their broader context.

Factors in Agricultural Development

Agricultural development has been a matter of concern for many centuries. One has little knowledge of some of the ancient civilizations which were characterized by the development of vast and intricate systems of tanks and canals; the present day ruins bear testimony not only to the skill of the people, but also to the predominant position that agriculture, especially rice production, occupied. Much of today's agricultural development in Ceylon lies in restoring these tanks and canals and building up new settlements (Farmer, 1967). One should draw attention, in spite of constant references to stagnant agriculture in peasant societies, to periods of rapid growth in agriculture in recent times. The development of export agriculture in Ceylon has been associated with very rapid rates of growth (Jogaratnam, 1964). It is unfortunate that very little work has been done to assess the draw on these experiences. Considerable attention, on the other hand has been devoted to the historical experiences of countries such as Japan and Taiwan and these are often cited as examples which the low income countries could usually follow in their quest for modernization.

The more recent history of agricultural development in some of the low income countries provides a good insight into the factors considered relevant at various times. If one takes Ceylon as an example, development strategy in the early years of this century was concerned with the provision of cheap and easy credit which was considered to be the critical factor limiting sustained increases in agricultural production. Thus, agricultural policy was mainly concerned with the sponsorship of rural cooperative credit societies. Ceylon, in fact, based itself on the

Indian model which was influenced heavily by the Raiffeisen system. Cooperative credit did not prove to be the answer and interest shifted to irrigation, land development and settlement in the 1930s. The idea was that farm units were far too small to be economically viable and that new land had to be opened up under state sponsorship to relieve land hunger. With the war and the attendant food shortages, land settlement was considered too costly and too slow a process and interest shifted to marketing and land reform. Credit was then tied up with production and marketing and we had the beginning of the multipurpose cooperative societies on which so much emphasis is being placed now. Ceylon also felt the impact of the post-independent sweep of land reform measures and legislation was enacted to regulate tenancy. Land reform did not, however, go so far as to involve redistribution of land and the fixation of ceilings on size of holdings.

These programmes have been accompanied by a scheme of incentive prices which guarantee the farmer a price for rice (which has continued to be well above world prices), input subsidies (particularly for fertilizers and seed paddy) and a crop insurance scheme (which covers only about 20% of the area under rice). Research and extension has not been neglected, either. A local hybrid variety, H4, with a production potential of over 160 bushels per acre was developed and released to the farmers as early as 1958. The importance of extension activity has also been long recognized, though the quality and coverage leave much to be desired.

The various measures undertaken by the government have had a certain effect. Rice production is estimated to have increased at an average annual rate of over 4.5% in the post-war period. In considering this development it should be pointed out that the major emphasis in the pre-war period was on the development of the plantation sector, although the resultant technological breakthroughs have received hardly any attention. The concentration of effort on rice production is a post-Korean war development and at a period of 15-20 years is insufficient to expect any dramatic changes in a peasant economy. However, the pressures exerted by a rapidly increasing population and worsening balance of payments position have resulted in an overall feeling of disappointment and pessimism at the considered slow rate of progress in food production. In retrospect, it is apparent that the fault lies in the implementation of the multitude of programmes designed to change peasant production. This problem will be referred to subsequently in more specific terms. In general, it can be said that implementation at the

village level of policies conceived in aggregative terms at the national level requires a high degree of coordination amongst various arms of the government. This coordination seems most difficult to achieve. The administrative problems involved in implementing development programmes seem to be one aspect of development that has not received adequate attention in development literature.

Apart from the problems of implementation there are several other factors which could explain the lack of success of many of the development programmes. Many of these measures were conceived on an adhoc basis, in response to the pressures arising at different times. Very often, the emphasis was on single programmes which were the trend at the time, despite the existence of an array of programmes in the statue books. The sequence and timing of these programmes very often had little impact on the farmers, the supply of cheap and easy credit without adequate marketing facilities had little impact on production and guaranteed prices were ineffective when there was an absence of adequate storage and transport facilities. However, progress was made in spite of the existence of these and many other problems. Ceylon may perhaps be an exception in the wide array of programmes undertaken, but most other countries could similarity point to the increasingly active role of governments in agriculture and the steady progress in production.

Current development strategy with its emphasis on an integrated approach to agricultural development seems a logistic development based on past experiences. A large number of factors are identified as being necessary for development. As Dr. Mosher summaries, the five essential are markets, technology, local availability of input supplies, production incentives and transportation; the five accelerators are education, production credit, group action by farmers, land improvement and development and national planning. Given the structure of peasant agriculture, it is argued that the impact of change must not only encompass all these factors, but must also be massive enough to bring about the required changes. Since limited resources prevent massive operation on a broad front, the need for some sort of selectivity in the use of resources arises; area of high potentiality and low risks were chosen for a concentration of effort.

Today, the strategy of intensive agricultural development in selected areas constitutes an important aspect of agricultural planning in many low income countries. Questions have been raised whether government possess the capacity and capability to cope with multiplicity of limiting

factors even in restricted areas to determine priorities and sequence in which the various problems should be extended tackled. There is some evidence that the results may be greater if the major constraints can be identified and dealt with, as in the case of water in West Pakistan (Falcon, 1968). However, the technological breakthrough referred to as the 'Green Revolution' has given added force to the strategy of concentrated effort in selected areas and the problem must be considered as a whole in the context of the new developments. The development of the new high yielding varieties of grains and their rapid adaptation in selected areas of West Pakistan and Indian Punjab and Tanjore with remarkable results has aroused a great deal of enthusiasm. The FAO Indicative World Plan projected that by 1985 India and Pakistan would be in a position to export grains or feed them to livestock (U.N.1969). The 'Green Revolution' reflects the potentials for development. The basic concern is whether the potentials can be realized and how soon and to what extent it would help in the eradication of poverty, unemployment and malnutrition.

Restraints in Exploitation of New Technology

The 'Green Revolution' has as its basis the development of high yielding varieties. There is evidence that the spread of these varieties have been much more rapid than generally anticipated. However, it is by no means certain that this will continue, leading to a sufficiently wide adoption of the new varieties. The manifold factors that influence the rate of adoption have received considerable attention and have been well documented (Baker, 1969; FAO, 1968; Johnson and Couston, 1970; Mellor, 1969; Mosher, 1969; Wharton, 1969). In areas where the rate of adoption has been rapid, it has led to what are referred to as second-generation problems. These relate mainly to problems of marketing and storage. Production increases could be so overwhelming that the existing marketing framework may not be able to cope with it. There is also the possibility that the existing institutional framework may not permit an adequate supply of the increased inputs such as fertilizers and insecticides. Where the attendant problems should not be too difficult to overcome. The broad framework of policy exists and the authorities should be able to cope with any bottlenecks.

There are likely to be other more difficult problems. These may possibly influence the margin of economic advantage beneficial to individual farmers and would be of critical importance in determining the

rate of adoption of the new technology. Here again, there already exist policies at the national level relating to prices and support programmes, credit arrangements, input subsidies, marketing, etc. these are all part and parcel of the 'package programme' or 'Intensive Agricultural Development programme' which have been accepted by most countries as the major strategy in agricultural development planning. The problems arise in the actual implementation of these programmes and assume more serious proportions because the new varieties are very specific in their requirement of water, fertilisers and other inputs, and management practices.

The spread of the new varieties is directly related to the extension of the area under assured water supplies. In some areas, as in West Pakistan and the Indian Punjab, the yield advantage and physical conditions make private investment on tube wells profitable. In other areas, the water supply is dependent on the construction of costly dams with long gestation periods. It is noteworthy that the irrigable area is estimated at approximately 20% of the total arable area for ECAFE countries as a whole. In Ceylon irrigable extent does not necessarily mean an assured water supply. Thus while it was once suggested that agricultural development strategy should make minimum demands on capital, it now appears that investment requirements for rice growing at least will be very high (Hsieh and Ruttan, 1967). Water control is more important than water availability and individual farmers face many problems on this. Large irrigation systems in Ceylon are based on gravity flow and the rate and timing of water release is beyond the control of individual farmers. The spread of new varieties and new practices such as multiple cropping and crop diversification is apt to be slowed down in the absence of adequate individual water supply control. It is doubtful whether existing irrigation systems can be redesigned except at enormous cost.

Attention has been drawn to problems such as the increased susceptibility to diseases and acceptability of grain quality, all of which it is felt could be overcome in a comparatively short time (Baker, 1969). It is important to note that many of these problems vary from area to area and require decentralized action. The need for a considerable amount of adaptive research has been stressed. This would depend on the speed of availability of trained personnel, buildings and equipment.

A major problem is the higher levels of investment and risk attached to the adoption of the new varieties. Since the new varieties are highly specific in their requirements and demand a much higher level of

managerial competence, yield potentials are not always realised. This means that the yield advantage over local varieties is not always great enough to induce farmers to adopt the new varieties. Even though farmers who are conscious of the advantage insure themselves by restricting the new varieties to a portion of their holdings. It is therefore, difficult to find an area where an entire holding is planted with one variety. This would seem to support the view that farmers, in order to reduce risks, do not obtain the maximum profit (Lipton, 1968).

The problem is more where the small farmer who dominates the peasant economy is concerned. For example, in Ceylon nearly 60% of all agricultural holdings is under 2 acres. Most operate under rainfed conditions but evidence indicates that there yield per acre is higher than average. It is unlikely that they can be induced to plant the new varieties and the success of the 'Green Revolution' without price guarantees and input subsidies will weaken their position. It is inevitable that there would be a growing disparity in income, but there does not appear to be any policy to minimize the problem. One solution would be to encourage these farmers to plant new crops. This is likely to be a slow process, as one has to begin to do research on new crops, alter price structures and persuade farmers to give up rice production. In countries like Ceylon where agriculture is already heavily subsidized, such changes would only increase the burden to the government. Experience indicates that guaranteed prices can seldom be lowered and upward revisions of prices of commodities other than rice will increase the burden to the government.

Mass unemployment which may occur in the 70's is associated with the problem of low incomes. In view of the importance of agriculture, development methods which increase employment opportunities inside and outside its limits, therefore need critical examination. It is conceded that the absolute size of the population in agriculture will continue to increase for several decades and a solution to the employment problem cannot be found solely by creating alternative employment opportunities outside of agriculture (Ahmad and Sternberg, 1969). The agricultural sector must offer employment to increasing numbers of people and this may prove difficult in countries with limited land resources.

It has been argued that the resources such as land, water and capital which complement labour and under-utilized in many of the low income countries and that the obstacles to improve utilization can be attributed to the structure of agriculture itself (Ahmad and Sternberg, 1969). Thus,

attention has been drawn to the heavy concentration of land ownership and a case made for widening land ownership. However, redistribution of land in itself cannot provide a solution to the problem of unemployment. It has to be associated with several other measures which would increase production (Warriner, 1969).

Apart from altering the structure of agriculture, the potential of the 'Green Revolution' to absorb additional labour is tremendous. There is evidence to show that the high yielding varieties of seeds require relatively more labour. New technology leads to multiple cropping and crop diversification with labour-intensive high value crops; this, in turn, will need much higher labour requirements on farms. We should, however, not ignore the possibilities of a better utilization of family labour as opposed to an all round increase in employment opportunities within agriculture. The year-round cultivation and more scientific rotations may reduce the seasonal peaks in labour requirements and lessen the opportunities for hired labour. This is, however, an area where more information is needed than is available at present.

The widespread tendency to mechanise agricultural operations in some of the areas which have felt the full impact of the 'Green Revolution' as in West Pakistan, has been noted (Cownie, Johnston and Duff, 1970). The need to encourage selective mechanization and to adopt positive measures to prevent labour displacement has been suggested. Recent studies indicate a similar tendency in rice production in Ceylon. The problem is, however, complicated by labour shortages in settlement areas and difficulties in inducing labour to migrate (even seasonally) from surplus areas, the importance of timeliness in operations, a shortage of buffaloes as well as other factors.

In considering employment problems in agriculture, one should also refer to the new class of educated unemployed who find agriculture unattractive. This type of unemployment is becoming an increasing problem in Ceylon where there has been a scheme of free education at all levels for over twenty years. Employment in agriculture is considered unskilled labour and there is a preference for white collar jobs. The blame lies in the educational system and the solution may be increased opportunities for technical and agricultural training. This, however, does not solve the immediate problem of finding employment for thousands or potentially millions. A recent attempt to provide educated youths with employment opportunities in agriculture in Ceylon is very illustrative: The government announced pilot scheme to provide selected youths with

two-wheeled tractors for hiring service; however, very few youths accepted the offer in spite of the serious unemployment situation. The fear of a lost opportunity for a white collar job may be the reason for the failure of the scheme. The problem is that an average sized holding of 1-2 acres does not give an adequate assurance of making a living out of agriculture. There are many examples of intensively farmed small holdings which sustain a relatively high standard of living, but with the present information and the limited financial, technical and administrative resources available, it is difficult to repeat them on a large scale.

One should also consider whether the success of the 'Green Revolution' in selected areas would generate employment outside agriculture. One would expect and increased demand for durable consumer goods. The impact does not appear to be as great as the expected probably because of the high marginal inclinations to consume and a high income elasticity of demand for food. A fast agricultural development has also not given any evidence of supporting and increase rural public works programme. The administrative problems involved in bringing farmers into the tax structure as well as the political unpopularity of such measures has prevented any channeling of the gains in income for such purposes. Evidence available also does not indicate any appreciable increases in rural savings. These are, however, areas in which little information is available and there is need for investigations which would help explain the lag, or in some cases the absence, of spread effects.

Summary

To summarise the discussion presented so far, it would appear, at least as far as Ceylon is concerned, that there exists a broad framework of policy which recognises the need to help the peasant farmer tide over a wide array of problems. Appropriate policies exist in respect of land tenure, credit, marketing and prices, with the state also endeavouring to ensure adequate supplies of fertilizer, improved seeds and other inputs. These basic policies have their shortcomings - land reform measures ignore the problem of fragmentation and parcelisation and agricultural credit concentrates solely on production despite evidence of production credit being cancelled for consumption purposes. These shortcomings are due more to inadequate administrative and financial resources than to

lack of understanding. Although all these measures have had an impact on production, it is apparent that farmers have not derived the full benefits. Those who have observed the process personally and at the farm level have noted that the implementation of these programmes must be improved.

With the advancement of technological breakthroughs the implementation of development programmes assumes critical importance. The new varieties are highly specific in their requirements of water, fertilizer, management practices etc, and if there is to be a sufficiently wide dissemination of the new varieties, it is necessary that the obstacles at the farm level be removed. This would require a greater knowledge of what these problems are as well as an administrative framework that would bring about a high degree of coordination amongst the several agencies that now seek to help the farmers.

It is also being increasingly realised that the new technology will increase the disparity in incomes between farmers and between regions. This seems to be an inevitable part of the strategy of intensive agricultural development now being pursued. As a result of the attention placed on production problems, not much concerned is being given to the problems of those farmers who are being by passed by the 'Green Revolution'. This will increase the social tensions which are beginning to become apparent.

The problems of the small farmers farming 1-2 acres require considerably more attention. These farmers form a big majority in most areas. It appears that the new technology will barely affect their social and economic viability. We need to know much more about them, the reasons for their lagging development and to find a solution for them. We will have to develop new crops, new systems of farming and new combinations of enterprises to help these farmers. We will have to discover whether these will provide a solution or whether the answer is something apart from agriculture.

Finally, the employment potential of the new technology needs careful investigation. It is certain that for a long time to come, agriculture will have to remain the major source of employment. A great deal of research is indicated if agricultural development is to be designed to absorb the maximum numbers of workers possible. There also seems to be an inadequate understanding of the process by which developed areas can induce development not only in the backward areas but in the rest of

the economy as well. The backward and forward linkages and the spread effects do not seem to work quiet as smoothly as postulated in theory.

It would thus appear that all the factors mentioned above indicate the need for a fresh approach to planning. In recent years, the necessity for 'planning from below' has attracted considerable attention. It appears, however, that we know far less of the techniques and methods of planning from below than that of planning from the top. This may be explained partly by the aggregative approach of most plans and partly by the 'urban bias' of most of the planners themselves (Lipton, 1968) Whatever the reason, it must be realised that the rate of agricultural progress in the next decade will depend largely on the mobilization of active farmer participation in running development programmes in a farmer- government partnership.

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Domestic Food Sector

CHAPTER 4

Food in the Economy of Ceylon[1]

Thambapillai Jogaratnarn and Thomas T. Poleman[2]

I. Introduction

Economic development in Ceylon, as in so many other tropical countries, has traditionally been associated with the production of export crops. First cultivated on a large scale soon after the occupation of the island by the British in 1815, these crops now hold a predominant position in the economy. Today, export crops - principally tea, rubber, and coconut — occupy about 65 percent of the total cultivated area. In 1962, the latest year for which statistics are available, they contributed about a third of the gross national product (7:284). Equally important is their contribution to employment. According to the Census of 1953, nearly 30 percent of the total gainfully occupied population were directly engaged in export crop production (5:19). A substantial additional proportion were engaged in commercial and professional activities which largely serve the needs of export agriculture.

Even more significant is the contribution made by export crops to the foreign exchange earnings of the country. Exports of tea, rubber, and coconut, as the following tabulation reveals, account for more than 95 percent of total foreign exchange earnings (7:223-24):

These products are exchanged in the world market for Ceylon's consumer needs, chiefly foodstuff's and manufactured goods. Imports of food items bulk particularly large; as indicated below, they have recently accounted for about 40 percent of the total import bill and about 45 percent of the country's export earnings (7):

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Table 4.1: Ceylon Exports of Tea, Rubber and Coconut (1958-1962)

Year	Total exports (million rupees)[1]	Percentage contribution of tea, rubber, and coconut
1958	1,651	93
1959	1,692	96
1960	1,775	93
1961	1,680	96
1962	1,766	94

[1] U. S. dollar equals 4.76 rupees.

Table 4.2: Ceylon Values and Shares of Food Imports (1936-1962)

Years	Value of food imports as percentage of total imports	Value of food imports as percentage of export earnings
1936-38 average	45	38
1948-52 average	48	47
1958-62 average	45	48

The size and productivity of the export sector has supported a relatively high level of living. Ceylon's per capita income, although well below that of the industrialized countries of the temperate zone, is one of the highest in South and Southeast Asia (Table 4.3).

But if export specialization has served Ceylon well in the past, developments in recent years point to a need to modify the existing trade pattern. Acceleration of economic growth will require that open proceeds be used increasingly to finance capital investment rather than to meet consumer goods. This calls for either an expansion of the export sector or a reduction in the imports of consumer goods. In the main, this resolves itself into an investment choice between the export and food sector of the agricultural economy.

Export Expansion

The earnings from the export of agricultural commodities are a function of output and price. In the past, expansion of output has been achieved primarily by an increase in acreage. The scope for further expansion in the acreage under the traditional export crops is however extremely limited. The Wet Zone of Ceylon, the home of the plantation sector, has been fully exploited and very little new land is available. Thus,

according to estimates of the 1957 Ten-Year Plan, no increase in net acreage is foreseen (11:172). Increases in output will therefore have to be secured by increases in yields per acre. Such possibilities seem bright in the long run. It is estimated that the introduction of new, high-yielding strains could more than double yields of both tea and rubber. Yields for coconuts could also be substantially improved (11:167). But extensive replanting with improved material would take time. Tea, rubber, and coconut are all perennials and take anywhere from 5 to 7 years to come into production. Costs of replanting, moreover, are inevitably high because of the income lost when bearing plants are uprooted and replanted. This tends to slow down the rate of replanting. Thus, to consider tea, for example, it is not expected that more than 12 percent of the total acreage will be replanted over the period of the Ten-Year Plan (11:173). The outlook for rubber and coconut is equally modest.

Table 4.3: Ceylon Average per capita income in selected countries of South and Southeast Asia, 1959*

Country	Income (dollars)
Malaya	207
Philippines	185
Ceylon	122
Taiwan	98
Thailand	75
India	64
Pakistan	52
Burma	50

*Computed from data in United Nations, Statistical Yearbook, 1962.

But even were the output of the export sector to grow faster than in the past, the demand conditions for its products do not have much ground for optimism. There is a relatively low income elasticity of demand for tea in the major consuming countries. It is also relatively price inelastic, so that any increase in supply is likely to leads to a more than proportionate fall in prices and thus to a reduction in total export earnings (24: 1-52). The experience in recent years illustrates this very well. Between 1958 and 1962 the export volume of Ceylon tea rose by 10 percent; export earnings, on the other hand, remained almost constant. The situation is no better for rubber and coconut products. In the

postwar-period rubber has had to face acute competition from synthetics, and there has been a steady decline in price since the early 1950's. Unfortunately, this has not been offset by any increase in production. Coconut oil, mainly used as an edible oil, has similarly been losing ground to soybean oil.

The experience of recent years has been one of general decline in the prices of primary products. Should many countries attempt to increase export earnings by greater production, it may only serve to intensify such declines. Yet this does not mean that no attempt should be made to develop Ceylon's export sector. The demand for any single country's exports is likely to be less inelastic than for the product in general, and it would therefore pay to make Ceylon's exports more competitive in world markets. But such developments are unlikely to lead to any dramatic increases in earnings in the immediate future.

Import Substitution

Given the unlikelihood of expanding export earnings at any substantial pace, a policy of development will have to depend heavily on import substitution as the means to conserve foreign exchange and divert it to investment purposes. Fortunately, there is considerable scope for action here in the field of foodstuffs. Ceylon imports large quantities of food items, many of which can successfully be produced locally. Imports include nearly half the domestic utilization of rice, as well as substantial amounts of subsidiary foodstuffs including potatoes, chillies, curry stuffs, and fish and milk products. While not all these products can be grown in the country, a wide range of items remain that are either already being grown or for which acceptable substitutes could be found.

The need to expand the domestic production of foodstuffs assumes even greater significance when viewed in the context of Ceylon's rapidly growing population. The postwar period has witnessed a virtual explosion of population. Improvements in public health measures, most notably the eradication of malaria, resulted in more than halving the death rate. Today the annual rate of population growth stands at 2.8 percent, one of the highest in the world.

Unless food production can keep pace with population, Ceylon will have to draw on her limited foreign exchange resources simply to stave off hunger. In fact, the demand for food is likely to grow by more than the

rate of increase in population. Developing countries are characterized by a relatively high income elasticity of demand for food. This means that in all likelihood the country will have to increase its food output by more than 3 percent per annum. Since few tropical countries have ever achieved such a rate, the magnitude of the task before Ceylon cannot be overemphasized.

Framework of the Study

If development of the food sector is to proceed along efficient lines, it must be based on an adequate understanding of the present position and of the forces determining future demand and supply. Unfortunately, any such assessment is rendered difficult by the paucity of reliable statistical evidence. The key element of the present paper is therefore an evaluation of existing evidence and on the basis of it to build up estimates of present availabilities and future demand.

Sections II and III contain the core of this analysis: an examination of the different methods by which agricultural data may be scrutinized for reliability. Basically, the approach is to use consumption data as a check on apparent availabilities arrived at by means of a food balance sheet. On the basis of this analysis, adjustments are made to the balance sheet figures in Section IV to arrive at a final estimate of food availabilities. In Section V, the major determinants of future demand for food are examined and probable rates of growth projected.

II. Evaluation of Agricultural Data: Production Estimates

Statistical data in the less developed countries are typically deficient in coverage and poor in quality. But for Ceylon where food statistics are concerned, the problem is not overly acute. This is because Ceylon imports more than half its food requirements, and trade data are generally reliable. Moreover, rice is by far the most important crop in the food sector, and attempts have been made in recent years to improve the quality and coverage of rice production data. Nevertheless, an analysis of the overall food supply situation and of future demand is made difficult because the data available for several other food commodities are unsatisfactory.

Different techniques may be adopted to evaluate available data and to fill in data where none exist. The basic approach of this study is to compare production statistics with data from consumption studies. This enables a comparison of data from mutually independent sources. Information from nutritional surveys as well as estimates of food requirements are also used as further checks.

The food balance sheet technique is used to determine estimates of food availabilities from the production side. Initially, only official data are used in constructing the balance sheet, which is subsequently evaluated subjectively for ranges of error. This evaluation is based on an appraisal of the coverage of the official figures as well as of the methods of gathering them. The data so evaluated are then compared with quantitative data from consumer budget surveys. Since the budget studies themselves are but sample surveys, their representativeness must be examined through tests of both external and internal consistency. This provides a basis for comparison, following which the data are further scrutinized by reference to the nutritional status of the population.

Balance Sheet Technique

Comprehensive information on the net food supply available for human consumption may be presented by means of a food balance sheet. The balance sheet is a method for bringing together data on the supply and utilization of various individual foodstuffs available to a country in a given period of time. The supply side of a balance sheet is made up of domestic production, net trade, and net changes in year-end stocks. On the utilization side are: seed use, animal food, waste on the farm and in distribution up to the "retail level," industrial nonfood use, the processing or extraction losses involved in turning the product (especially cereals and oil seeds) into the form in which it is usually sold, and the net food supply available for human consumption. Ideally, each of the component items should be computed independently, or one of them as a residual, so that the, supply and utilization sides should balance (16:181-82).

In actual practice, however, reliable information is not available on several of the component items of the balance sheet. Even the more advanced countries do not attempt to collect complete statistical information on all food production. The most complete crop information in these countries is for grains. Although production estimates are based on crop reporters' subjective impressions about yields, further checking is

possible since the bulk of the produce passes through marketing channels and processing plants. But less developed countries present enormous difficulties because production is on a subsistence level, innumerable holdings are small and scattered, and processing is limited. As in the more advanced countries, estimates of production are based on the subjective judgments of individual reporters, but there is no way of determining the nature of the bias, since very little production enters into trade. Moreover, information on the amounts used as seed; fed to animals; or wasted on the farm, in transport, and in storage is practically nonexistent.

However, the situation is by no means hopeless. The recent emphasis on planned economic development has resulted in increased efforts to improve the reliability and coverage of data in Ceylon. More objective methods of gathering data, such as estimating acreage by sample surveys and yields by crop-cutting experiments, have been introduced since 1952 (10:65). Moreover, imports play a dominant role in Ceylon's food supply. It is estimated that in recent years imports of rice have accounted for about half the total requirements. The dependence is even greater for subsidiary foodstuffs like wheat flour, potatoes, sugar, pulses, and condiments (11:230). Equally significant is the importance of domestically produced rice in the total food supply. Rice is by far the most important crop in the peasant economy and available statistical information is most complete in the case of rice. The estimates of gross food supply arrived at on the basis of information available for the domestic production and imports of rice, as well as the imports of several other foodstuffs, can therefore form the basis of a fairly reliable food balance sheet.

Furthermore, given domestic production, reasonable approximations can be made of the amounts of several other components of the balance sheet. Items such as seed, animal feed, and waste do not constitute a sizable portion of production and it is unlikely that errors in estimating them could seriously distort the final calculations. It is also possible to arrive at fairly reliable approximations of these items on the basis of traditional customs and practices and general experience of the area. For example, peasant farmers use seed largely according to tradition. It would be most unusual for a peasant to depart from the customary quantities used per acre. Similarly, no significant amounts of human food are apt to be used as animal feed, since the animal industry is relatively insignificant in Ceylon (11:258-59). The handful of poultry and the few cattle or goats that the peasant family may own normally fend for

themselves. Even the few dairies that supply the urban centers rely on oil cakes and rice bran as supplements rather than on grain feed.

Wastage is also likely to be small in Ceylon. Since production is largely of a subsistence nature, losses in the distributive processes are small. The losses occurring on farms are also much smaller than those associated with the mechanized forms of agriculture employed in the more advanced countries. On the other hand, wastage is likely to be high for fruits and vegetables because refrigeration facilities are lacking.

Food Balance Sheet, 1955-60

Table 4.4 presents in balance sheet form the estimates of the average amounts of various foodstuffs available to the population of Ceylon over a 6-year period from 1955—60. By employing an average, the problem of estimating stock changes is avoided. At the same time, major year-to-year variations arising from climatic and other natural causes can also be eliminated. Practically all of the estimates of domestic production given in Table 4.4 are based on official sources (4:7). Where no such data are available, as for fruits and vegetables, the production estimates in the balance sheet represent informed guesses.

The calculation of the net supply of the various commodities involved a number of problems. The basis on which the estimates were arrived at is therefore considered below.

Table 4.4: Food Balance Sheet, 1955-60 (Average population – 9,303,000)

Commodity	Production	Gross exports	Gross imports	Available supply	Seed &feed+	Waste+ +	Non-Food Manu-facture	Gross food supply	Extraction rate	Net food supply	Per capita supply per day		
											grams	Calories**	Protein (grams)**
	thousand metric tons								percentξ	1000 metric tons			
Cereals													
Rice	731.9		712.5	1,444.4	59.4	30.3	-	1254.7	68-72	943.3	277.7	1,000.0	18.90
Wheat flour	-		206.5	206.5	-	-	-	206.5	-	206.5	60.8	223.0	6.00
Maize	7.5		-	7.5	0.5	-	-	7.0	90	6.3	2.0	7.0	0.02
Kurrakan	17.6		-	17.6	0.5	-	-	17.1	90	15.4	5.0	17.0	0.35
Sorghum	0.8		-	0.8	0.025	-	-	0.8	90	0.8	0.3	3.0	0.03
Total												1250.0	25.30
Root and tubers													
Manioc	196.5		-	196.5	-	19.6	-	176.9		176.9	52.1	57.0	0.5
Sweet potatoes	38.9		-	38.9	-	3.8	-	35.0		35.0	10.4	10.0	0.1
Potatoes	0.5		36.0	36.5	-	3.6	-	33.0		33.0	9.6	7.0	-

Commodity	Production	Gross exports	Gross imports	Available supply	Seed &feed+	Waste+ +	Non-Food Manu-facture	Gross food supply	Extraction rate	Net food supply	Per capita supply per day		
											grams	Calories**	Protein (grams)**
	thousand metric tons								percentξ	1000 metric tons			
Total												74.0	0.6
Sugar													
Refined	-		144.0	144.2	-	-	-	144.2		144.2	42.5	164.0	-
Not refined	-		20.8	20.8	-	-	-	20.8		20.8	6.0	21.0	-
Jiggery	-		4.2	4.2	-	-	-	4.2		4.2	1.4	5.0	-
Total												190.0	-
pulses													
Dhall	-		9.2	9.2	-	-	-	9.2		9.2	2.7		
Green gram	3.6		9.4	13.0	0.22	-	-	12.8		12.8	3.8		
Black gram	-		4.2	4.2	-	-	-	4.2	4.2		1.4		
Chick peas	-		4.9	4.9	-	-	-	4.9	4.9		1.4	58.0	12.7

Commodity	Production	Gross exports	Gross imports	Available supply	Seed &feed++	Waste++	Non-Food Manu-facture	Gross food supply	Extraction rate	Net food supply	Per capita supply per day		
											grams	Calories**	Protein (grams)**
	thousand metric tons								percentξ	1000 metric tons			
Lentils	-		16.6	16.6	-	-	-	16.6	16.6		5.0		
Other	2.5		5.8	8.3	0.13	-	-	8.1	8.1		2.5		
Total												58.0	12.7
Vegetables	475Π		-	475.0	-	25.0	-	450.0		450.0	125.2	28.0	1.7
Fruits	55.0Π		-	55.0	-	5.0		50.0		50.0	14.8	9	0.06
meat	12.9		-	12.9	-	-	-	12.9		12.9	3.8	6.0	0.60
Beef	0.9		-	0.9	-	-	-	0.9		0.9	0.3	0.2	0.04
Mutton	1.3		-	1.3	-	-	-	1.3		1.3	0.3	0.4	0.04
Pork	1.1		-	1.1	-	-	-	1.1		1.1	0.3	0.9	0.04
Poultry	0.1		-	0.1	-	-	-	0.1		0.1	0.3	0.4	0.04
Canned meat	_			-	-	-	-	-		0.1	-	-	-

Commodity	Production	Gross exports	Gross imports	Available supply	Seed &feed+	Waste+ +	Non-Food Manu-facture	Gross food supply	Extraction rate	Net food supply	Per capita supply per day		
											grams	Calories**	Protein (grams)**
	thousand metric tons								percentξ	1000 metric tons			
Total												7.9	7.6
Eggs	7.5ل		1.4	8.8	-	-	-	8.8		8.8	2.5	4.0	0.3
Fish													
Fresh	42.8		-	42.8	-	10.7	17.3	15.0		15.0	4.4	6.0	0.8
Dried	5.9		38.8	44.7	-	-	-	44.7		44.7	13.2	40.0	6.0
Tinned	-		40	4.0	-	-	-	4.0		4	1.4	4.0	0.3
Total												50.0	7.1
Milk													
Cow	57.1ل		-	57.1	-	-	-	57.1		57.1	14.0	9.0	.5
Buffalo	15.2ل		-	15.2	-	-	-	15.2		15.2	4.4	4.5	.2
Milk foods	-		1.6	1.6	-	-	-	1.6		1.6	.6		

Commodity	Production	Gross exports	Gross imports	Available supply	Seed &feed+	Waste+ +	Non-Food Manu-facture	Gross food supply	Extraction rate	Net food supply	Per capita supply per day		
											grams	Calories**	Protein (grams)**
	thousand metric tons								percentξ	1000 metric tons			
Oils & fats												13.5	.7
Coconut	2300.5	6.7	-	2,293.8	-	-	2,213.8	80.0	-	80.0	24.0	42.0	.5
Coconut oil	1100.0	750.0	-	325.0	-	-	-	325.0	-	325.0	37.0	320.0	-
Butter			0.1					0.1		0.1		0.2	
Total												362.2	.5
TOTAL												2046.7	49.7

∗Production estimates, unless otherwise indicated, and trade data from Ceylon, Dept. Census and Stat., *Statistical abstract of Ceylon* (various issues).

+Seed rates at 2 bu/ A for rice, 3% for other cereals, and 5% for pulses based on customary practices, as adapted by FAO in FAO, *Food balance sheets*, 1957-59 *average* (Rome, 1963). No allowance made for animal feed as insignificant quantities used as feed (see text).

++Wastage allowed at 5% rate for domestic rice, 3% for imported rice, 10% for roots, tubers, vegetables, and fruits, and 25% lor fresh

fish. These rates seem reasonable and approximate those used by FAO for India and Ceylon. In other cases, rates or quantities concerned are considered insignificant.

ξExtraction rates of 68% applied for milled imported rice, 70% for milled brown rice, and 72% for hand-pounded rice. These appear to be the normal rates used in India (India, Min. Food and Agr., Econ. and Stat. Adm., *Rice Economy of India,* 1961, p. 36).

ΠBased on estimates of area under town and village gardens and of numbers of fruit trees in Ceylon, Dept. Census and Stat., *Census of Agriculture*, 1952, as well as data on collections made by the Marketing Dept., Govt. of Ceylon.

ȷ Derived by applying average production rates to numbers, as given in Ceylon, Dept. Census and Stat., *Statistical Abstract of Ceylon* (various issues).

**Energy and protein values from FAO, *Food Composition Tables - Minerals and Vitamins — For International Use* (Rome, 1954).

+Manufacture of dried fish.

++Manufacture of coconut oil.

Cereals. Cereals as a group supply 1250 calories out of the 2046 calories that are estimated to be available per person per day. Rice alone accounts for about 1000 calories.

The acreage, yield, and production of paddy (unhusked rice) as published in official sources is shown in Table 4.5. To arrive at gross supply, domestic production is adjusted for net imports. Because rice is imported mainly in the form of highly milled white rice, it was converted into paddy equivalent by using a conversion factor of 68 percent. This is a commonly used factor, but the rate itself is not significant here, since the paddy equivalent was converted back into rice to estimate net supply on the same basis.

To arrive at the net supply, deductions are made for nonfood use. Lacking information on the quantities used as seed, rates that are in traditional use were applied. Two bushels to the acre are normally used in broadcast sowing, with a little more than half this amount being required where transplanting is practiced. These rates were applied to the acreages under broadcast sowing and transplanting shown in Table 4.6. No allowance was made for animal food or nonfood manufacturing; this is negligible.

Table 4.5: Ceylon: Acreage, yield, and estimated production of paddy, 1955-1960°

Year	Gross acres sown	Gross acres harvested	Net acres harvested+	Avg. yield per not acreage harvested++	Estimated production J
	thousands			bushels	1000 bushels
1955	1,347	1,285	1,092	32.5	35,700
1956	1,178	1,052	894	29.5	26,400
1957	1,206	1,138	967	32.2	31,280
1958	1,382	1,239	1,053	33.0	36,600
1959	1,330	1,228	1,043	35.0	36,400
1960	1,468	1,393	1,183	36.5	43,000

° Based on data in Ceylon, Dept. Census and Stat., *Statistical Abstract of Ceylon* (various issues).

+ Estimated at 85% of gross acreage harvested. Correction factor of 15% allowed for over estimation. See text for discussion.

+ Based on crop-estimating surveys.

J Estimated as product of net acreage harvested and yield per net acre harvested.

Table 4.6: Ceylon: Area under paddy and extent transplanted, 1955—1960°

Year	Area under paddy	Area transplanted
	thousand acres	
1955	1,347	81
1956	1,204	105
1957	1,208	73
1958	1,382	80
1959	1,309	76
1960	1,468	74

° Based on data in Ceylon, Dept. Census and Stat., *Statistical Abstract of Ceylon* (various issues).

In allowing for wastage, rates of 3 percent of domestic production 2 percent for imported rice were used. Wastage here refers to wastage storage and transportation. Virtually no information is available on wage rates for Ceylon, but it is unlikely to be high under peasant farm conditions. Besides, rice can be stored over fairly long periods of time though it is subject to insect damage. Wastage rates used in India have been applied to Ceylon and seem proper, although the figure might lowered for imported rice, which is used mainly in urban areas and stay for only short periods.

The extraction rates used for domestically produced rice varied between 70 and 72 percent, depending on whether it was machine-milled bran rice or hand-pounded. This is in line with rates generally prevailing India (25:36). Most producers are believed to consume hand-pounded rice. On this basis, about 40 percent of the domestic production is hand-pounded; official statistics indicate that producers retain about 40 percent of their crop and sell the remainder to the government under the guaranteed purchase scheme (Table 4.7).

Table 4.7: Ceylon: Purchases of paddy under government guaranteed purchase scheme, 1955-1960°

Year	Production	Purchases	Purchases as a portion of production
	1000 bushels		Percent
1955	35,700	13,405	38
1956	26,400	9,728	37
1957	31,280	13,110	42
1958	36,600	16,260	45
1959	36,400	16,640	46
1960	43,000	21,835	51

° Data from Ceylon, Dept. Census and Stat., *Statistical Abstract of Ceylon* (various issues).

In computing per capita supplies, the average population was calculated from estimates of mid-year population based on census data; there seems to be no reason to question these figures (7). The calorie and nutrient composition was computed on the basis of figures prepared by the Food and Agriculture Organization of the United Nations (FAO) (19).

Among the other cereals consumed, wheat flour is wholly imported. No deductions were made for nonfood uses; these are considered to be negligible. The locally produced cereals such as maize, sorghum, and kurakkan (Eleusine Coracana) contribute relatively insignificant quantities to the total food supply. The seed and extraction rates of 5 and 90 percent, respectively, are arbitrary, but are in close agreement with rates used in India (18).

Roots and tubers. The estimated contribution of roots and tubers to the total food supply is relatively small, amounting to only 74 calories per head per day. No allowance was made for seed, since these crops are mainly propagated by cuttings. Very little, if any, are fed to animals. Wastage was estimated at 10 percent; this is an arbitrary figure, but it is likely to be higher than for grains because roots and tubers neither transport nor keep well. On the other hand, the harvesting of manioc and, to a lesser extent, of sweet potatoes, can be delayed to suit requirements.

Sugar. Sugar in its different forms is entirely imported. No allowance was made for wastage because it is considered to be negligible. Sugar is not used for any nonfood manufacture in Ceylon.

Pulses. Pulses contribute an estimated 58 calories per head per day, but are next in importance to cereals as a source of protein. Pulses are largely imported, domestic production being confined to green gram and cowpeas (included under the item "other"). Since the gross available supply of each crop is small, any refinements that might be introduced by making allowances for nonfood use would be insignificant.

Vegetables and fruits. Very little information is available on the production of these crops. The only available basis for estimating production is to make use of data put out by the government marketing department on their yearly collections of vegetables and fruits from producers. These probably represent about 10 to 15 percent of the total volume marketed (9). It is believed that only about half the total production enters marketing channels. Wastage was assumed at 20 percent for both fruits and vegetables.

Meat. Estimates of production of the different types of meat are based on official slaughter data (Table 4.8). In converting these into dressed carcass weights, the average dressed weights as reported in the FAO publication on technical conversion factors were used (22). These are in general agreement with scattered information in official publications of the government of Ceylon (11:258-70). It was assumed that wastage is negligible.

Milk and eggs. No official estimates are available; production was estimated on the basis of official figures on numbers of cattle and poultry and on average production as given in official reports (11:269). It was assumed that one-third of the cattle and one-quarter of the poultry are in production.

Fish. Data on the production of fresh and dried fish is based on official reports (Table 4.9). In the case of fresh fish, wastage was estimated at 25 percent. Wastage is likely to be high due to the absence of refrigeration facilities. In estimating the quantity of fresh fish that is cured, the fresh fish equivalent of dried fish was calculated, using a conversion factor of 35 percent (11:313).

Table 4.8: Ceylon: Estimates of production of beef, buffalo meat, mutton, pork, and poultry, average 1955—1960

Animals	Average population*	Average total slaughter*	Dressed weight per head ∫	Estimated production
			pounds	metric tons
Cattle	1,463,000	177,400	72.0	12,900
Buffaloes	767,000	6,127	125.0	950
Sheep and goats	533,500	157,360	8.0	1,260
Pigs	62,000	16,411	68.0	1,125
Poultry +	850,000	297,500	0.9	120

*Data except for poultry, based on Ceylon. Dept. Census and Stat., *Statistical Abstract of Ceylon* (various issues). Slaughter data deficient; about 15% average of local administrative bodies not reporting numbers slaughtered.

∫ Dressing weights from information in Ceylon, Natl. Planning Secretariat, *The Ten-Year Plan,* 1957, pp. 265-270.

+ Based on 1957 data in Ceylon, Natl. Planning Secretariat, *The Ten-Year Plan, 1957*. Slaughter rate based on assumption that 35% of poultry population used annually for meat. A dressing weight of 2 pounds is used.

Table 4.9: Ceylon Landings of fresh fish and production of cured fish (dried weight), 1055 1900°

Year	Fresh fish J	Dried fish
	metric tons	
1955	38,647	5,792
1956	38,642	5,765
1957	36,983	7,572
1958	39,363	5,579
1959	44,126	5,135
1960	48,452	5,960

° Based on data in Ceylon, Dept. Census and Stat., *Statistical Abstract of Ceylon* (various issues).

J Excluding trawler landings

Fats and oils. Coconuts, both raw and as oil, are ranked next to rice in importance as suppliers of calories. Production is estimated on the basis of the area under cultivation and average yields. Large quantities of coco-

nut, mainly as oil and desiccated coconut, are exported. While export figures are available, no information is available on total domestic production of these items. It was assumed that half of the domestic production is consumed locally and the balance exported (11:210—12).

Evaluation of the Balance Sheet

The balance sheet yields an average calorie availability of 2046 per head per day for the period 1955—60. A certain margin of error in this figure is to be expected because of the unsatisfactory nature of **a** part of the data on which it is based. The nature of a good part of the data makes it impossible to place any statistical limits to the range of error. But a subjective evaluation of the data underlying the balance sheet estimates is revealing.

Table 4.10 presents a classification of the component items of the food balance sheet according to the degree of reliability. Group I includes all those items that are wholly imported. Since trade data for Ceylon are quite reliable, that portion of the food supply made up of imports can be accepted as being subject to no sizable error. Total, imports contribute about 50 percent of the per capita calorie supply.

Domestically produced rice, which makes up Group II, accounts for about 20 percent of the calorie supply. As the most important crop of the peasant economy, the government has attempted to arrive at reliable estimates of production. But the methods used leave room for error.

Acreage is based on reports sent in by village officials, and yields per acre are derived from crop-cutting surveys. A correction factor of 15 percent is applied by the Statistics Department to acreage figures; sample surveys have revealed the estimates of village officials to be overestimates (10:65). In estimating yields, crop-cutting experiments are conducted during the “maha” or major and “yala” or minor seasons of each year for each district (10:65).

Table 4.10: Subjective evaluation of range of error for estimates of Ceylon food balance sheet, average 1955—1960*

Commodities	Calories	Maximum downward error	Probable minimum calories	Maximum upward error	Probable maximum calories
	no.	percent	no.	percent	no.
Group I					
Rice imports	504				
Wheat flour	223				
Potato imports	7				
Sugar imports	190				
Pulses imports	52				
Dried fish imports	35				
Tinned fish imports	4				
Egg imports					
Total	1015		1015		1015
Group II					
Rice production	496	15	422	10	546
Group III					
(a) Cereals	27	10		25	
Pulses	6	10	90	25	125
Roots and tubers	67	10		25	
(b) Coconut	362	10	326	20	434
(c) Meat	8		8	25	10
Fish	15		15	25	19
Total	485		439		588
Group IV					
Milk	14	50	7	100	28
Eggs	3	50	2	100	6
Fruits	9	50	4	100	18
Vegetables	28	50	14	100	56
Total	54		27		108
Total calories	2050		1903		2257
Total percent error		93		110	

***** See text for discussion of error ranges.

The estimation of the area under rice production poses some difficult problems. Because rice is rather specific in its requirements for water, wide differences are likely to arise between the areas sown and harvested, especially in rain-fed areas. It is likely that when village officials

report the acreage harvested, they may be influenced by earlier estimates based on acreage sown; this may explain the overestimation revealed by sample surveys. However, the correction factor of 15 percent seems large enough, especially in recent years when reporting at the village level are more likely to be accurate because official interest in rice production is greatly increased.

In estimating yields per acre, a different set of problems arise. It is a widely held view that estimating yields from an unharvested crop, the "biological" yield as it is called, is likely to overestimate actual yields (16:193). This is mainly because it does not take into account the harvesting losses that arise subsequently. In fact, in Soviet Russia where crop cutting was first employed, a discount of 10 percent was initially allowed for in such losses (27:542). It can be argued that such losses are unlikely to be of a high order in a less developed country, where it may be presumed that peasants are more careful of every grain produced. Moreover, losses in intensive rice production are unlikely to be as high as in the mechanized grain- producing areas of the temperate zone. But considering harvest conditions in Ceylon, some losses are to be expected. Harvesting is done by hand and threshing with bullocks. Losses arise in winnowing methods and; in transporting and drying the grain.

It must also be realized that crop sampling is carried out on an extensive scale by personnel who are not necessarily well trained. It has been found in India that when very small plots are used for sampling, a bias towards, overestimation results because of a tendency to pull in plants on the boundary that should properly be left out (35:142). The same tendency would probably be carried over to the larger plots commonly used in sample surveys. It therefore seems likely that any bias would be towards an overestimation of yields, but the degree is not likely to exceed about 15 percent.

On balance, the possibilities of underestimation cannot be ruled out, especially because errors are likely to arise in estimating acreage. As a safeguard against such a possibility, it seems desirable to leave a margin of at least 10 percent. Actual production could therefore lie between 10 percent above and 15 percent below the figures used in the balance sheet.

In Group III are placed all those items that probably tend to be under rather than overestimated. Three different categories are in this group. First, are the estimates of domestic production of the minor cereals, roots

and tubers, and pulses. While official estimates of production are available for all these, no effort has been made (as for rice) to assess their reliability through sample surveys. Production estimates are based on reports supplied by village officials (10:65). The bias, if any, is likely to be towards underestimation. The cultivation of these crops is carried out in widely scattered areas, notably in the rather sparsely populated areas of the Dry Zone and consequently there is a greater likelihood of under- than of overestimation. On the whole, a range of 10 percent below to 25 percent above the figures given in the balance sheet would seem to represent a safe margin.

Second are coconuts, the most important item in Group III, accounting for about 20 percent of the total calorie supply. Coconuts are grown on plantations, smallholdings, and town and village gardens. Plantations are defined as holdings of more than 10 acres, smallholdings as being less than 10 acres; town and village gardens refer to the trees that are invariably found in every dwelling compound. This type of acreage accounts for about 15 percent of the total coconut-growing area (11:212). While estimates of production on plantations and smallholdings arc made on the basis of sample surveys, the allowances for production in town and village gardens are at best rough approximations and probably underestimated. On balance, a margin of error of 20 percent above and 10 percent below the figures recorded in the balance sheet seems reasonable.

Meat and fish are the other items in Group III. Estimates of meat products have been based on licensed slaughtering reported by village, urban, and municipal councils. However, coverage is not complete. There is also the possibility of illegal slaughtering, although religious taboos make this seem unlikely. The balance sheet figures are therefore probably underestimates, and a margin of error of 25 percent above the estimates seems reasonable. There is no likelihood of overestimation.

Estimates of the fish supply are based on the production records maintained by the Ministry of Fisheries. It is improbable that the Ministry has been able to maintain accurate records of the fish catch. Moreover, the estimates do not include trawler landings, although they are still not very important. The error is therefore bound to be toward underestimation and a margin of 25 percent is allowed.

In Group IV are included milk, eggs, fruits, and vegetables, for all of which no estimates of production are available. For milk and eggs,

production has been estimated on the basis of average production per head and on official estimates of the number of cattle and poultry. These figures are subject to a wide margin of error. Estimates of fruits and vegetables are based on the acreage in town and country gardens. A wide variety of vegetables and fruits are grown in Ceylon for which no yield figures are available. In addition, there is no way of knowing the size of the area growing each type of vegetable and fruit. While some information is available concerning the area used for the more important type of fruit trees, it is unlikely that it takes into account all of the trees that are scattered over the compounds of most dwellings. For the same reason, it is also unlikely that the estimates for vegetables fully consider the output of backyard gardens. On the whole, the estimates in this group are little more than reasoned guesses and are subject to a large margin of error. But it is unlikely that they are underestimated by more than 100 percent or overestimated by more than 50 percent.

The total effect of the application of the error margins for the various balance sheet components results in an error range of 93 to 110 percent of the balance sheet figure of 2046 calories calculated to be available to the population of Ceylon per head per day. Probably an average of the maxi mum and minimum availabilities resulting from the subjective evaluation should give a better estimate of the per capita supply per day. It would not, however, give any basis for estimating the supply of the individual foodstuffs that go to make up the balance sheet.

III. Evaluation of Agricultural Data: Consumption Estimates

The estimate of food supplies derived in the balance sheet exercise can be cross-checked for reliability with data from consumption studies. Such data are, however, not plentiful for Ceylon. Only the surveys on consumer finance conducted by the Central Bank of Ceylon in 1953 and 1963 (2; 3) are comprehensive enough to provide detailed information. The dietary survey conducted in 1957 (6) and the number of nutrition surveys carried out in the immediate postwar years are too restricted in scope to permit thorough analysis. The dietary survey was restricted to upper-income households, while the nutrition surveys were in the main confined to low-income, rural groups and the representativeness of the samples are open to question. Therefore, only the 2 Central Bank surveys are examined in detail.

Central Bank Consumer Surveys

The 1953 and 1963 consumer surveys were undertaken by the Central Bank with the basic objective of securing detailed information on consumer finance. The 2 surveys were alike in many respects, although the size and sampling techniques differed. Their main features are summarized in Table 4.11.

The surveys included only private, households, but covered the whole country. Information on expenditures was collected on a monthly basis in 1953 and for the 2 months immediately preceding the survey in 1963. The method of direct interview was followed and enumerators were required to visit each household at least thrice. For food expenditures, both surveys sought data on actual consumption during the week of the survey. The findings were subsequently blown up to obtain monthly figures for 1953 and for 2 months in 1963.

The household was the unit of sampling, with household lists maintained by the government for the issue of rice ration books being the sampling frame. The population was stratified into an estate and non-estate sector in 1953, and into urban, rural, and estate sectors in 1963. The 1963 survey went further and also analyzed the data on a regional basis. The island was divided into 4 zones and consumption data presented for each. Zone I included Colombo, the capital city, and adjoining districts. It is, therefore, more or less urban in character. Zone II included the north central and south eastern districts of Ceylon and is typically rural. Zone III was confined to the Tamil-speaking areas and includes both urban and rural areas. Zone IV was essentially estate in character, being confined to the areas where plantation agriculture predominates.

In both surveys, the number of households selected from each sector was made proportionate to its population. Whereas the 1953 survey was based on cluster sampling, a 2-stage, stratified, sampling design was employed in 1963.

Both surveys present their findings in terms of income ranges. As indicated in Table 4.12, the sample sizes for the extreme income ranges in some sectors and zones in the 1963 survey are very small. Consequently, these observations have to be interpreted with extreme caution.

While the unit of sampling was the household in both surveys, the data were collected in terms of “spending units.” All individuals, including

dependents, who pooled their incomes for major items of expenditure constituted a, spending unit. This is no drawback if information is available on the size and composition of spending units. While such information is available for the 1963 survey, the age-sex breakdown is not presented in as much detail as to be of the greatest use.

Sample surveys, if properly carried out, can yield accurate information. But in less developed countries, a great many difficulties must be surmounted. Errors both of a sampling and nonsampling nature can easily be introduced. It is, therefore, necessary to test the data before using it, to get some impression of its overall reliability.

The representativeness of the surveys may be judged by comparing them with recent population censuses. Unfortunately, the results of the 1963 census of population have yet to be released. However, estimates of the midyear population made by the Registrar General's Department, based on the 1953 census and on records of births and deaths, may be utilized.

Table 4.13 shows the racial distribution of the population according to the 1953 census and the 1953 and 1963 surveys. The percentage distribution of the different races seems close enough. The only noteworthy discrepancy relates to the Kandyan Sinhalese. The reason that the proportion of Indians has fallen is probably that many have left Ceylon since 1953.

Table 4.11: Survey characteristics, 1953 and 1963°

Areas surveyed	Total no. households (estimated)	Number selected	Number used	Average size of household	Average no. spending units per household	Average size of spending unit	Sampled population
1953							
All island	1,589,297	1,100	970	5.34	1.12	4.77	5,179
1963							
All island	2,220,811	5,184	4,984	5.75	1.08	5.31	28,688
Urban	338,298	835	768	5.97	1.21	4.93	4,590
Rural	1,659,040	3,799	3,671	5.70	1.07	5.34	20,916
Estate	223,473	550	545	5.80	1.02	5.69	3,162
Zone I	-	-	3,671	5.70	1.11	5.12	10,094
II	-	-	548	5.58	1.05	5.31	3,056
III	-	-	549	5.47	1.07	5.12	3,004
IV	-	-	2,115	5.92	1.07	5.52	12,514

°Based on data from Ceylon, Central Bank of Ceylon. *Survey of Ceylon's Consumer Finance, 1953* (1954) and *ibid.., 1963* (1965).

Table 4.12: Ceylon: Distribution of spending units by income classes, sectors, and zones. Consumer survey 1963°

Sector and zone	Income class								
	0 to 50	51 to 100	101 to 200	201 to 400	401 to 800	801 to 1000	1001 to 2000	2001 to-3000	3000+
	Rupees/ 2 months								
Urban	19	60	159	268	208	144	28	22	22
Rural	171	411	1,063	1,337	682	210	16	12	11
Estate	3	13	94	293	137	14	1	-	1
Zone I	54	146	426	666	418	191	29	25	18
II	31	52	163	201	97	24	1	2	4
III	32	48	127	202	119	49	6	1	2
IV	76	238	600	829	393	104	9	6	10
All island	193	484	1,316	1,898	1,027	368	45	34	34

°Based on data from Ceylon, Central Bank of Ceylon. *Survey of Ceylon's Consumer Finance, 1963 (1965).*

Table 4.13: Ceylon: Racial distribution as percentage of total population, 1953 and 1963°

Race	Census 1953	Survey 1953	Survey 1963
	percent		
Kandyan Sinhalese	26.6	25.4	29.9
Low Country Sinhalese	42.8	43.9	43.6
Ceylon Tamils	11.2	12.6	10.3
Indian Tamils	12.2	11.2	8.7
Others	7.1	6.8	7.5

°Based on data from Ceylon, Dept. Census and Stat., *Census of Ceylon*, 1953; Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances*, 1953 (1954); and *ibid*., 1963 (1965).

Table 4.14 indicates the sex distribution of the population according to the different sources. While the survey data on the whole decreases the difference in the proportion of males to females, there is no apparent contradiction, and the survey estimates lie close to the census figures. The age distribution of the population according to the 1961 midyear

estimate of the population and the 1963 survey is indicated in Table 4.15. Although the age groupings are not strictly comparable, the closeness of the distributions is striking.

Table 4.14: Ceylon: Sex distribution, 1953, 1961, and 1963°

Sex	Census 1953	Survey 1953	Midyear population 1961	Survey 1963
	Percent		Percent	
Male	52.7	51.7	52.9	50.7
Female	47.3	48.3	47.1	49.3

°Based on data from Ceylon, Dept. Census and Stat,, *Census of Ceylon, 1953;* Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1953* (1954); and *ibid., 1963* (1965).

Table 4.15: Ceylon: Age distribution, 1961 and 1963°

Age group	Midyear population 1961	Age group	Survey 1963
	Percent		Percent
0-14	40.6	0-13	40.5
15-19	9.7	14-18	11.5
20-55	43.7	19-55	40.7
55+	6.1	55+	7.2

°Based on data from Ceylon, Dept. Census and Stat. *Statistical Abstract of Ceylon, 1963*; Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1963* (1965).

In addition to testing for external representativeness, the reliability of consumption surveys can also be checked through an examination of their internal consistency. In this connection, expenditure patterns are particularly revealing. If normally expected standards of behavior are mirrored in the data on expenditure, our confidence in the overall reliability of the survey is heightened.

Expenditure patterns. A striking feature revealed by the surveys is the high proportion of total expenditure allocated to food (Table 4.16). Food accounted for 60 percent and 56 percent of all domestic expenditures in 1953 and 1963, respectively. Next in importance came other goods and services and clothing and housing. The decrease in the proportion spent on food between 1953 and 1963 is significant. A high proportion of income devoted to food is characteristic of low-income countries: it reflects the fact that poor people have little money left over after meeting the basic needs of hunger. A decline in the percentage spent on food over time should therefore reflect increasing per capita levels of income. According to the 1963 survey, real incomes did show an increase of 3.62 percent during the 10 years between the surveys (3:71).

Table 4.16: Ceylon: Domestic expenditure patterns. Consumer surveys, 1953 and 1963°

Item	1953	1963
	percent	
Food	59.9	56.2
Clothing	7.9	9.5
Housing	3.6	7.3
Medical	1.3	2.8
Other goods and services	23.2	22.7
Durable consumer goods	3.2	0.4
Taxes (other than income tax)	0.2	0.2
Interest on debt	0.7	0.8
Total	100.0	100.0

°Based on data in Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1953* (1954) and ibid., 1963 (1965).

The 1963 survey also revealed differences in the proportions spent on food between the different sectors and zones (Table 4.17). Percentage expenditures on food ranged from 47 percent in the urban sector to 59 percent in the rural sector and 62 percent in the estate sector. The urban, rural, estate differentials are reflected in the zonal distributions. Thus, persons in Zones III and I, which are more urban than rural, spent 51 and 53 percent respectively on food; whereas, persons in Zones II and IV, which are predominantly rural and estate in character, spent 58 and 60

percent respectively on food. The major reason for such differences would appear to be differences in per capita incomes (Table 4.18).

Table 4.17: Ceylon: Domestic expenditure patterns, by sectors and zones. Consumer survey, 1963°

Item	Urban	Rural	Estate	Zone I	Zone II	Zone III	Zone IV
	percent						
Food	46.6	58.9	61.9	53.4	58.4	50.9	59.9
Clothing	9.7	9.1	11.0	10.3	7.7	9.5	9.2
Housing	12.7	5.9	3.3	9.1	8.0	8.1	5.4
Medical	2.8	3.2	1.4	2.8	4.0	2.8	2.6
Other goods and services	25.5	21.9	21.0	22.9	21.0	27.1	21.5
Durable consumer goods	0.8	0.2	0.4	0.4	0.3	0.5	0.7
Taxes (other than income tax)	0.3	0.1	0.2	0.1	0.2	0.3	0.2
Interest on debt	1.5	4.2	0.9	1.0	0.7	0.7	0.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

°Based on data in Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1963* (1965).

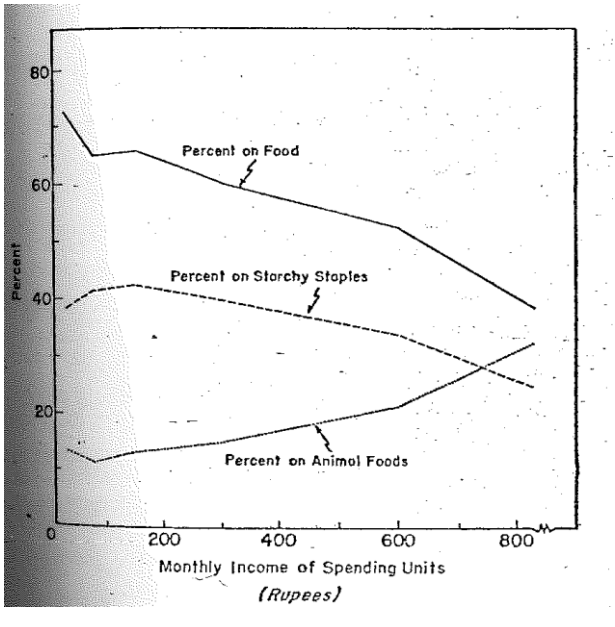
Table 4.18: Ceylon: Average 2-monthly incomes per head, by sectors and zones. Consumer survey, 1963°

Areas	Mean income	Median income
	Rupees	
All island	267	166
Urban	511	296
Rural	254	181
Estate	128	114
Zone I	334	210
Zone II	279	186
Zone III	314	233
Zone IV	206	132

°Based on data in Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1963* (1965).

Another expected feature revealed by the surveys is the decline in the proportion spent on food when income increases. This almost universally observed Engellian relationship is clearly brought out by figures 1 and 2. Food expenditures range from about 70 percent in the lowest income class to about 30 percent in the highest. The relationship is, however, not as clear-cut for some of the sectors and zones in the 1963 survey (figs. 3 and 4). Thus, for the rural and estate sectors, the proportion spent on food shows an initial increase before following the familiar pattern of declining with a rise in income. The initial income levels probably reflect consumption below the poverty line, thus providing the exception to Engel's law. At such levels, increases in income are matched by more than proportionate increases in the expenditure on food. Because the size of the sample in the highest income ranges is small, the observations for the estate and rural sectors do not appear to be representative.

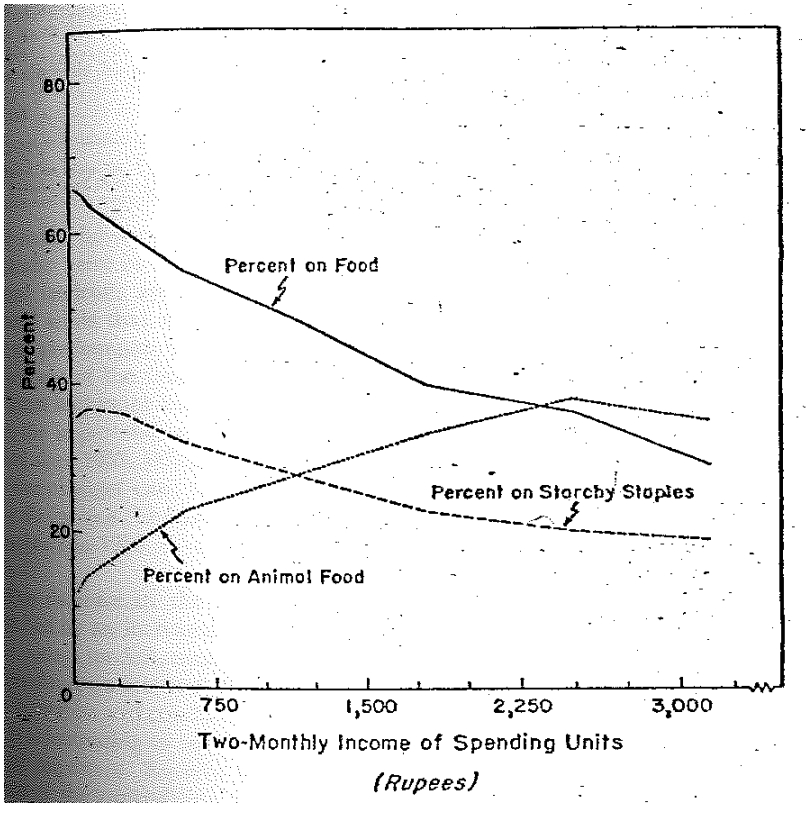
Figure 4.1: Ceylon: Proportion of total expenditure on food and proportion of total food expenditure on starchy staples and animal foods - all-island. Consumer survey, 1953°



°Based on data in Ceylon, Central Bank of Ceylon, *Survey of Consumer Finances, 1953,* (1954).

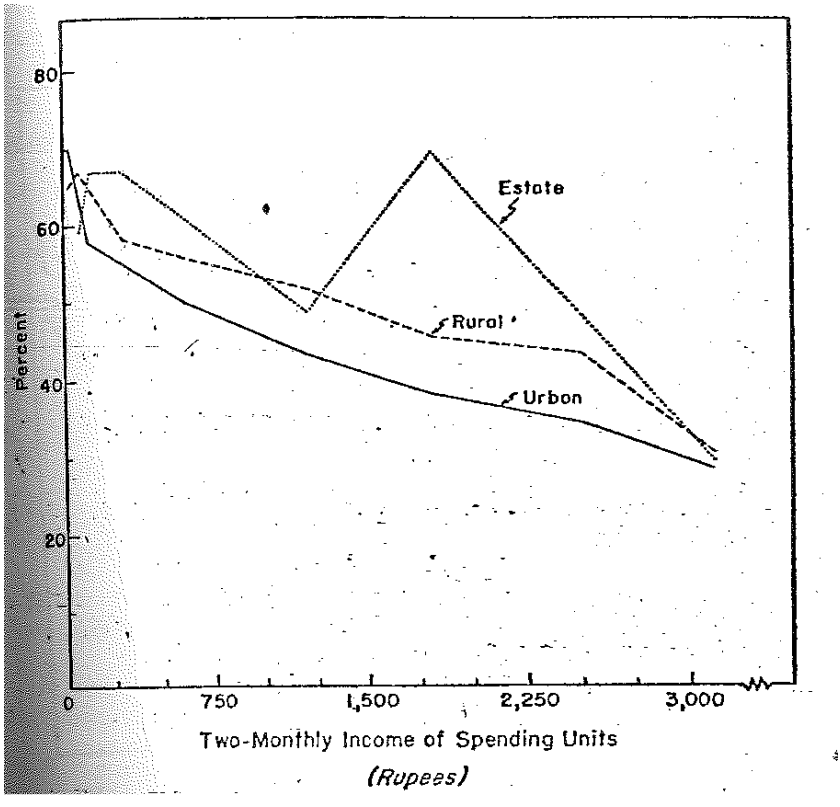
On the whole, a striking conformity of the data to Engel's law is evident. This is a significant indication that the expenditure data presented in the consumer surveys are internally consistent. Another test of internal consistency lies in an analysis of the dietary characteristics.

Figure 4.2: Ceylon: Proportion of total expenditure on food and proportion of total food expenditure on starchy staples and animal foods — all-island. Consumer survey, 1963*



*Based on data in Ceylon, Central Bank of Ceylon, *Survey of Consumer Finances, 1963,* (1965).

Figure 4.3: Ceylon: Proportion of total expenditure on food, by sectors. Consumer survey, 1963*

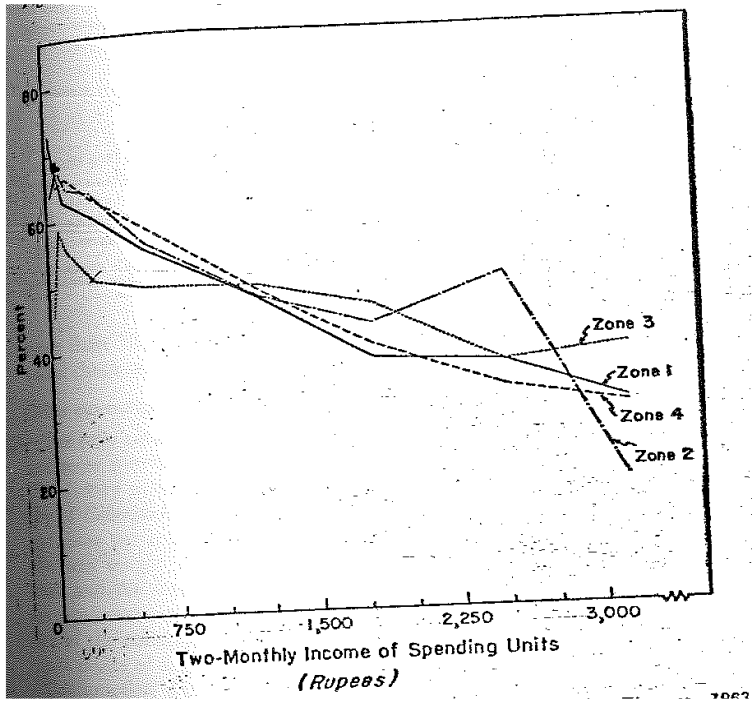


*Based on data in Ceylon, Central Bank of Ceylon, *Survey of Consumer Finances, 1963,* (1965).

Dietary characteristics. Low-income diets the world over are characterized by the importance of starchy staples (1:218). Being the cheapest source of calories, they invariably predominate in diets of poor people. Ceylon is no exception, as indicated by Table 4.19. Percentage expenditure on food items, however, is, not the best indicator of the relative amounts of particular items in the diet Because starchy staples are relatively cheap and animal food costs are high, the importance of the former will be underestimated while that of the latter will be overestimated. But starchy staples still do predominate in the diet. They accounted for nearly 41 percent and 34 percent of the food expenditure in 1953 and 1963, respectively. Rice is the most important item in this

group and wheat is next. But it is significant that the importance of rice as well as of the starchy staple group has declined since 1953. Wheat shows no change.

Figure 4.4: Ceylon: Proportion of total expenditure on food, by zones. Consumer survey, 1963*



*Based on data in Ceylon, Central Bank of Ceylon, *Survey of Consumer Finances, 1963,* (1965).

Price changes can, however, mask the real changes in consumption, as they do for rice. The price of rationed rice was reduced from 40 to 25 cents a measure in 1956. The apparent decrease in consumption is therefore overstated.

The decrease in the importance of starchy staples has, however, been matched by an increased percentage expenditure on animal products. Relative outlays for fish, meat, eggs, and milk have all increased. The

percentage expenditure on fats and oils, sugar, and other foods also increased, while that on vegetables and condiments declined.

It is interesting to note that among the animal products, fish is by far the most important. Equally interesting is the fact that considerable proportions of the expenditure are allocated to vegetables, condiments, and fats and oils, principally coconut. These features simply reflect the rice and curry diet of the people in which vegetables are important and for whose preparations the condiments and coconut are indispensable.

Table 4.19: Ceylon: Domestic expenditure patterns on food items. Consumer surveys, 1953 and 1963°

Item	1953	1963
	percent	
Starchy staples	40.6	33.7
Rice	29.3	19.4
Wheat products	10.1	10.2
Animal products	14.7	20.6
Fish	7.8	8.4
Meat	2.3	5.4
Egg	1.0	1.9
Milk	3.2	4.1
Fats and oils	8.7	9.1
Coconuts	6.2	7.0
Sugar	7.2	9.9
Vegetables	11.3	10.7
Condiments	9.1	5.2
Other foods	8.4	10.8
Pulses	3.3	3.9
Non-alcoholic beverage	∫	4.3
Total	100.0	100.0

°Based on data in Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1953* (1954) and ibid., 1963 (1965).

∫ Included with vegetables

The dietary changes associated with income changes for the 2 broad groups of starchy staples and animal products for the country as a whole are indicated in figures 1 and 2. They follow general expectations: as incomes increase, a smaller and smaller proportion is spent on starchy staples, while the proportion spent on animal products increases.

The relationship at the lowest income levels appears somewhat distorted, possibly because, as mentioned earlier, at very low income levels expenditure on food tends to increase initially with increases in income. For starchy staples, it may lead to an increase in the proportion spent.

The foregoing analysis of the consumer surveys, both in terms of internal and external consistency, points out the overall representativeness of the inquiries. One may therefore proceed to use the information on consumption with a considerable degree of confidence.

Apparent consumption. Table 4.20 presents the limited quantitative data on consumption that are to be got from the 1953 and 1963 surveys. Unfortunately, information on physical quantities is available for only a few food items, since efforts in the 1953 survey to collect this information were not successful (2:20). Moreover, it has not been possible to estimate consumption from expenditure data by using average prices. Price information relating to the period of the 1963 survey was still not available at the time of writing. The available information, however, relates to some major items, of consumption, notably rice, coconut products, and sugar. They add up to more than 50 percent of the total calorie intake. As such, they provide a useful check on the estimates contained in the food balance sheet.

Table 4.20: Ceylon: Apparent caloric consumption of selected items. Consumer surveys, 1953 and 1963°

Item	Consumer surveys 1953	Consumer surveys 1963
	per head/ day	
Rice	842	1,040
Coconuts and coconut oil	450	-
Sugar	134	184
Fish	47	-
Meat	10	-

°Based on data in Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1953* (1954) and ibid., 1963 (1965).

Other consumption data

The only other sources of consumption data are the 1957 dietary survey and some nutritional studies carried out in the immediate postwar years. The dietary survey (6) was confined to upper income householders in the city of Colombo. Only 75 households in the income range of 500 rupees and more per month were investigated. Unlike the bank surveys, information was sought on physical consumption. But because tin; sample was small and the income class responses open-ended, the results may not be too representative. Nevertheless, the data are of some value in giving an idea of the consumption levels at the higher income ranges. The daily per capita intake of selected items is therefore given in Table 4.21.

Table 4.21: Ceylon: Apparent caloric consumption of selected items. Consumer surveys, 1957°

Item	Calories
	per head/ day
Rice	915
Coconuts and coconut oil	539
Sugar	263
Fish	102
Meat	75

°Based on data in Ceylon, Dept. Census and Stat., A Report on a Dietary Survey of Upper Income Householders in the City of Colombo, 1957.

Consumption data are also available in several nutritional surveys carried out immediately after World War II (12; 14). The data, however, are not presented in usable form. The surveys were in the main confined to the rural sector. Moreover, the basis on which the samples were selected is not known, nor is it possible to check on their representativeness. The consumption data is given in terms of consumption units, but no information on the age-sex breakdown is available to express the data in comparable form. But the surveys do provide useful insights into the quality of the diets of those investigated. In general, they indicate that the principal deficiency symptoms are associated with protein deficiency rather than with an inadequate calorie intake (12:21; 14:251).

Consumption Requirements

Estimates of per capita food requirements can also be used to provide further checks on the estimates of food supply. Since there is no evidence of gross undernourishment in Ceylon, it is reasonable to expect that food availabilities will, on the whole, be fairly near recommended food requirements.

No estimates of requirements are available for Ceylon. But estimates of calorie requirements can be made on the basis of the FAO reference man adapted to the Ceylonese environment and to Ceylonese body weights (17: 37-49). Such a calculation is presented in Table 4.22. Average body weights of the adult Ceylonese male and female are placed at 50 and 40 kgs., respectively. This draws on the results of surveys conducted by L. Nicholls (29:342) and H. Cullumbine (13:225). On this basis, requirements are calculated at 1930 calories per head per day.

Table 4.22: Ceylon: Average per head calorie requirements°

Group	Population		Actual requirement scale	
	Males	Females	Males	Females
	percent		calories/head/ day	
0-4	16.1		1,260	
5-9	13.7		1,795	
10-14	5.7	5.4	2,533	2,349
15-19	5.0	4.7	2,784	1,889
20-29	8.7	7.9	2,445	1,689
30-39	7.2	6.2	2,372	1,635
40-49	5.6	4.5	2,298	1,585
50-59	3.4	2.6	2,115	1,458
60-69	1.4	1.2	1,932	1,332
70+	0.4	0.5	1,687	1,163
	Average per head requirements per day: 1,931			

°Adult weights: male, 50 kg; female, 40 kg. Environmental temperature: 25°C. Body weights based on information in L. Nicholls, *Tropical Nutrition* (London 1945), p. 342 and H. Cullumbine "Some Health Statistics for the Ceylonese," The Ceylon *Journal of Medical Science, March 1951, p.225.* Environmental temperature and age-sex breakdown of population from Ceylon, Dept. Census and Stat., *Statistical Abstract of Ceylon, 1963.*

These requirements are calculated at the physiological level and differ from availabilities by an amount equal to cooking losses and plate waste or waste of cooked food. FAO recommends making an average allowance of 10 percent to cover such losses (17:51). A lower figure would seem more reasonable for Ceylon. True, the absence of refrigeration could make for greater spoilage, but marketing practices have been adapted to these conditions, with food products purchased more or less daily. Plate waste is also unlikely to be as high as in the more developed countries.

IV. Present Food Supply Position

Before comparing the several estimates of food availabilities generated in the preceding 2 sections, certain limitations of the data bearing on such a reconciliation should be noted. First of all, the 2 consumer surveys of the Central Bank ignore food eaten outside the household and to this extent understate actual consumption levels. But consumption outside the household is not overly significant in Ceylon. People are more accustomed to carrying food to work rather than eating in restaurants or boutiques. Secondly, since the data on food consumption were gathered over a period of 1 week and blown up to yearly totals, seasonal variation was ignored. The importance of imports is likely to minimize this factor for most commodities, but because the period of the surveys coincided with the major harvesting season, they may possibly overestimate the consumption of rice. Thirdly, the dietary survey relates only to upper-income households. Consumption of fish, meat, and other animal products, and fruits and vegetables will therefore probably be higher than average, while consumption of items belonging to the starchy staple group is likely to be below average.

The estimated daily per capita calorie availabilities arrived at from the balance sheet as well as from the several consumption surveys are shown in Table 4.23. The daily per capita availabilities of rice vary from about 840 calories, according to the 1953 survey, to about 1040 calories in the 1963 survey, a difference of 200 calories. The increased consumption of rice in 1963 may partly be explained in terms of a substitution of rice for wheat flour. As figure 5 indicates, per capita imports of wheat flour have declined over this period. Any tendency for substitution would have been further reinforced by the reduction in the price of rationed rice from 40 cents a measure to 25 cents in 1956.

Table 4.23: Ceylon: Apparent caloric consumption of selected items, from 4 independent sources°

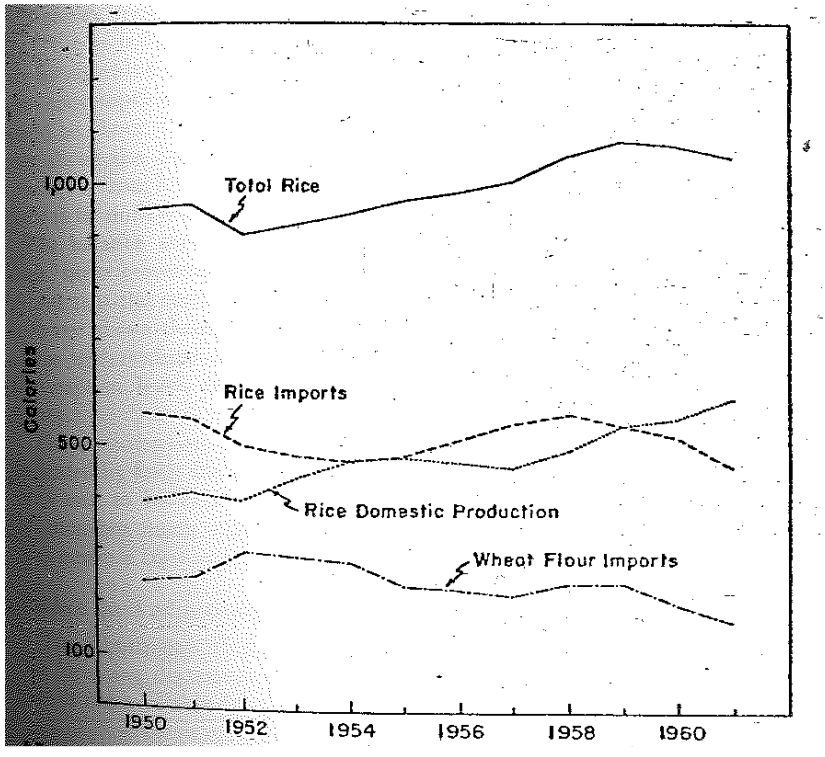
Item	Balance sheet 1955-60	Consumer survey 1953	Consumer survey 1963	Dietary survey 1957
	per head/ day			
Rice	1,000	842	1040	900
Coconuts and coconut oil	362	450	-	539
Sugar	190	134	184	263
Fish	50	47	-	102
Meat	8	10	-	75

°Based on data in table 2; Ceylon, Central Bank of Ceylon, *Survey of Ceylon's Consumer Finances, 1953* (1954) and ibid., 1963 (1965).; and Ceylon, Dept. Census and Stat., *A Report on a Dietary Survey of Upper Income Householders in the City of Colombo, 1957.*

Production and trade data also reflect a fairly consistent upward trend in the per capita availability of rice (fig. 5). There has been a decline in per capita imports of rice, and trade data can be regarded as accurate. Since it is very unlikely that there has been a reduction in per capita consumption, especially in view of the operation of a consumer subsidy on rice, it is clear that domestic production per head must have increased. This does not, however, rule out the possibility of domestic production being overestimated. But it is important to recognize that supply data also reflect the trend towards increasing per capita consumption of rice between 1953and 1963.

Assuming a consistent increase over this period, average per capita availabilities per day for the period 1955-60 will be halfway between the 840 and 1040 calories of the consumer surveys. This will be about 940 calories. The balance sheet for the same period indicates 1000 calories and the 1957 dietary survey indicates 900 calories. It has already been seen that the balance sheet figures are likely to be overestimates while the dietary survey figures are probably on the lower side. Probably a figure of 950 calories per head per day provides a truer indication of actual level of availability.

Figure 4.5: Ceylon: Caloric availability per head per day for specified items. 3-year moving average, 1950-1961*



*Data from Ceylon, Dept. Census and Stat., *statistical Abstract of Ceylon* (various issues).

Consumption at a level of 950 calories per head per day results in a decrease of 50 calories from the balance sheet estimates. This would involve a reduction in the domestic production component of net supply; import quantities are assumed to be free from error. The reduction amounts to about 12 percent and is an indication of the extent to which domestic production of rice is overestimated. The subjective evaluation of the balance sheet arrived at an overestimation of 15 percent.

The balance sheet estimate for coconuts of about 360 calories per head per day has, on the basis of the subjective evaluation, been seen to be an underestimate. No estimates are available from the 1963 survey, but the 1953 survey indicates a level of availability of 450 calories per head per day. This, as indicated earlier, is likely to be an underestimate.

But the dietary survey value of 540 calories is likely to be above average, since it represents consumption by upper-income households. A more realistic average would be about 475 calories. This is an increase of 115 calories or 30 percent above the balance sheet estimates. Since domestic consumption accounts for roughly half of domestic production, domestic production is likely to be underestimated by 15 percent.

The balance sheet estimate for sugar has been seen to be free from error; sugar consumption depends entirely on imports. But it is interesting to note that the consumer survey estimates are below and the dietary survey estimates above those of the balance sheet. This is to be expected, in view of the underestimation of the consumer surveys and the relatively higher consumption levels of the upper-income classes as shown by the dietary survey.

The consumption of fish and meat is probably higher than the levels indicated by both the balance sheet and the consumer surveys. These have been seen to be underestimates. But the dietary survey estimates are unquestionably much higher than the average levels of consumption since they measure consumption by the upper-income households.

Balance Sheet Adjustments

The adjustments that can be made to the balance sheet on the basis of the foregoing discussion are presented in Table 4.24. Since sufficient information is not available from either the consumer surveys or dietary survey, no adjustments are made to the groups represented by other cereals, roots and tubers, pulses, fruits, vegetables, milk, and eggs. These items are relatively insignificant as suppliers of calories in the average Ceylonese diet.

Adjustments are made to the balance sheet estimates of rice, coconut oil, fish, and meat. The balance sheet estimate of rice consumption is reduced by 50 calories while that of coconut oil increased by 115 calories. Fish and meat consumption are also increased by 10 and 4 calories, respectively.

The adjustments made to the balance sheet do not produce any substantial changes. There is only an increase of 75 calories above the original estimates of net availability. This is caused primarily by the compensatory nature of the adjustments.

Table 4.24: Adjusted balance sheet estimates, 1955-60°

Commodity	Balance sheet original estimates	Adjustments		Adjusted estimates	
		Increase	Decrease	Calories	Protein (grams)
	calories				
Cereals	1,250	-	50	1,200	22.6
Rice	1,000	-	50	950	16.3
Others	250	-	-	250	6.3
Roots and tubers	74	-	-	74	0.6
Sugar	190	-	-	190	0.0
Pulses	58	-	-	58	12.7
Vegetables	28	-	-	28	1.7
Fruits	9	-	-	9	0.1
Meat	8	4	-	12	0.8
Fish	50	10	-	60	7.1
Eggs	4	-	-	4	0.3
Milk	13	-	-	13	0.7
Fats and oils	362	115	-	477	0.7
Total	2,046	129	50	2,125	47.3

°See text discussion for basis of adjustments.

Characteristics of the Adjusted Balance Sheet

According to the revised balance sheet, the net supply of food available to the Ceylonese people is the equivalent of 2125 calories and 47 grams of protein per person per day. This represents a diet that is adequate to meet average energy requirements, which were earlier calculated at 1930 calories. When allowance is made for plate waste, available supplies are approximate to requirements. In equating availabilities to requirements, however, an even distribution is assumed. What in fact is likely to exist is a normal distribution with under consumption by a part of the population, presumably the poor. But that this is not serious is borne out by the fact that Ceylon has not suffered from any famine conditions within living memory. The nutrition studies referred to earlier also do not indicate serious undernourishment.

While the food supply suggests an overall adequacy, it is at the same time characterized by an overwhelming dependence on starchy staples and vegetable fats. The main features of the adjusted food balance are summarized below in percentage terms: Table:

Food group	Calories	Protein
Starchy staples	68	50
Cereals	56	50
Tubers	3	
Sugar	9	
Fats and oils	22	
Vegetables including pulses and fruits	5	30
Animal foods	4	19

The starchy staples, including sugar, supply about two-thirds of the calories in the average Ceylonese diet. Rice alone accounts for about 50 percent - a fact that cannot be stressed too strongly. As Bryce Ryan remarks (32: 39), “a meal which is not basically rice is not considered a real meal, and the test of abject poverty is the absence of at least one rice meal during the day.”

The relatively high contribution of fats and oils to the food supply is also noteworthy. This is essentially due to the major role of the coconut in various food preparations.

Between them, the starchy staples and fats and oils account for about 90 percent of the total food supply. The other food groups such as animal foods, vegetables including pulses, and fruits play a relatively insignificant role. The minor role of animal foods in the diet is something that is characteristic of most Asian countries. Contributory factors to this situation are the high cost of such foods and religious prejudice against the consumption of animal foods in a predominantly Buddhist and Hindu society. The nutritional deficiencies that may arise as a result of a low intake of animal food are, however, not compensated by a large intake of vegetables and pulses. It is now generally recognized that vegetable proteins could substitute for animal proteins if consumed in sufficient quantity and variety to make available the essential amino acids. But in the Ceylonese diet nearly 50 percent of the protein is supplied by the cereals, principally rice. It is therefore not surprising that the principal

deficiency symptoms associated with Ceylonese diets are ascribed to inadequate protein intakes (12:2.1).

V. Future Demand for Food

Reliable estimates of the future demand for food, are of substantial importance in formulating plans of economic development. Such estimates are necessary not only to prevent demand from outrunning supply and creating inflationary pressures, but also in determining adequate levels of investment in agriculture. Estimates of future demand must be based not only on a correct evaluation of present requirements but also on a proper understanding of the determinants of the long-term demand for food.

The major factors influencing long-term movements in aggregate demand are population and the pattern and level of per capita consumption. In general, an increase in the size of the population will raise demand at the same rate, while increases in per capita consumption will be determined primarily by increases in income. The major feature of the income-consumption relationship is the tendency for consumption of food to increase at a smaller proportionate rate than income. Expressed as elasticity coefficient, this relationship is a valuable tool in estimating future growth in demand.

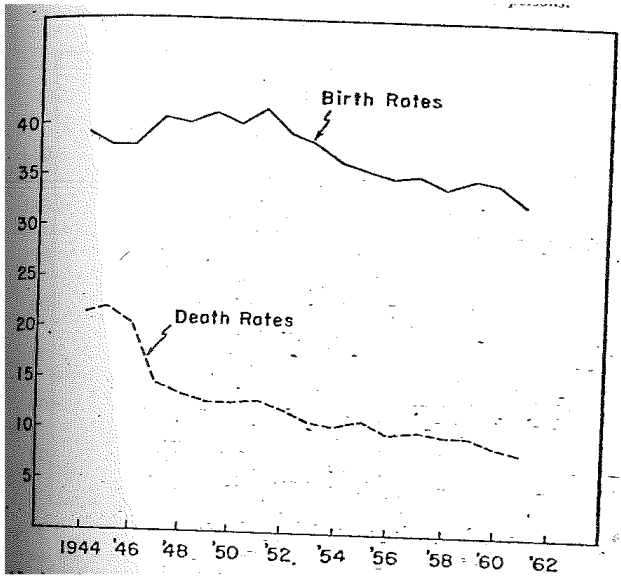
Population and Food Requirements

The rate of growth of population is determined by mortality, fertility, and net migration rates. Population projections are based on assumptions regarding the future behaviour of these rates.

The mortality rate in Ceylon has experienced a steep decline in the post World War II period (Figure. 4.6). Ceylon seems never to have experienced mortality rates quite as high as most of the other less developed countries. Mortality rates fluctuated around 30 per thousand at the beginning of the century and gradually declined, with the extension of medical and sanitary facilities, to around 20 per thousand in the immediate pre-war years. Malaria was still endemic then and the periodic outbreaks in epidemic proportions were primarily responsible for the rather high mortality rates. When, in the immediate post-war period, the widespread use of DDT virtually exterminated the malarial mosquito

overnight, the effect on death rates was dramatic. The crude death rate declined from 20.2 per thousand in 1946 to 14.3 the following year. The further extension of medical and sanitary services led to a continuous decline in the death rate, which stands at about 8.0 per thousand today.

Figure 4.6: Ceylon: Birth and death rates per thousand persons*



*Based on data from Ceylon, Dept. Census and Stat., statistical Abstract of Ceylon, 1963.

Conflicting opinions have been expressed on the future course that death rates will take in Ceylon. N. K. Sarkar in his study, "The Demography of Ceylon," expresses the view that any further decline in the death rate is unlikely unless accompanied by a fundamental social transformation (33: 276). Kingsley Davis in his study of the population of India (15:221-31) also argues that a continued low death rate without a modern economy and a low fertility rate is inconceivable. The relatively slow rate of economic development associated with rapid increases in population is likely to lead to a breakdown in health services and consequently to an upsurge in death rates. A recent study by S. Selvaratnam, on the other hand, projects population on the assumption of a further decline in

mortality rates because of favourable prospects for economic development (34:27).

Comparable mortality rates from the more advanced countries may suggest that death rates in Ceylon have about reached the lowest levels possible.[33] This, however, does not take into account the relatively youthful nature of Ceylon's population. The crude death rate is an inadequate measure for comparing mortality rates because it does not take into account differences in age composition (38:33). The infant mortality rate, which has been called the "most sensitive index of social welfare and of sanitary improvements which we possess," though declining (Figure 4.7) is still rather high.[34] This would suggest that the extension of medical facilities would lead to further declines in death rates. If medical progress and the speed with which it is carried to the underdeveloped countries are also considered, further declines in the mortality rate can be anticipated.

Declining mortality rates in Ceylon have been accompanied by continuing high fertility rates (Figure. 4.7). Indeed, the initial response to improved medical and sanitary conditions following the war was for the birth, rate to rise (26:4). However, fertility is influenced by a number of factors, primarily socio-economic. In the more advanced countries, a rising standard of living has been associated with a decline in fertility rates. It seems too early to say if and to what extent the less advanced countries will follow the same pattern. In general, the spread of education among the female population, as well as their increasing

[33]Crude death rates for some countries (36:550-57):

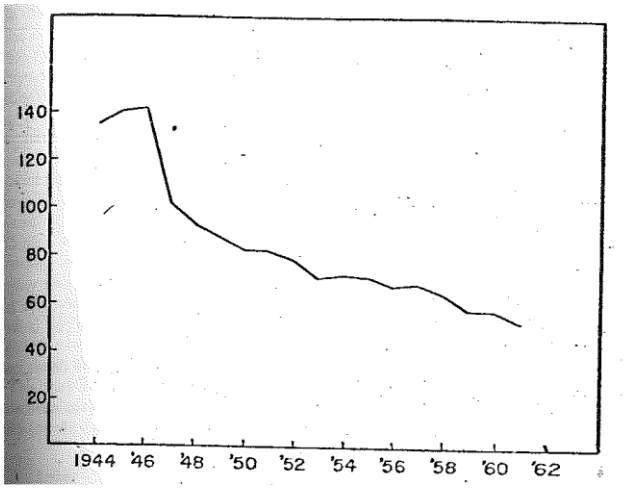
	1945-49	1950-54	1955-59	1960	1961	1962
United States	10.0	9.5	9.4	9.5	9.3	9.4
United Kingdom	11.6	11.7	11.6	11.5	12.0	11.9
Japan	11.8	9.4	7.8	7.6	7.4	7.5
Taiwan .	15 1	10 0	8.0	6.9	6.7	6.4
Singapore	12.5	10.4	7.3	6.3	6.0	5.9

[34] Infant mortality rates for some countries (36: 558-67);

	1945-49	1950-54	1955-59	1960	1961	1962	1963
United States	33.3	28.1	26.4	26.0	25.3	25.3	25.0
United Kingdom	41.0	29.0	24.1	22.5	22.2	22.4	15.0
Sweden	25.7	20.0	17.0	16.6	15.8	15.3	-

participation in work outside the home, leads not only to a rise in the marriage age but also to fewer marriages. Studies in fertility trends in Ceylon indicate that early marriages produce larger families than late marriages (28:15). Urbanization, accompanied by improved economic conditions, may also lead to declines in fertility rates. On the whole, barring any major breakthrough in carrying birth control techniques to the bulk of the population, it seems safest to conclude that if fertility rates do decline, they will do so only gradually.

Figure 4.7: Ceylon: Infant mortality per thousand live births*



*Data from Ceylon, Dept. Census and Stat., statistical Abstract of Ceylon, 1963. Infant mortality is defined as deaths among children less than 1 year old.

The other factor influencing population trends is the net migration rate. In the past, especially in the late nineteenth and early twentieth centuries, immigration of South Indian labour has been an important determinant of population growth in Ceylon. In recent years, however, it has been government policy to restrict immigration and subsequent changes in migration rates have had little influence on population growth. The recently concluded Indo-Ceylon agreement, if implemented, will result in the repatriation of half a million Indians over a period of 15 years. Since net migration rates will depend largely on government policy in the future, they defy forecasting.

Certain conclusions regarding the future rate of population growth can be drawn on the basis of the preceding discussion. Assuming a constant fertility and declining mortality, it is quite conceivable that growth rates may approach, if not exceed, 3.0 percent. On the other hand, assuming a gradual decline in fertility rates and a more or less constant mortality rate, a growth rate of 2.5 percent is possible. It is unlikely that in the immediate years ahead one could anticipate a lower rate.

This may be compared with a number of population projections that have been made for Ceylon recently. The average annual rates up to about 1975 (34:42) are given as follows:

Sarkar	Registrar General of Ceylon	United Nations	Selvaratnam
1.7	2.9	2.5	3.0

Except for Dr. Sarkar's, the projections postulate average rates of growth that fall within the range of 2.5 to 3.0 percent. Dr. Sarkar's, being based on higher mortality rates, gives a lower rate of growth. The present annual growth rate for Ceylon averages around 2.8 percent.

Assuming there are no changes in income levels and in other factors influencing per capita consumption, it may be concluded that the aggregate demand for food would increase by as much as the increase in population. This, however, would be to ignore changes in the age and sex structure of the population which also influence food requirements. But their effect is negligible over a period of 10 to 15 years, and thus it can be ignored.[35]

[35] According to an FAO estimate, assuming a stable fertility rate and a life expectation at birth which would double itself, average calorie requirements will be reduced by about 2 percent over a period 75 years. If the increase in life expectation is accompanied by a decline in fertility rates, the proportion of aged persons increases; this can lead to an increase in calorie requirements of about 3 percent over 50 years (21:6).

Income and Food Consumption

Income has long been regarded as one of the major influences on the pattern and level of food consumption. Engel summarized this relationship in a well-known law which states that the proportion of income spent on food decline with increase in income. This may, however, not hold true at very low levels of income, below the so-called poverty line. Since the primary consideration in the consumption of food is the satisfaction of hunger, low levels of income are characterized by proportionately higher levels of expenditure on food. It also follows that at low levels of income, the diet is likely to consist of a high proportion of cereals and starchy staples because of the relative cheapness of these items as suppliers of calories (1:216-18). Once hunger is appeased, increased incomes tend to result in the consumption of a more expensive and varied diet consisting principally of dairy foods, meats, fruits, and vegetables.

In general, the demand shifts from starchy staples to preferred foods as incomes increase. The experience of the more advanced countries certainly illustrates such a relationship. Thus, in Ceylon, the percentage expenditure on starchy staples has declined while that on animal products has gone up with increases in income. However, the changes in demand vary widely for different foods and for different ranges in the income scale (1:212—26). Nor does this relationship seem to be as clear-cut for all societies or at all stages of development (30:154). It is influenced greatly by the food habits and preferences of a particular people.

The relationship between income and consumption may be estimated on the basis of data from cross-section budget studies and time series. In cross-section analysis, food consumption data from a sample of households during a given period of time are used to compare consumption patterns at different income levels. It is essentially a static analysis based on the assumption that income changes are the only variable affecting consumption. The usefulness of consumer surveys will depend on the representativeness of coverage, in terms of both place and time span.

A time-series analysis, on the other hand, attempts a study of the variations in consumption by the whole population over long periods of time. Unfortunately, reliable time-series data on production, prices, income, and consumption are rarely available for the less developed

countries. The income-consumption relationship has therefore to be analyzed on the basis of cross-sectional surveys.

The 1963 Survey of Consumer Finances for Ceylon (3) provides cross-sectional data suitable for estimating the income-consumption relationship. This survey has already been shown to be of acceptable reliability. The data on expenditure on food items by various income classes may therefore be used to construct consumption functions.

Consumption functions. Consumption functions describe the relationship between *per caput* consumption and other variables, principally income. This relationship can be expressed in terms of elasticity coefficients that measure the percentage change in consumption corresponding to a percent increase in income. The advantage of using elasticity coefficients is that they are independent of units of measurement and therefore allow a comparison between different commodities and different countries.

The major problem in constructing consumption function is to isolate influence of income on consumption. Besides income, other factors such prices, household size, age and sex distribution, tastes and preferences, other such noneconomic factors also influence consumption. The difficulty is that many of these factors are not quantifiable. But it is possible to inate the influence of most of these other factors by stratification into homogeneous groups, so that within each stratum all other factors except me are held equal. Thus each stratum may contain only households the same size, race, or other variable. One may also explicitly allow age-sex differences by considering only *per caput* consumption. While it is not possible to isolate all other sources of variation besides income, it assumed that changes in *per caput* consumption are primarily due to changes in income (23:71).

The income-consumption relationship may be estimated on the basis of different types of consumption functions (20:2). The major considerations in selecting the form of the function used are the statistical accuracy of the fit, the economic interpretation of the fit, the economic interpretation of the function, and the simplicity of computation. In practice, the linear, logarithmic and semi-logarithmic forms have been widely used. The semi-logarithmic form would seem to be most appropriate for food items because it allows for a decline income elasticity as incomes increase. This is a normal expectation in food consumption.

Expenditure elasticities. Expenditure data from the 1963 consumer vey were used to calculate expenditure elasticities. The functions with the following forms were fitted to the data:

$$y = a + bx$$

$$y = a + b \log x$$

$$\text{Log } y = a + b \log x$$

Where y = per capita 2-monthly expenditure on food items,

x = per capita 2-monthly total expenditure.

The expenditure data were weighted by the number of individuals in each income group. Total expenditure rather than income was used as the explanatory variable. Income data were found unsatisfactory because of the dependency for reported expenditure to exceed reported incomes at lower income levels. Difficulties arising from under-reporting of incomes and of iluing incomes in kind were thus avoided No attempt was made to derive income elasticities from the expenditure elasticities. This is not a serious disadvantage as the elasticity of total expenditure with respect to income, in general, close to unity for the less developed countries (31:326).

Of the 3 functions fitted, the semilogarithmic form gave the best fit in terms of high correlation coefficients and low standard errors for the beta coefficients. Since theoretical considerations also suggest the semilogarithmic form as being the most appropriate function. This function was selected.

The expenditure data used to compute the income-consumption relationships relate to expenditure at the retail level. Retail prices are higher than farm prices since they include distribution costs which remain negatively inelastic and, if anything, tend to rise at higher income levels ow to more elaborate processing and packaging. The effect of rising income therefore greater at the retail level than at the farm level. Furthermore expenditure elasticities are generally greater than quantity elasticities. This is because quantity elasticities leave out the effects of shifts to higher quantities or more highly processed foods. For planning agricultural production the effect of income changes on quantities purchased is more relevant because data on physical consumption is absent, no estimates of quantity elasticities could be arrived at.

Estimates of expenditure elasticities for the key items of food consumers in Ceylon are presented in Table 4.25, along with the consumption function from which they were derived. The rather high elasticity coefficient of hgfu for all food should be noted. The negative elasticity coefficient for rational rice as well as the high figures for meat, milk products, and eggs are significant. Income increases are clearly associated with a shift in demand to better quality unrationed rice as well as to greater demand for the non starchy staples. The implications for the agricultural economy, especial the livestock sector, are obvious.

Demand Projections

It remains to summarize the effects of population and income growth into a single tabulation that sets forth the probable future food requirements of the country. This is most readily done in terms of annual percentage increases, and necessitates certain assumptions regarding income growth.

No attempt is made here independently to project incomes; it is a subject far beyond the scope of this paper and a nebulous one at that. Instead, the estimates of the several plans for Ceylon's economic development are taken into account. The 1957 Ten-Year Plan projected income growth at an annual rate of 2.9 percent (11:66). This seems singularly optimistic, especially in view of the dim prospects for Ceylon's export crops. Indeed, according to the Short Term Implementation Programme, a rate of 1 percent was barely achieved during the first few years of the plan (8: 38). With greater effort, a higher rate may prove feasible, but it is unlikely. The government would almost automatically syphon off into capital formation a good part of any improvement.

It is customary to estimate the rate of increase in food demand as being equal to the rate of growth of population plus the product of the rate of growth in per capita income and the income elasticity (37:4). This may be expressed by the equation d = p + gn, where *p* and g are the rate of growth of population and per capita income and *n* the income elasticity of demand.

While this method provides a simple and ready method of ascertaining rates of increase of demand, it is not entirely satisfactory. The formula assumes a constant elasticity over the entire income range. But for a semilogarithmic function, expenditure elasticities decrease with

increasing total expenditure. Therefore elasticities should be derived preferably from the consumption function for any given level of total expenditure.

Table 4.25: Ceylon: Regression coefficients (semilog) for major food items°

Food items	Regression equation!	R^2	SE b	Elasticity ∫
Rationed rice	y = 8.60 – 1.12x	.87	.003	-.29
Unrationed rice	y = -4.97 + 2.13x	.91	.004	.53
Rice	y = 3.62 + 1.00x	.64	.004	.13
Wheat products	y = -9.40 + 3.22x	.93	.005	.77
Meat	y = -.18 + 4.75x	.97	.005	2.18
Fish	y = -5.72 + 2.17x	.95	.003	.64
Eggs	y = -1.11 + 2.86x	.87	.006	3.76
Pulses	y = 2.04 - .86x	.77	.003	.55
Vegetables	y = -2.09 + 1.52x	.55	.008	.35
Fats and oils	y = -3.04 + 1.60x	.96	.002	.43
Milk and milk products	y = -.19 + 4.92x	.91	.009	2.47
Sugar	y = -4.59 + 2.04x	.97	.002	.51
Total food	y = -9.5+ .32x	.97	.032	.80

° See text for discussion.

! Where y = per capita 2-monthly expenditure on food item, and x - per capita 2-monthly total expenditure.

∫ Expenditure elasticities of demand at point of means.

Nevertheless, because of the simplicity of computation, anticipated growth rates of demand for the major food categories are given in Table 4.26, based on this equation. A rate of population growth of 2.8 percent and of per capita income of 1 percent are used, as are the “income” elasticities presented in table 23.

Great accuracy cannot be claimed for the results over the short run. For periods of 1 or 2 years, the influence of such other factors as prices can often exceed that of income. But over the long pull - 5 years or more - the results have meaning. For this period the message is clear. The

demand for food products in Ceylon is both great and diverse. To meet it is one of the greatest challenges facing the country.

Table 4.26: Ceylon: Rate of growth of demand for major food items°

Food item	Projected rate of growth of demand
	percent/annum
Rationed rice	2.51
Unrationed rice	3.33
Rice	2.93
Wheat products	3.57
Meat	4.98
Fish	3.44
Pulses	3.35
Vegetables	3.15
Fats and oils	3.23
Milk products	5.27
Sugar	3.31
Total food	3.60

°See text for discussion.

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CHAPTER 5

Paddy and Poverty in Sri Lanka: An Analysis of the Impact of Technological Change[1]

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Abstract

The poverty problem in Sri Lanka, as elsewhere, has come under close scrutiny. Poverty estimates vary, but there is a consensus that it is largely a rural phenomenon. The rural sector is characterized by a heavy dependence on paddy cultivation, and paddy cultivation in turn has benefited most from technological advances in agriculture. The objective of this paper is to explore the relationship between paddy production and poverty. More specifically, it takes a look at paddy production, prices, and incomes and their impact on levels of consumption of low- income groups, given that poverty is often defined in terms of food poverty or consumption poverty.

The relationship between agricultural performance and poverty is beset with controversy. This is in part due to the fact that the rural poor are part farmers, part labourers, part non- farmers and all are consumers. The behaviour of households with respect to production, consumption, sales and purchases will determine the impact of changes in prices and incomes.

Given differences in concepts, methodologies and the data used, it is difficult to establish any trends in poverty. Recently however, a consistent set of estimates has been made available, based on the household income and expenditure surveys of the Department of Census and Statistics conducted in1985/86, 1990/91 and 1985/86, and it is being widely used. Food poverty is estimated on the basis of calorie requirements and intake and adjusted for non-food expenditures to

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arrive at consumption poverty. Estimates of calorie requirements have remained static over a period of thirty years or more and do not appear to have been adjusted for changes in demographic structures, incomes, food preferences and the like. Nor have variations in activity levels been controlled for. The study however confirms that about a fifth to a third of the population live in poverty, and finds that about 85 percent or over are in the rural sector, and that in the rural sector about 35 percent of the poor households are farmers accounting for 42 percent of the poor. The highest incidence of poverty is located in the Uva, Sabragamuwa, North Central and North Western provinces, with Moneragala district being identified as the poorest in the country. The large majority of the poor are either landless or operate extents of under two to three acres.

Paddy cultivation in Sri Lanka occupies about 75 percent of the arable land, and production has increased several fold such that the country is now almost self-sufficient in rice compared to a self-sufficiency ratio of about 30 percent in the immediate post war years. Production increases have come about through increases in both area cultivated and yields. However, the increase in area is under major irrigation schemes. The extents under minor schemes and rainfed areas have declined and yields are, respectively, about 15 to 30 percent lower. Also, over 67 percent of all paddy holdings are below two acres in extent. The area under major irrigation schemes are heavily concentrated in the districts of Anuradhapura, Ampara, Polonnaruwa, Hambantota and Kurunegala, which together account for nearly 60 percent of the area coming under major irrigation schemes. Associated with the increased production are a decline in real prices and real incomes, an increase in real wages and a decline in the man days of labour engaged in paddy production. There also appears to be a substitution of family labour for hired labour. The increase in wages is more than offset by the reduction in labour use.

Consumption patterns were examined to gain insights into patterns and levels of rice consumption. Apparent per capita calorie intake on average has shown little variation over the last 40 years or so, despite increases in per capita incomes. The large increases in domestic production appear to have replaced imports. Rice consumption varies across household types and income groups, and average about 45 percent of per capita calorie intake. Different surveys carried out over the last 20 to 30 years indicate that the bottom three to four income deciles do not meet their energy requirements, but increased the calorie consumption. A survey carried out by the Central Bank in 1996/1997

indicated that calorie inadequacy ranged from over 70 percent of the sampled population in the poorest decile to 30 percent in the richest decile. The proportions were somewhat higher in the urban sector and much lower in the estate sector, ranging from 46 to 24 percent. Also, the share of own produced rice in consumption varied from 1.5 percent in the estate sector to 2.9 in the urban sector to 21.4 percent in the rural sector. An earlier survey indicated that 84 percent of rural households were net buyers of rice.

It is to be expected that urban dwellers and estate residents will be net purchasers of rice, while the rural population will be net sellers, on average. The effect of price changes on households is given by the net benefit ratio (NBR), which reflects a household's net sales position. Calculations, at best tentative, suggest that on average a decrease in the price of rice by 10 percent will lead to an increase in real incomes of about 0.2 percent in the urban sector, an increase of about 1.0 percent in the estate sector, and a decline in rural incomes of about 2.0 percent. Disaggregating the data for the rural sector by farmers, agricultural workers, and the bottom decile of the rural population indicates that farmers will suffer an income loss of more than 2.0 percent, while workers and the bottom decile will benefit by about 1.5 and 2.0 percent respectively.

In summary, while rural poverty is widespread, equally widespread is paddy cultivation. The literature documents that higher farm yields are associated with both higher agricultural wages and lower food prices and benefit the poor, both absolutely and relatively. In Sri Lanka, marked increases in paddy yields are associated with a slight upward movement in real wages and lower real prices. But poverty is most acute in areas where paddy is dominant. Other factors appear to be at work and more in depth analysis is required.

Poverty has come under close scrutiny in Sri Lanka, but the emphasis has been on the measurement of the magnitude and incidence of poverty rather than on its determinants. Since poverty is acknowledged to be largely a rural phenomenon and the rural sector is characterized by the predominance of paddy (unhusked or rough rice) production, which has benefited most from technological advances, a study of the relationship between paddy production and poverty attracts attention. The relationship between agricultural performance and poverty alleviation is however beset with controversy. Intuitively, it can be argued that

increased production and lower prices would have beneficial impacts on the poor. Much however would depend on the net sales position of producers and the response of consumers. It has also been argued that the very process of agricultural development could generate social changes that could work against the poor. Inadequate and unreliable data comes in the way of a rigorous analysis of the interrelationships. But to quote Hazell and Haddad (2001), "the net effect of agricultural growth is difficult to quantify and qualitative assessments very often provide a better understanding of the interrelationships." An attempt is made here to sift through the available evidence from secondary sources to provide some such understanding. It examines in turn the trends in poverty and their relationship to the production and consumption of paddy.

Agricultural Performance and Poverty

The linkages between agricultural performance and poverty are not straightforward. Poverty itself is acknowledged to be a complex phenomenon, dynamic and varying over time and space. Numerous factors are involved in the determination of poverty, and equally varying over space and time. Productivity increasing technological change reduces the cost of food production, lowers real food prices and increases the demand for labour. Such developments will be favourable to the poor. On the other hand, it is also argued that unequal access to land and other resources will bring about adverse consequences to the poor. Rapid increases in population and high rates of inflation compound the situation, and changes in weather conditions are also known to push or pull people into or out of poverty. The poor are part-farmers, part-labourers, part non-farmers, and all are consumers. The behaviour of households with respect to production, consumption, purchases and sales will determine the impact of changes in prices and incomes. Kerr and Kolavalli (1999), in a comprehensive review of the literature, come up with the following linkages between agricultural performance and poverty. Technological change that is yield increasing or cost reducing can: 1) increase the incomes of farmers who adopt the technology, 2) reduce food prices and thereby increase real incomes of consumers, 3) change the demand for agricultural labour, and 4) stimulate economic growth, generate additional employment, and increase wages. The net effects of such changes are uncertain because the positive and negative effects could offset each other.

The relationship between agricultural growth and poverty has been most studied for India, principally because of the availability of data of acceptable quality. Ahluwalia (1976, 1978) in a pioneering study of rural poverty in India sought to explain rural poverty in terms of agricultural performance and a time trend to encapsulate all other factors thought to affect poverty. He concluded that 'there was strong evidence to suggest that agricultural growth, within the existing institutional system, tends to reduce the incidence of poverty.' Griffin and Ghose (1979) however argued that changes in the reference period in Ahluwalia's study indicated that there was no significant relationship between the change in rural poverty and the rate of growth of agricultural production at state levels. Saith (1981) argued that other unidentified factors could offset the impact of agricultural growth, thus refuting the trickle down effects implied in Ahluwalia's study. Dharm Narain expanded the Ahluwalia specification by including nominal prices of commodities consumed by the rural poor as an explanatory variable (Mellor and Desai 1985). Still others considered that investments in social and economic overheads, land reform and the development of the services sector as also being important (Desai 1985). More recent studies by Datt and Ravallion (1998) using data over an extended period of time appear to confirm the Ahluwalia findings. An IFPRI study also suggests that investment on rural roads and research had significant impacts on poverty (Fan, Hazell and Thorat 1999). But the debate is far from over (Rao 1998 ; Ravallion 1998). The section below briefly summarizes recent poverty literature in Sri Lanka.

Trends in Poverty

Poverty is multifaceted and multidimensional. Poverty may be approached from many different angles, but in the literature major attention is directed towards consumption poverty and the social or human development dimensions of poverty. Attempts to measure poverty in Sri Lanka have come up with different estimates (Alailima 2001). These have to be explained in terms of differences in definition, methodologies, cut-off points for poverty lines, concepts of minimum incomes and the like. One estimate of poverty suggests that poverty increased sharply from a little under 20 percent in the fifties to about 35 percent in the mid-eighties, before dropping down to the earlier levels by the mid-nineties (Alailima 2001). A World Bank study (1995) indicates

that there was little consumption poverty decline between 1950 and 1965 but a sharp decline between 1965 and 1985, and a continuing gradual decline thereafter. Such declines were associated with rapid growth of per capita incomes and consumption and improvements in income distribution (World Bank, 1995). One must however point out that the north and east were excluded from the late eighties and such estimates are not representative of the whole island. As has been pointed out (Hopkins and Jogaratnam, 1993), the ethnic conflicts would have exacerbated poverty. Dunham and Edwards (1997) in an exhaustive review of the available data conclude that the data does not provide evidence of any significant decline in poverty over the last decade or so. Both the World Bank (1985) and Gunawardena (2000), using the same data base and the same methodology, find that poverty declined from 1985 to1990, but increased in 1995, attributed in the main to a poor paddy harvest. By the same token, the paddy harvest registered a growth of more or less the same magnitude in 1990. What is important to note is that in the absence of any information on long- term movements in the incidence of poverty, point estimates are subject to the influence of so many factors that it is difficult to draw inferences on trends.

While a discussion of recent trends in poverty is beset with difficulties, Gunawardena (2000) has come up with a consistent set of estimates using the data from the Household Income and Expenditure Surveys (HIES) of 1985/86, 1990/1991, and 1995/1996, conducted by the Department of Census and Statistics. She has also used data from the Consumer Finance Survey 1996/1997 conducted by the Central Bank of Sri Lanka to extend the analysis. The methodology adopted is to construct a poverty line using the cost of basic needs approach. A food poverty line based on the cost of a food bundle meeting the recommended energy requirements is first constructed and adjusted to reflect average non-food consumption needs of those who meet their energy needs. A poverty line 20 percent higher is also used to overcome the arbitrary nature of such computations. As indicated by Gunawardena, the poverty line is anchored on a reference food poverty line of Rs.200 in 1985/86 based on a normative energy requirement of 2500 calories per male adult equivalent aged 20 to 39 years. A food price index was used to update the food poverty line to give a lower poverty line of Rs. 791.67 and a higher poverty line of Rs. 950 per person per month in 1995/1996 prices. Problems of comparability arise, but it is felt that they are indicative of rough orders of magnitude. The methodology is based on that of Foster,

Greer and Thorbecke (1986). Apart from information on the magnitude, incidence and depth of poverty, the analysis is carried further to include information on poverty regionally and by occupation. This makes it possible, although in a limited way, to relate rice production to poverty.

That poverty in Sri Lanka is a rural phenomenon is the general conclusion of all previous studies and is confirmed by Gunawardena (2000). It is confined largely to the landless agricultural labourers and operators of mini holdings, operating extents under a hectare. Unfortunately data on the numbers of holdings involved goes back to 1981 when the last Census of Agriculture was carried out. In terms of numbers, Gunawardena (2000) concludes that the incidence of poverty moved from 25 percent in 1985/86 to 19 percent in 1990/91 to 30 percent in 1995/96. It is estimated that over 88 percent of the poor are in the rural sector. In regional terms, over 50 percent of the poor are located in the four provinces, namely Uva, Sabragamuwa, North Central and North Western provinces. The district wise distribution of the incidence of poverty is shown in Table 5.1. Given that these four provinces are also the major producers of paddy, the relationship between paddy production and poverty merits attention. Overall, it is reported that 35 percent of households whose principal income earner was a farmer were poor and accounted for 42 percent of the poor. Gunawardena finds no relationship between size of land holding and poverty, except among paddy landowners. The size distribution of paddy holdings is shown in Table 5.2. Nearly 80 percent of the poor were landless in terms of paddy holdings and the balance accounting for almost 20 percent operated paddy holdings below three acres in extent. The incidence of poverty averaged a little over 25 percent amongst these groups.

Questions can be raised about the manner in which the poverty cut-off points themselves have been determined. As indicated earlier, most discussions start off by estimating the cut- off line for food poverty, defined as that level of consumption below which the body's energy requirements cannot be met. Poverty is thus defined in terms of the calorie equivalent of food consumption. It has been suggested that this makes sense for low income countries like Bangladesh since low calorie intake is the main manifestation of poverty (Hossain and Sen 1992). Others would have it that human beings cannot live on food alone, but would require some minimum expenditure on clothing and shelter. Very often about 20 percent, arbitrarily determined, is added to the

expenditures necessary to meet minimum calorie requirements. The definition of poverty then moves from food poverty to consumption poverty. Other indicators like the proportion spent on food have also been suggested (Rao 1981). What appears crucial in most poverty determinations is to estimate the level at which the energy (calorie) intake falls short of a predetermined adequacy level.

Table 5.1: Incidence of Poverty by Districts (percent), 1995

Under 20	21-30		31-40	Over 40
Colombo	Gampaha Kalutara Galle Matara Hambantota	Kandy Nuwara Eliya Kegalle Badulla Polonnaruwa	Matale Kurunegala Puttalam Anuradhapura Ratnapura	Moneragala

Source: Gunawardena (2000)

Table 5.2: Distribution of holdings reporting paddy, by districts, 1982 (percent)

20-30	31-40	41-50	51-60	61-70
Colombo Gampaha Jaffna	Galle Matara Kegalle Ratnapura Puttalam Hambantota Moneragala	Kandy Nuwara Eliya Ampara Batticaloa Vavuniya	Matale Badulla Kurnegala Mannar Mullaitivu	Anuradhapura Polonnaruwa Trincomalee Mannar

Source: Dept. of Census and Statistics, Census of Agriculture 1982 (1987).

Minimum energy requirements depend on weight, height, age, sex, temperature or altitude and, importantly, activity levels. Because of a shortage of information on many of these parameters, many countries depend on determinations made by FAO/WHO, the latest of which was released in 1985. Where ever possible, these are adjusted to suit local conditions .In Sri Lanka the adjustments have been made by the Medical

Research Institute (MRI). An energy requirement level of 2200 kcal has long been used, but it is not clear whether it has been updated on the basis of the 1985 FAO/WHO determinations. These are used in nationwide analyses and are not appropriate for regional or community specific comparisons, because they do not control for differences in activity and altitude. In fact it has been suggested that for sectoral comparisons, activity levels should reflect low or inactive levels for the urban sector, and medium active and very active levels for the rural and estate sectors, respectively. A recent publication by the FAO (2002) suggests that in calculating food energy requirements, physical activity norms for adults be specified in terms of the following: light activity defined as activity associated with sitting at a desk or behind a counter with reliance on automated appliances; moderate activity defined as continual light physical activity such as in light industry or during off-season farm work; and heavy activity defined as heavy and occasionally strenuous work, as in agricultural production, mining or steel work. Approximate daily energy requirements for men of height 1.71m and with a lowest acceptable body weight of 54 kg are set at 2335 kcal for light activity, 2682 for moderate activity, and 3164 for heavy activity. Similar norms for women with heights of 1.59m and a lowest acceptable body weight of 47kg are 1846, 1941 and 2154 kcal respectively. How the requirements are to be controlled for temperature variations is not clear. It is pointed out that if variations in activity levels are not controlled for, then energy levels will be misspecified. Region specific or community specific norms in the assessment of energy adequacy are also said to be essential (Randolph et al 1991). Edmundson and Sukhatme (1991) conclude, after reviewing several studies, that the poor spend more time on economically productive work and are more likely to be engaged in heavy physical labour than are the wealthy. Higher earnings are associated with increased leisure. In the context of the foregoing, it would appear that in Sri Lanka the estimations of poverty that do not control for activity levels and variations in altitudes are likely to have underestimated the incidence and magnitude of poverty in the rural sector. Equally, the several conclusions that poverty in the estate sector is lower than normally perceived need further clarifications.

On the other hand, it should also be pointed out that the selection of the minimum physiological requirements as the cut-off point for food poverty is itself arbitrary. Some countries like Bangladesh consider 80 or 90 percent of the minimum physiological requirement as the cut-off point

for food poverty and do not adjust for other consumption needs (Hossain and Sen 1992). Still others would argue that the human body could adapt itself to lower energy intakes and set poverty levels at 1600 to 1700 kcal. No attempt however is made in this paper to arrive at an independent estimate of energy requirements. Given that poverty is largely a rural phenomenon, with the landless and operators of mini-holdings at risk, attention is focused on the trends in paddy production and consumption, the behavior of paddy prices and incomes, and the likely impact on the poor.

Trends in Paddy Production

Paddy is the single most important crop cultivated in the country occupying about 740,000 ha, and accounting for about 43 percent of the total cultivated area. It is double cropped where water availabilities permit it, and extents cultivated in a normal year could exceed 50 percent of the total cultivated area. Based on water availabilities, extents cultivated are classified as coming under major irrigation, minor irrigation and rain fed regimes. It is estimated that in recent years the extents cultivated under these regimes averaged about 51 percent, 22 percent and 27 percent respectively. Policy emphasis on irrigation investment saw a near 100 percent increase in the area under major schemes over the period 1950 to 1997, whereas the extents under minor schemes and rain fed areas have declined after registering slight increases up to the eighties (Jogaratnam 1999). It is also usual to distinguish between Dry and Wet zones in terms of rainfall, and Maha (major) and Yala (minor) cultivation in terms of seasons. The wet zone occupies the southwest quadrant of the island and receives a well distributed pattern of rainfall under the influence of both the Southwest monsoon (May to October) and the Northeast monsoon (November to March). The rest of the island comes under the influence of the Northeast monsoon and has an extended dry period from May to September. About 30 percent of the cultivated area under paddy falls within the wet zone.

Paddy production increased sharply in the post independence era, registering average annual rates of growth of about 4.0 percent over a period of about 30 years, from the 1960s to the 1990s. Since then there appears to have been a period of relative stagnation. Production has been influenced by increases in both area cultivated and yields. The asweddumized extent, that is the land prepared for paddy cultivation,

increased from about 390,000 ha in the early 1950s to about 740,000 ha by 2000. Much of the increase occurred in the 1960s and 1970s, declining thereafter and showing little change in the decade of the 1990s. The cultivated extents, reflecting the area cultivated in the Maha and Yala seasons, increased proportionately, increasing from over 430,000ha to nearly 860,000 ha, but with variations in the annual extents cultivated. The decade of the fifties saw increases of over 30 percent followed by sharp declines in the sixties, and increasing thereafter to reach a growth rate again of over 30 percent in the eighties, only to decline again to under 10 percent in the nineties. These variations were to a great extent weather induced and in turn reflected in fluctuations in the cropping intensities, which increased from over 110 in the fifties to about 130 in the seventies and declined to below 120 in the nineties. Paddy yields, under the influence of the technological advances and their rapid adoption by farmers, increased by over 20 percent and by nearly 40 percent in the decades of the fifties and sixties, respectively. Thereafter yield increases slowed down to a level of a little over 10 percent in the nineties. Overall, production increased by about 500 percent over the period 1950 to 2000, with cultivated extents increasing by about 100 percent, cropping intensity fluctuating around 125, and yields increasing by over 150 percent.

Production increases were secured through increases in both area cultivated and yields. However while the area under major irrigation schemes expanded, the extents under minor tanks and rain fed areas declined, by about 15 and 30 percent respectively. The major irrigation schemes are heavily concentrated in the districts of Polonnaruwa, Anuradhapura, Ampara, Hambantota and Kurunegala. These districts in total account for about 60 percent of the area under major schemes. These are also the districts with a high incidence of poverty.

Trends in Rice Consumption

Data on rice consumption in Sri Lanka is available through the food balance sheets (FBS) published by the Department of Census and Statistics (DCS) and the periodic consumer surveys carried out by the DCS and the Central bank of Sri Lanka (CB). The increase in paddy production appears to have replaced imports and helped contain the impact of increases in population. Per capita availability of rice over time has remained remarkably stable (Table 5.3). Data on rice consumption from

cross-sectional surveys sourced to CB are presented in Table 5.4. They tell a different story. They reflect a slow but steadily increasing levels of rice consumption. By way of comparison, per capita consumption of rice in Taiwan declined by about half over the period 1960 to 1980.This was however accompanied by much sharper increases in incomes. Rice consumption across income levels is shown in Table 5.5. Consumption increased across all deciles to the ninth in 1981/82, to the eighth in 1986/87 and the seventh in 1996/97, and then declined. Interestingly, while per capita consumption in the urban sector has declined from 1981/82 onwards, and in the estate sector from 1986/87, consumption in the rural sector has increased over the same period.

Information in terms of own produced rice and open market purchases reflect a decline in the share of own produced rice in consumption, from 27 percent in 1981/82 to 22 percent in 1986/87 to 21 percent in 1996/97. Sector wise, the share of own produced rice in consumption in 1996/97 ranged from 1.5 percent in the estate sector to 2.9 in the urban sector to 21.4 percent in the rural sector. While no strong patterns can be discerned, there appears to be a tendency for own produced consumption of rice to be higher at the higher income levels (Central Bank 1999).

Table 5.3: Per Capita Availability of Calories 1970-1999

Year	Per Capita Availability of Calories (gms per day)
1970	2371
1975	2127
1980	2169
1985	2517
1990	2292
1995	2260
1999	2332

Source: Department of Census and Statistics, Food Balance Sheet (several issues).

Table 5.4: Average quantities of rice consumed per person for one month, by income deciles of spending units, 1981/82, 1986/87 and 1996/97

Decile	1981/82	1986/87	1996/97
1	6647	7440	8096
2	6869	7799	8392
3	7423	8170	8803
4	7817	8680	9041
5	8025	8838	9177
6	8597	9032	9391
7	8857	9092	9209
8	9204	9340	9165
9	9721	8812	8833
10	9519	8435	8028

Source: Central Bank of Sri Lanka, Consumer Finance and Socio Economic Surveys 1981/82, 1986/87 and 1996/97.

Table 5.5: Proportion of persons with daily energy consumption below 22,260 calories

Income Decile of Spending Units	Urban	Rural	Estate	All Sectors
1	77.4	70.9	45.9	70.2
2	73.9	71.1	43.9	70.1
3	73.0	64.2	36.0	64.0
4	70.6	62.9	39.5	62.7
5	73.2	56.8	38.6	58.0
6	49.0	49.4	40.8	48.9
7	62.2	45.0	19.6	45.7
8	48.9	42.8	29.1	42.9
9	47.8	35.9	29.4	37.2
10	34.0	30.0	24.4	30.1

Source: Central Bank of Sri Lanka (1999), Consumer Finances and Socio Economic Survey – 1996/97 (Part I).

Rice, as noted earlier, is the single most important source of energy accounting for 44 percent of the daily total per capita calorie intake in 1996/97. But as incomes increased the share of rice decreased, from about 46 percent in the lowest four deciles to about 35 percent in the

highest decile. Overall, per capita daily calorie intake declined from 2261 in 1981/82 to 2204 in 1986/87, but increased to 2337 in 1986/87. Given that the minimum required calorie intake is set at 2260 calories, it appears that on average there is calorie adequacy for the country as a whole. However, as indicated in Table 5.6, calorie inadequacy ranges from about 70 percent in the lowest income decile to about 30 percent in the highest decile. This suggests that calorie inadequacy is more than poverty, in that some in the low income groups can meet their energy requirements while a similar proportion in the high income groups are unable to meet energy requirements. Calorie inadequacy is greatest in the urban sector and lowest in the estate sector. This again goes against the perception that since urban incomes are high, calorie inadequacy must be low, and that the estate sector is characterized by low incomes and considerable malnutrition. Apparently aggregative data hides intra variabilities.

Paddy Prices, Incomes and Employment

The stable level of per capita consumption in the context of rapid increases in production would have had impacts on paddy prices and paddy incomes. The picture however is clouded by the heavy involvement of the government in paddy procurement and distribution since World War 2. Consequent to food shortages experienced during the war, the government introduced a rice rationing scheme in 1948. It had universal coverage and was operative till 1979 with modifications from time to time. The scheme was implemented through a government monopoly on rice imports and rice procurement in the domestic sector at support prices which were above open market prices from about 1960 to 1967. During this period procurement averaged about 50 percent of production. Thereafter procurement began to decline, with market prices rising above the guaranteed price. The government found the fiscal burden too heavy and the ration was replaced in 1979 by a scheme targeted at low income groups. A study on the impact of the ration scheme on food consumption and welfare, using time series data from 1954 to 1979 and socioeconomic data 1969/70, estimated that the ration contributed on average to about 45 percent to 65 percent of daily per capita consumption of rice (Gavan and Chandrasekera 1979). Moreover, it was found that the ration mainly substituted for open market purchases and had only a small impact on calorie intake in 1969-70. Total

calorie consumption was increased by about five percent of total requirements in the lowest decile of the population. The ration was insufficient to raise availabilities to the bottom four deciles to meet the average calorie requirements. While ration rice appeared to substitute for open market rice and other cereals, principally wheat, the substitution between cereals and other commodities appeared to be unimportant. The analysis of the time series data appeared to indicate that rice production changes had a greater impact on rice consumption than the indirect impact through price and income changes.

Table 5.6: Paddy, average real gross earnings and real wage rates in 1980 prices, for selected years

Year	Average paddy yield (mt/ha)	Average real farmgate price Rs/kg	Real earnings (Rs. 000/ha)	Real wage rate (male) (Rs/md)
1981	3.04	2.66	8.08	21.21
1990	3.41	2.17	6.78	21.00
2000	3.83	1.46	5.59	26.33

Source: Paddy yields, prices and wage rates from Department of Census and Statistics, Statistical Abstract (Various Issues) Real earning derived from yield and price.

Note: Data are 3 year averages centred on year shown.

Budgetary problems forced the Sri Lankan Government to move from a food subsidy scheme with universal coverage to a direct income transfer scheme directed at a target population. The eligibility for food stamps was based on household income, household size, and household composition. But the value of the food stamps was not indexed to changes in the value of the foods that could be purchased. Consequently, inflation quickly eroded the value of the stamps. Edirisinghe (1987) estimated that the real value of the food stamps declined by a little over 50 percent of the original value by 1981/82. In the comparative study of the ration and stamp schemes using data from the CB consumer finance surveys of 1978/79 and 1981/82, Edirisinghe (1987) estimated that the nutritional position of the bottom three deciles had deteriorated, by 12 percent, 6 percent, and 3 percent in the bottom decile, the second decile and the third decile respectively. The nutritional position of the other

deciles, except the highest, however improved. The rural sector fared relatively better, though still experiencing declines in calorie intakes in the bottom three deciles. The study also noted that paddy production grew at an annual rate of 7.9 percent between 1976/78 and 1980/82, compared to a 1.4 percent annual growth in the previous seven year period. The GDP averaged over 6.0 percent per annum over the period of study, but poorer agricultural households, defined by Edirisinghe in terms of the "ultra poor" were worse off. Thus in particular amongst agricultural workers mainly in paddy, it was estimated that the proportion of ultra-poor households increased from 23.8 percent to 36.7 percent, and amongst all households from 10.8 percent to 15.4 percent. The food stamp scheme was subsequently modified to include an investment component and came to be called Janasaviya, and still later Samurdi, still operative. Problems of targeting still remain and the general perception is that they have had little impact on problems of poverty and malnutrition.

It is not attempted, even if it be possible, to unravel the manifold factors affecting paddy prices and incomes. All that is attempted is to describe the developments in respect of paddy prices and incomes in the context of rapid increases in production, stable levels of consumption and widespread poverty. As indicated elsewhere, research investments in paddy in Sri Lanka have had a high payoff and the new high yielding varieties found rapid acceptance among all sections of the farming community, irrespective of farm sizes and agro-climatic conditions (Niranjan et al, 1998). As shown in Table 5.7, increases in paddy productivity were associated with a decline in real prices and real incomes, an increase in real wages and a decline in the man days of labor engaged in paddy production. There also appears to be a substitution of family labor for hired labor. On the other hand, there does not seem to be any significant increases in the use of machinery. Real gross margins too have declined, with real cash costs increasing (Department of Agriculture, various years). This is part of the agrarian crisis that Dunham and Edwards (1997) refer to. But cross sectional data derived from the Central Bank Surveys of Consumer Finances of 1986/87 and 1996/97 indicate that real average per capita income from all sources increased by 17.8 percent in the rural sector, but increased by nearly 30 percent for farm workers, and declined by about five percent for farmers and estate workers (Table 5.8). While the database is thin, there is a general perception that part time farming has increased. While crop diversification is not considered important, income transfers by way of

employment in the middle- east and in the armed forces may explain the increase in incomes, other than from paddy (Dunham and Edwards, 1997).

Table 5.7: Labour use in paddy cultivation, by selected districts for selected years (md/ha)

District	Year	Family labour	Hired Labour	Total Labour
Polonnaruwa	1980	20	36	56
	2000	22	12	34
Kurunegala	1980	33	23	56
	2000	27	16	43
Kandy	1980	55	30	85
	2000	42	17	59
Anuradhapura	1980	21	18	39
	2000	19	17	36

Source: Dept. of Agriculture, Cost of Production Reports (Various), Peradeniya.

Note: Data are average of five seasons centered on the Maha of year shown.

Table 5.8: Real average per capita income, by sectors and selected occupational groups, 1986/87 and 1996/97 (Rupees)

Sector and group	1986/87	1996/97	% change
All sectors	577	631	9.4
Rural	493	581	17.8
Estate	370	343	-7.3
Farmers	664	630	-5.1
Farm workers	236	306	29.7
Estate workers	357	339	-5.0

Source: Calculated from data in Central Bank of Ceylon 1999. Consumer Finance and Socio-economic Survey 1996/97, Colombo.

It is to be expected that declining rice prices will benefit urban dwellers and estate workers who are net purchasers of rice. The impact on farm operators and farm workers will depend on whether they are net purchasers or net sellers. The effect of price changes on households is given by the net benefit ratio (NBR), which reflects a household's net

sales position. Unfortunately, data on production and sales of paddy by households is not available. Assumptions based on yields, extents cultivated, production and marketable surpluses have to be made. Whether such assumptions are plausible depend on the authors' familiarity with the production environment. Calculations, which should be regarded as tentative, suggest that on average a decrease in the price of paddy by 10 percent will lead to an increase in real incomes of about 0.2 percent in the urban sector, an increase of about 1.0 percent in the estate sector, and a decline in rural incomes of about 2.0 percent. Disaggregating the data for the rural sector by farmers, agricultural workers, and the bottom decile of the rural population indicates that farmers will suffer an income loss of more than 2.0 percent, while workers and the bottom decile will benefit by about 1.5 and 2.0 percent, respectively (Table 5.9).

Table 5.9: Paddy production, consumption, and net sales by household groups, 1996/97

Group	Paddy production as percent of income	Paddy consumption as percent of income	Net sales of paddy as present of income
Sri Lanka	20.00	9.9	10.1
Sectors			
Urban	3.0	5.2	-2.2
Rural	30.0	10.9	19.1
Estate	2.0	14.4	-12.4
Occupation			
Farmers	42.0	20.0	22.0
Farm Workers	1.0	16.0	-15.0
Income Group			
Poorest decile	1.0	19.4	-18.4

Source: Calculated from data in Central Bank of Sri Lanka, 1999, Consumer Finance and Socio-economic Survey, 1996/97, Colombo.

It must however be pointed out that while estate workers receive little or no income from paddy, farmers receive less than 50 percent of their total income from paddy, and farm workers receive about 60 to 70 percent of their total income from work in paddy cultivation (Central Bank 1999).

Conclusions

Paddy production in the post-war period increased at rates that can be considered as high by most standards. Yet, there has been no appreciable impact on consumption. Time series data reflect more or less stagnant levels of per capita consumption, both of paddy and food in total. Cross-sectional studies show that a high proportion of the bottom three or four deciles are not able to meet their energy requirements. Since poverty measurements are in terms of energy adequacy, poverty remains high although there is no agreement on the actual numbers in poverty. Even government procurement and distribution policies and income transfer programs, which seek to subsidize the poor, do not appear to have had a major impact on consumption. The increases in production seem to have gone largely to replace imports and cushion the increases in population. Real prices have declined, reflecting in part the worldwide tendency for real prices of rice to fall. Lower paddy prices could be expected to benefit net purchasers of rice, that is the urban dwellers and estate workers. But the impact has been marginal and done little to improve energy adequacy. Lower food prices are expected to have a positive effect on employment, but labour use in paddy production appears to have declined. The elasticity of paddy income with respect to paddy price appears to be relatively low. But data problems prevent any firm conclusions being drawn. The linkages with the off-farm sector were not addressed in this study. The literature, largely drawn from India, documents that numerous factors, of which agricultural performance is one, influence poverty. This appears to be true of Sri Lanka too.

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CHAPTER 6

A Methodology to Identify Yield Constraints in Sri Lanka[1]

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Introduction

The recent years have witnessed a breakthrough in rice production technology leading to the introduction of modern rice varieties with high yield potential. The varieties have recorded potentials of about 7.5 t/ha whereas the less old, traditional varieties had potentials of than 2.5 t/ha. To realize the benefits of the modern rice varieties and their associated technology it is necessary that these varieties along with their complementary inputs and practices are accepted by the farmers, and also that their yield potentials are realized under true farm conditions. However, the experience in Sri Lanka, as in many of the South and Southeast Asian rice growing countries indicates that while the farmers have been quick to adopt the new varieties, the increase in the yield per hectare has been less than expected.

Thus in the case of Sri Lanka, During the 10-year period 1965-75, the hectarage under the new varieties is estimated to have increased to about 80% of the total area under rice. Yield levels, however, do not reflect this substantial progress made in the diffusion of the modern rice varieties. Yields are estimated to have increased from an average of 1.6 t/ha in 1955-57 to about 1.9t/ha in 1965-67, and to about 2.4 t/ha in 1970-72. Since then, the yields have been practically stationary, due perhaps to adverse weather conditions.

Evidently, in farmers' fields these modern varieties have performed much poorer than expected. This raises questions. Firstly, whether the high yields obtained at research stations can be actually realized in farmers' fields. Secondly, how well the present farm-level yield, compares with the potential farm level yield, and if there is a substantial difference (or farm-level yield gap) what factors, either agronomic or socio-economic are responsible for that gap.

[1] Reproduction from a paper presented by V. Premakumar, A.P. Jinadasa, H.P.M. Gunasena and T. Jogaratnam. IRRI publication.

Investigations to answer these questions form the basis of the Rice Yield Constraints Studies. It seems pertinent to answer here the question, “How can these investigations help towards increasing rice yields?”

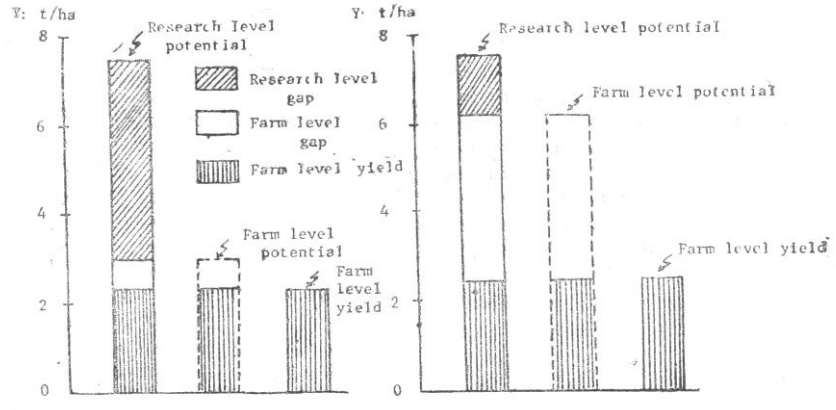
Ideally, the answer to the two questions are expected to accurately reveal, substantiated with experimental results, the exact points, both in the research and production activities, where remedial measures are due if an effective increase in rice yields to be achieved.

Assume, for example , that in an experiment it is found that the farm-level potential is low and is close to the farm level yield, there being a significant gap between the research station potential and the farm level potential (Figure 6.1) . One possible inference would be that the modern varieties are not as useful as they are claimed to be. Therefore, if a further increase in rice yields is to be achieved at the farm level, it will be for the researchers to provide farmers with more suitable technology, including varieties, which would produce high yields under farm-level conditions and not under experimental conditions alone. It may also be that, the input recommendations made from experimental station results do not suit farm-level conditions, and therefore a review of input recommendation is necessary. This again calls for a remedial action at the research level.

On the other hand, if the true farm level potential is high, and shows a significant farm level yield gap (Figure 6.2), it would then be necessary to experimentally determine the major agronomic factors responsible for such low farmer yields. The factors responsible could be one or more of the many agronomic practices, starting from land preparation and nursery techniques, through fertilizer use, insect control measures, etc, up to harvesting, threshing and cleaning processes, To assess the constraining effects of such agronomic factors, a simple factorial experiment could be designed and carried out in farmers’ fields (a simple technique of experimentation is detailed in a following section).

Should a specific agronomic practices consistently prove to be a significant constraint in a certain locality, further studies may be undertaken to identify the socio-economic factors responsible for the adoption of that agronomic practice at such a “low” level by the farmers. To illustrate this, assume that the experiments conducted in a certain area showed a wide farm-level yield gap, the major portion which was subsequently attributed to inadequate fertilizer use at the farm level. The studies would, therefore, proceed towards finding out WHY the farm-level practice in that area remains “low”.

Figure 6.1 Figure 6.2



The detailed answer to this why question would disclose the socio-economic constraints, which form the root-cause, bringing about the agronomic constraints, thereby limiting the production capacities. In the example cited above, the socio-economic constraints responsible for the inadequate use of the fertilizer could have been unavailability of fertilizer, revealing the need for better marketing and supplies; unawareness on the part of the farmer revealing a need for better extension services; shortage of capital pointing out the necessity for better credit facilities; risk aversion attitude of the farmer, disclosing the importance of crop insurance; being considered uneconomical by the farmer necessitating either more convincing extension services, or a review on fertilizer and rice prices, etc.

The investigation may be further extended to a study of the institutions and services, in respect of the findings, to determine the implication of alternative ways of alleviating these constraints. In the example used above, assume it is found that the farmers considered it uneconomical to use a higher level of fertilizer. Such a finding would necessitate a study of the relevant institutional activities in respect of fertilizer, including the true economy of fertilizer use, the comparative economy of fertilizer use, the comparative economy of use of capital on fertilizer, the possibility of improving credit facilities for purchasing fertilizer, the pros and cons of an additional fertilizer subsidy, and the possibility of crop insurance.

In the above manner, the yield constraints studies may be therefore expected to reveal any inadequacy in the functioning of the infrastructure, and thereby assist the institutions concerned to make necessary changes that could lead to the optimum exploitation of the research findings, and make possible to achieve the potential yields under true farm levels conditions.

The international Rice Research institute (IRRI) in the Philippines in close cooperation with the researchers in six rice growing countries of Asia has planned and implemented a multidisciplinary research program towards the objective of closing the yield gap. By this program, known as the International Rice Agro-economic Network (IRAEN) yield constraint program, IRRI has courage and assisted the cooperating Southeast Asian rice producing countries to undertake yield constraints studies. With IRRI's cooperation, yield constraints studies in Sri Lanka were undertaken jointly by the Department of Agricultural Economics and Farm Management and the Department of Crop Science, both of the Faculty of Agriculture, Peradeniya Campus,in late 1975.

It must be pointed out here that the constraining factors vary from the region to region and the same region from farm to farm and from season to season. Further, with changing rice varieties and rice production technologies, the constraints will also change. Therefore, the yield constraints studies too should form a continuous program like the research for higher yield. The yield constraint studies, established as a permanent feature and on an extensive scale spread over the different agro climatic zones growing rice, would keep pace with and complement research work and the institutional services by being a source of continuous assessment of the diffusion and success of the new research findings and institutional functions. Thus it seems fit that this work be incorporated as an already established service such as the National Extension Services.

Such extensive use of the methodology of a research program would no doubt warrant simple techniques of experimentation and analysis, which could be handled by the field staff. Also it should cost little. The constraint study undertaken by the Faculty of Agriculture was therefore primarily directed towards defining and refining methodology to suit purpose.

It was decided to conduct the first year's IRAEN experiments on the basis of the methodology developed by the IRAEN program with such modifications necessary to suit local conditions. It was also thought best

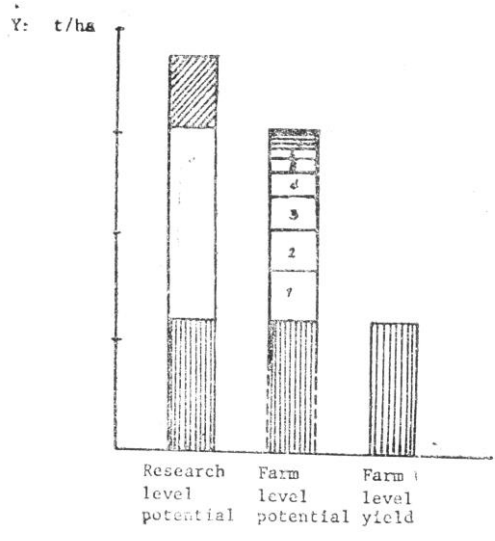
to carry out this testing of methodology in an area of intensive rice production, where adequate background information was available and where the farmers were known to be responsive. Thus, the Giritale special project area in the Polonnaruwa district was selected for the Maha (wet season) 1975-76 and Yala (dry season) 76 experiments. The sections that follow detail the development of the methodology, it's adoption at Giritale and the interpretation of the results that experiment for the purpose of critically analyzing the methodology and developing a suitable methodology for future use in Sri Lanka on extensive scale.

It seems possible to assess the farm level yield gap using a very simple method of experimentation, involving the laying out of an experimental plot in the middle of a block (liyaddha) of the farmer's field and treating the plot as per recommendation. The yield of this plot would give the farm-level potential while the yield of the rest of the block would give the farm level yield; the difference being the farm level yield gap. However, if a substantial yield gap is observed, it will not be possible to determine the exact factors responsible for it. We will only know that the farm level practices had produced low yields. It will not be known whether the low yield was due to inadequate fertilizer use, poor insect control, bad planting practices, or and any other similar agronomic practices. Also the question is raised as to whether it is experimentally possible to carry out all agronomic practices, such as land preparation, water control, etc. at the recommended levels in a plot in the middle of the farmer's field?

Figure 6.3 illustrates a situation with a substantial yield gap, it is likely that a large number of factors contribute to this yield gap and varying magnitudes. Testing all the probable factors, obviously is not possible. However, if as in Figure 6.3 the factors are arranged numbered from 1 to n, in the order of importance in filling the gap, it seems likely that a major portion of the gap can be covered by eliminating the first 3 to 5 factors alone.

The first stem would therefore be one of identifying the first 3 to 5 probable, more important factors for field testing. The constraining effects of each of the identified factors are then assessed by them in the field. If a large gap still remains even after filling the gaps due to the factors tested, it would indicate the presence of one or more other important constraints which should be subsequently identified and tested.

Figure. 6.3



For the purpose of identifying the probable, more-important constraining factors, a pre-survey of the same sample of farmers and the personnel closely involved with rice production activities in the locality may be used.

The next step is field –testing of the factors to assess their constraining effects. Talking a sample example, say inadequate weed control measures at farm level are identified major constraints. Field testing will be as follows.

Two similar blocks (liyadd has) would be selected from a farmer's field. In block I, two experimental plots would be laid out identifying them as W_f and W_R plots for weed control the recommended level respectively. The other block would be the comparable paddy or C_f block. The W_R plot would be treated for weed control as per recommendation while the W_f plot would receive the same measures of weed control as used by the farmer in the comparable paddy. All the other agronomic practices in W_f and W_R would be the same in C_f. Crop cuttings would be taken from W_R, W_f and C_f. the difference in yield between W_R and W_f would give the yield gap due to farm level weed control while comparison of W_f and C_f would show how well the experimenting officer has stimulated the farm level agronomic practices in the experimental plots,

In the same way, with more factors, a complete factorial design may be used to study the individual effects of the factors and their interaction effects. If for example three factors namely fertilizer use (F) weed control(W) and insect control (I) are to be tested at "f" and "R" levels, the resulting complete factorial design would be as follows.

Treatment No.	Treatments		
1	F_f	W_f	I_f
2	F_R	W_f	I_f
3	F_f	W_R	I_f
4	F_f	W_f	I_R
5	F_R	W_R	I_f
6	F_R	W_f	I_R
7	F_f	W_R	I_R
8	F_R	W_R	I_R

Effect of fertilizer $(F_R - F_f)$can be estimated by,

$$(F_R - F_f) = \{(F_R W_R I_R + F_R W_f I_R + F_R W_R I_f + F_R W_f I_f) - (F_f W_R I_R + F_f W_f I_R + F_f W_f I_f)\}$$

$$= \text{Treatments } \{(8 + 6 + 5 + 2) - (7 + 4 + 3 + 1)\}$$

That is,

Effects of $F = T_r \{(8 + 6 + 5 + 2) - (7 + 4 + 3 + 1)\}$

Effects of $W = T_r \{(8 + 7 + 5 + 3) - (6 + 4 + 2 + 1)\}$

Effects of $I = T_r \{(8 + 7 + 6 + 4) - (5 + 3 + 2 + 1)\}$

Total effect of Inputs $F, W, I(= Y) = T_r\{(8 - 1)\}$

Interaction effect of $F, W \& I =$

$$\left\{\begin{matrix}(\text{Total effect of } F, W \& I) \\ -(\text{Sum individual effects of } F, W \& I)\end{matrix}\right\}$$

In addition, with such a complete factorial design, it is possible to estimate the action effects of any two of the factors. That is the effect of F at low weed control can be estimated as follows:

$$(F_R W_{f-} F_f W_f) = \{(F_R W_f W_f I_R + F_R W_f I_F) - (F_f W_f I_R + F_f W_f I_f)\}$$

$$= T_r\{(6 + 2) - (4 + 1)\}$$

Apart from testing these factors at the farm level and the recommended level, it is worthwhile to test other levels to identify an economic package level of the selected inputs for farm conditions. Thus in addition to the factorial design, a management package experiment may be included.

A set of suggested level are as detailed below,

M_1 –All factors at "f" level

M_4 –All factors at "R" level

M_3 –Combination of factors, each at a level less than M_4

M_2 –Combination of factors, each at a level less than M_3

M_5 –Combination of factors, each at a level higher than M_4

M_1 level would be that determined as the farmer's level of use whereas M_2, M_3, $M_4$and M_5 have increasing input levels in that order.

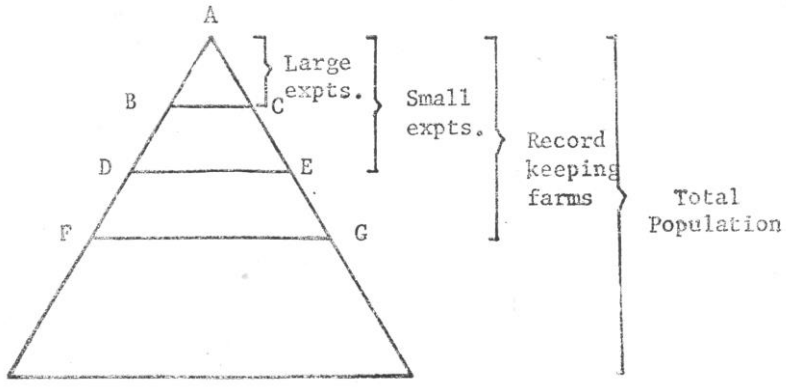
A complete experiment with two replications would, therefore, consist of 16 factorial plots and 10 management plots, totalling 26 plots. Even if $M_1$and M_4 are not repeated in the management plots, as they are included in the factorial design, the total number of plots required will be 22.

If four factors are to be tested, the total number of plots required will be 38. Such a large number of plots is undoubtedly too cumbersome and expensive to be handled in an extensive way. For the purpose of stimulating many of the farm level practices, evidently it would be necessary to monitor all the operations of the farmers. A simple daily record keeping program may be arranged for this.

One way to overcome that problem is to compromise between the accuracy of the experiments and the total number of experiments to be conducted. The pyramidal arrangement in Figure 6.4 may be used to explain this.

If for instance 15% of a population is considered an adequate sample, it would still be too tedious and expensive to conduct the experiments in 15% of the farms.

Figure 6.4



Instead, in 1% of the population (ABC) the complete or “large” design experiment may be conducted. In 4%of the population (BCDE) a “small” design experiment would be carried out with only 4 to 6 of the treatments selected from “large” design. It should be noted that the selected treatments would really be tested in a total of 5% (ADE). The treatments of the “small” experiments could be compared with the corresponding treatments of the “large” experiment to verify the applicability of the findings of the “large” experiments over a larger example. Further, the same record keeping program conducted in the 5% of the above experimental farms would be conducted in another 10% of the population. This 10% may be identified as mere record keeping farms, distinguishing them from the experimental farms. Crop cuttings will be taken from these record keeping farms and compared with those of the experimental farms to assess the applicability of the experimental findings over the rest of the population.

A follow-up survey conducted at the end of the season would enable to identify the socio-economic constraints responsible for the agronomic constraints identified from the experiments.

Yield constraints studies at Giritale: Maha 1975-76

The agricultural extension services of the Giritale special project area (about 1350 rice farming settlers) had the following set up:

1. The total project area, was under the care of the project agricultural extension officer ad was divided into two agricultural

instructor (A.I) ranges, each of which was under the direct supervision of an A.I .Each A, I range was further subdivided into 3 (Field level extension worker) (K.V.S) ranges each such range having a K.V. S who worked under the direct supervision of the A.I.

For the Maha 75-76 experiment, 4 K V S ranges were selected, 2 from each A.I. range ten farms were selected from K.V.S range selected giving a total of 40 farms. From each group of 10 farms, 7 were selected as record keeping farms and the other 3 were selected for field experiments. Of the 3 experimental farms in each K. V. S. range, one was selected for the "large" experiment and the other 2 for the small experiments.

Large Experiments	1x4	K V S Range	4
Small experiments	2x4		8
Record keeping farms	7x4		28
Total	10x4		40

From the pre-survey, fertilizer use (F) weed control (W) and insect control(I) were identified as the probable most important constraints. The agricultural extension staff suggested the study of depth of planting also because they felt the farmers generally planted too deep. Observations, however, showed that the farmers mostly transplanted at random and their spacing was such that the number of planting hills was twice as much as the recommended level. Further at the farm level the number of plants per hill averaged about 8 whereas the recommended practice was only 2 to 3 plants per hill. Deep planting may complement such close spacing because deep planting in effect lowers tillering. Therefore, depth (D) and spacing (S) were also selected as two additional factors for testing.

Experimental Design

A complete factorial with 5 factors would involve 32 treatment combinations. Instead, a 14 treatment design was selected and grouped as in Table 6.1 so that the complete design could be considered as two complete factorial designs, input factorial and practices factorial.

The management package consisted of M_2, M_3, M_4, M_5 and M_5H treatments. While M_2, M_3, M_4 and M_5 had depth and spacing at farmer's level. M_5H had recommended depth and spacing along with M_5 level of inputs.

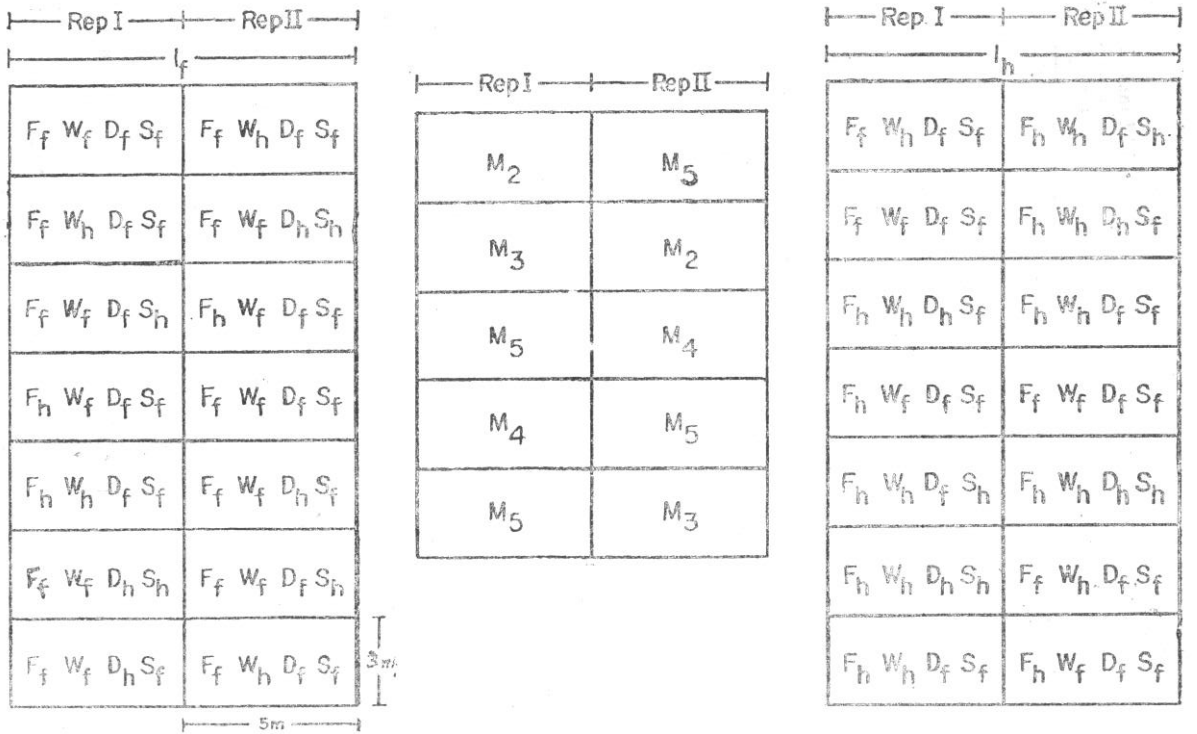
With two replications, the large design therefore had a total of 38 plots. A split plot design with insect control as the main plot was used (Figure 6.5). Plot size was $15m^2$. In the small experiments treatments were un-replicated.

The contribution of the different factors as obtained from the experiment conducted at Giritale during Maha 75-76 is as follow:

Table 6.1: Treatments in the two factorial components. Giritale, Sri Lanka,1975/76

No	Treatment Detail	Input factorial design		Practices factorial design	
1	$F_fW_f\ I_f\ D_f\ S_f$	1	$F_f\ W_f\ I_f$	1	$Y_fD_f\ S_f$
2	$F_RW_f\ I_f\ D_f\ S_f$	2	$F_R\ W_f\ I_f$		
3	$F_f\ W_R\ I_f\ D_f\ S_f$	3	$F_f\ W_R\ I_f$		
4	$F_R\ W_R\ I_f\ D_f\ S_f$	4	$F_R\ W_R\ I_f$		
5	$F_f\ W_f\ I_f\ D_f\ S_R$			5	$Y_fD_f\ S_R$
6	$F_f\ W_f\ I_f\ D_R\ S_f$			6	$Y_f\ D_R\ S_f$
7	$F_f\ W_fI_f\ D_R\ S_R$			7	$Y_f\ D_R\ S_R$
8	$F_RW_R\ I_R\ D_f\ S_f$	8	$F_R\ W_R\ I_R$	8	$Y_RD_f\ S_f$
9	$F_fW_R\ I_R\ D_f\ S_f$	9	$F_f\ W_R\ I_R$		
10	$F_R\ W_f\ I_RD_f\ S_f$	10	$F_RW_f\ I_R$		
11	$F_f\ W_f\ I_R\ D_f\ S_f$	11	$F_f\ W_f\ I_R$		
12	$F_RW_R\ I_RD_f\ S_R$			12	$Y_RD_f\ S_R$
13	$F_RW_R\ I_RD_R\ S_f$			13	$Y_R\ D_R\ S_f$
14	$F_RW_R\ I_RD_R\ S_R$			14	$Y_R\ D_R\ S_R$
F=Fertilizer use		Y=Input use			
W=Weed Control		Y=Depth control			
I=Insect Control		S=Spacing control			
R=Recommended Level		f=Farmer's level			

Figure 6.5: Lay-out of the large experiment, Giritale, Sri Lanka 1975-76



Recommended level fertilizer showed a positive response in three of the four large farms studied. In the fourth farm, the "f" level fertilizer application was higher than the recommended level, and the yield at "f" level too was high (Table 6.2).

Table 6.2: Input levels in experiments, Giritale, Sri Lanka,1975-76

	M_1	M_2	M_3	M_4	M_5
Fertilizer (kg/ha)	166	57.8	48.4	77.3 (106.2)[a]	91.8 (120.7)[b]
P_2O_5	29	0	17.22	34.44	57.66
K_2O	29	0	8.07	16.14	24.2
Weed control	0.7 Hw	Hand Weeding (35 DAT)	M C P A (21 DAT)	Saturn G (4 DAT)	Saturn G (4 DAT) Hand Weeding (35 to 42 DAT)
Insect control	1 foliar 0.7 Granular	2 foliars[c] (30 DAT & P I) 1foliar P I	Furadan G (10 to 14 DAT) 1 foliar	Furadan G (10 to 14 DAT) 2 foliars (30 DAT & P I)	2 Furadan G (10 to 14 DAT &60 DAT) 3 foliars 30 DAT 60 DAT & 70 DAT

[a] Average for four large experiments, level in eight small was very similar

[b] for 4-4-1/2 month. New improved varieties (Eg. BG 11.11)

[c] Foliar sprays were Fenitrothion

Use of the recommended level insect control showed positive results for all 4 farms, giving an average increase of 0.7t/ha.

Weed control had a small but positive effect. The results of the small experiments showed closely similar effects.

Depth and spacing individually did not show any substantial increase but along with recommended level of inputs, depth and spacing showed a define yield increase (Table 6.3).

The management package experiments showed marked increase from M_2 to M_4 levels (Table 6.4). But at the prices that prevail during the season, the M_2 level, which was much lower than the average M_1 level,

proved to be the most economical for the farmers, although the level of production was low.

Table 6.3: Contribution of inputs, depth and spacing towards improving rice yields Giritale, Sri Lanka, Wet Season 1975-76

Yield (t/ha)						Contribution (t/ha) of depth spacing Res		
Site	Farmer's inputs and practices	High Inputs, farmers practices	Difference due to inputs	High inputs, High practices	Difference due to practices			
1	3.3	4.0	0.7	4.1	0.1	-0.2	-0.4	0.7
4	0.6	2.4	1.8	2.5	0.1	0.3	0.0	-0.2
7	5.0	4.7	-0.3	4.9	0.2	0.1	0.2	-0.1
10	2.8	4.8	2.0	4.3	-0.5	0.4	0.3	-1.2
Av.	2.9	4.0	1.1	4.0	0.0	0.2	0.0	-0.1
Small Experiments	3.3	3.9	0.6					

Table 6.4: Rice yield (t/ha) from the management packages, Giritale, Sri Lanka, Wet season 1975-76

Package	Yield at site No.				
	1	4	7	10	Av
M_1	3.3	0.6	5.0	2.8	2.9
M_2	2.6	1.7	4.6	4.6	3.4
M_3	2.8	1.9	4.7	4.3	3.4
M_4	3.5	1.8	4.6	4.6	3.6
M_5	3.7	2.9	4.9	4.7	4.1
M_5 H	3.6	2.7	4.7	5.2	4.1

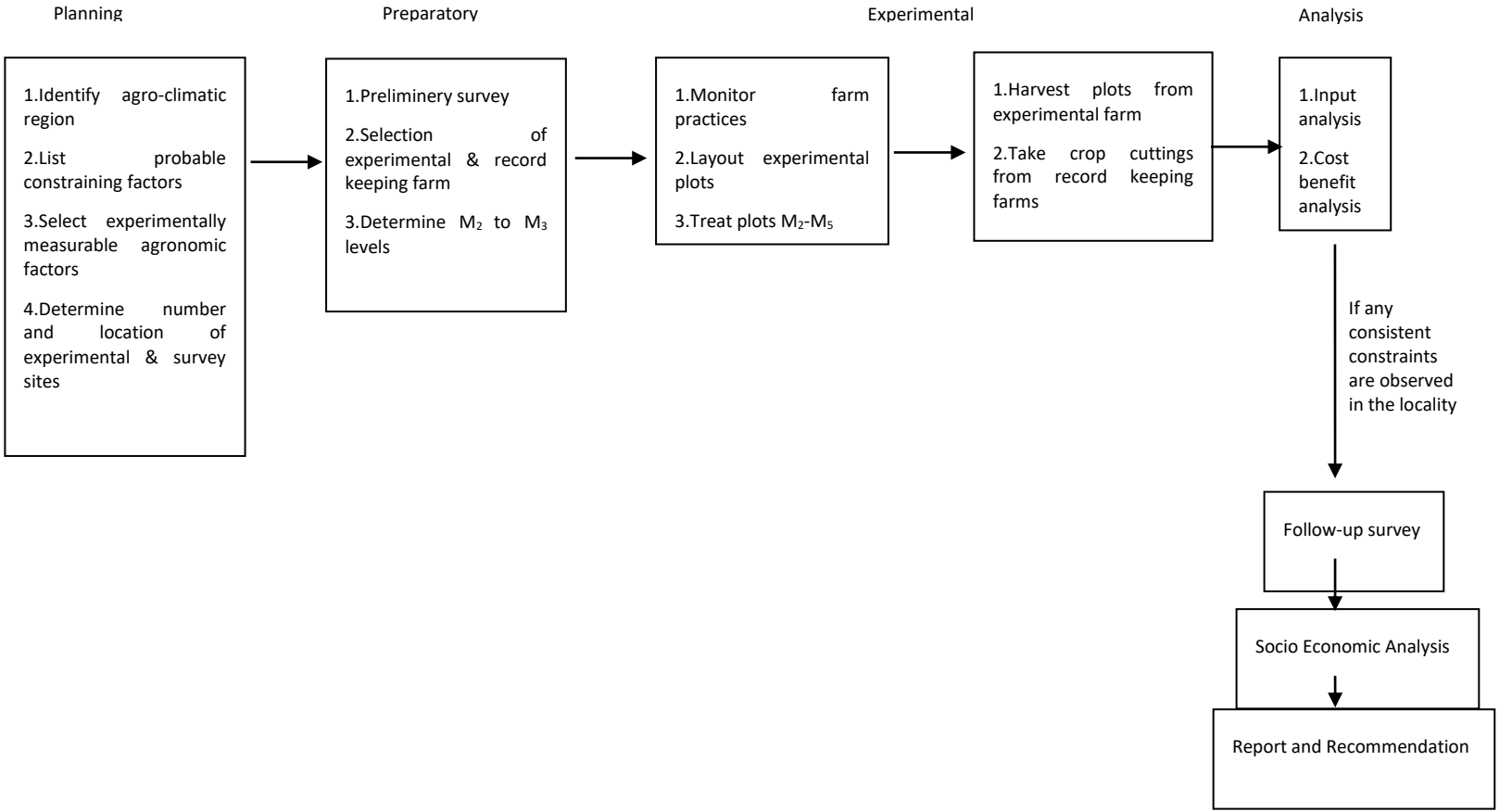
Summary

In the experiments conducted at Giritale insect control appeared to be the major contributor to the farm level yield gap, followed by fertilizer use. There was, however considerable variation between the farms. Management package experiments indicated that the M_2 level of inputs was the most economical. The highest management package of inputs (M_5), however, out yielded the recommended (M_4) level.

Data from the wider segment of the farm population collected by means of record books and farm surveys indicate that farmers are not utilizing recommended level of inputs and that there is considerable scope for improvement of infrastructural facilities.

The experiments, consisting of 4 large and 8 small experiments and comprising 190 plots were found to be unwieldy and for the yala season certain modifications were made.

However, results from the large and small experiments tailed and it is now proposed to considerably modify the experimental design and cover a larger number of farms. We feel that this is important because wide variations between farmers in a small sample may not accurately reflect farm-level conditions. In pursuance of this for this year's experiments which are being located at Kurunegala district, it has been decided to locate experiments on 35 farms using a simpler design with only 8 treatments per experiment.


Planning
Preparatory
Experimental
Analysis
1.Identify agro-climatic region
2.List probable constraining factors
3.Select experimentally measurable agronomic factors
4.Determine number and location of experimental & survey sites
1.Preliminery survey
2.Selection of experimental & record keeping farm
3.Determine M_2 to M_3 levels
1.Monitor farm practices
2.Layout experimental plots
3.Treat plots M_2-M_5
1.Harvest plots from experimental farm
2.Take crop cuttings from record keeping farms
1.Input analysis
2.Cost benefit analysis
If any consistent constraints are observed in the locality
Follow-up survey
Socio Economic Analysis
Report and Recommendation

Food Security, Malnutrition and Poverty

CHAPTER 7

Poverty, Food Insecurity and Malnutrition: The Sri Lankan Scenario[1]

Introduction

Poverty, food insecurity, and malnutrition are considered to be violations of basic human rights. But across the world, nearly a billion people are said to go hungry and about a third of all preschool children in the developing world are said to suffer from malnutrition. This is essentially a phenomenon of underdevelopment and there is widespread agreement that poverty is the leading cause of food insecurity and malnutrition, or under-nutrition to be more precise. The alleviation of poverty is expected to lead to greater food security and better nutrition. But recent research suggests that the problem is more complex. Nothing exemplifies this better than the so- called Asian Enigma. South Asia posts higher levels of income, food availability, health and environmental quality as well as higher rates of child malnutrition in comparison with sub-Saharan Africa. Sri Lanka presents an enigma of its own, with a relatively high index of the physical quality of life in association with relatively low incomes, a high proportion of underweight women, and high child malnutrition. These are matters for further research. This paper has a more limited objective, drawing on the literature to document the dimensions of poverty, food insecurity, and malnutrition in Sri Lanka and explore the linkages.

While food poverty measurements are commonly anchored on a nutritional norm, food security is assessed on the availability and accessibility of food. Food security, adequate care and health are considered as necessary conditions for nutritional security. Recent research suggests that the livelihood security approach presents a more holistic approach to confront the problems of poverty, food insecurity, and malnutrition, with livelihood security being defined in terms of the capabilities, assets and activities required to earn a living. This paper does not enter into such a discussion.

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[1] Reproduction from a paper presented at the National Symposium on Challenges to Poverty Alleviation: Re-defining the Role of Samurdhi, held at the Plant Genetic Resource Centre, Peradeniya, May 23-24, 2003.

Incidence of Poverty

Poverty has many faces and can be approached from many different angles. It can be defined as deprivation, especially of the basic needs as well as of safe drinking water, health facilities, education and the like. Concern in the developing world is with absolute poverty, and major attention is paid to food poverty or consumption poverty. Attempts to measure food/ consumption/ income poverty in Sri Lanka have come up with different estimates. These have to be explained in terms of differences in definition, methodologies, and sources of data. There is however a general consensus that poverty is relatively high, that it is largely a rural phenomenon, and that there are marked sectoral and regional variations.

Food poverty can be defined as that level of food consumption below which the body's energy requirements cannot be met. Minimum energy requirements depend on weight, height, age, sex, and activity level. An energy requirement level of 2200 kcal per head per day has been used in poverty estimations in Sri Lanka, but FAO (2002) has arrived at a figure of 1850 kcal for Sri Lanka. Some poverty estimations in India and Bangladesh have also been based on a level of 1850 kcal. It has also been suggested that for sectoral comparisons, activity levels should reflect low or inactive levels for the urban sector, and medium active and very active levels for the rural and estate sectors, respectively. FAO (2002) recommends that approximate daily energy requirements for men of height 1.71m and with a lowest acceptable body weight of 54kg be set at 2335 kcal for light activity, 2682 for moderate activity, and 3164 for heavy activity. Norms for women with heights of 1.59m and lowest acceptable body weight of 47kg are 1846, 1941, and 2154 kcal respectively. Jogaratnam and Poleman (1969) placed energy requirements for Sri Lanka at 1930 kcal per person per day, based on the FAO reference man adapted to the local environment, and estimating average body weights of adult male and female at 50 and 40kg, respectively. Region specific or community specific norms are considered essential to assess energy adequacy, and if variations in activity levels are not controlled for, energy requirements are likely be misspecified, resulting in substantial underestimation of individuals falling below the poverty line (see, for instance, FAO 2002, Randolph et al 1991). It has however been argued that the human body is capable of adapting itself to lower energy intakes and that energy requirements could be set at lower levels, at 1600 to 1700 kcal. It has also been pointed out that the poor are likely to be engaged in heavy physical labor, in comparison with the wealthy, and

therefore energy requirements of the poor will be higher (Edmundson and Sukhatme 1991). In the absence of any consensus on the appropriate methodology to be used in estimating the incidence of poverty, one has to bear in mind the arbitrary nature of poverty estimations and exercise care in interpreting and using poverty data.

While a discussion of trends in poverty in Sri Lanka is beset with difficulties, Gunawardena (2000) provides a consistent and recent set of estimates based on data from the Household Income and Expenditure Surveys of 1985/86, 1990/91, and 1995/96 conducted by the Department of Census and Statistics (DCS) (see Table 7.1). The poverty line is anchored on a reference food poverty line of Rs.200 in 1985/86 prices, as calculated by Nanayakkara and Premaratne (1989), and indices constructed to update the poverty line. Non-food expenditures are also accounted for. Nanayakkara and Premaratne anchor their poverty line on energy requirements developed in the Marga(1981) study, which in turn draws on the WHO guidelines developed in 1973. How sensitive poverty lines are to changes in energy requirements remains to be researched, but WHO/FAO updated their guidelines in 1985 and also more recently. Problems of comparability with other studies arise, due to differences in definitions and methodologies. Comparisons with DCS estimates using the same data base but a different methodology illustrates this (Table 7.1). What is surprising is not that these estimates differ, but that the estimates are so close for the year 1995/96. The incidence of poverty, by districts, and changes in the incidence of poverty, by districts, are shown in Tables 7.2 and 7.3. That poverty levels can vary widely between districts and move in different directions are well illustrated by these tables. Neither of these studies cover the North and the East because of the conflict situation. Like in all conflict situations, the general perception is that poverty levels are much higher. However, given the comprehensive nature of the analysis, coverage over an extended period of time and, for the first time, information on severity of poverty, and its potential for future studies, the Gunawardena findings form the basis of this study.

Table 7.1. Sri Lanka: Incidence of Poverty, 1986 – 2002

Sector	1985/86	1990/91	1995/96	2002
	Gunawardena			
All Island	30.9	19.9	25.2	-
Urban	18.4	15.0	14.7	-
Rural	35.6	22.0	27.0	-
Estate	20.5	12.4	24.9	-
	DCS			
All Island	-	30.4	26.7	28.1
Urban	-	18.2	14.7	8.6
Rural	-	34.7	27.0	31.3
Estate	-	20.5	24.9	28.0

Source: Gunawardena, 2002. DCS, Statistical Abstract 2001; www.statistics.gov.lk

Note: 1:- Not available 2:- Gunawardena uses the cost of basic needs approach. DCS defines poor as these spending more than 50% of total expenditure on food and food expenditure less than a specified amount.

Table 7.2. Incidence of Poverty by Districts (percent), 1995

Under 20	21-30		31-40	Over 40
Colombo	Gampaha	Kandy	Matale	Moneragala
	Kalutara	Nuwara Eliya	Kurunegala	
	Galle	Kegalle	Puttalam	
	Matara	Badulla	Anuradhapura	
	Hambantota	Polonnaruwa	Ratnapura	

Source: Gunawardena (2000)

Table 7.3. Changes in the Incidence of Poverty by Districts 1985/86 – 1995/96

Increase	Decrease
Kalutara	Colombo
Matale	Gampaha
Nuwara Eliya	Kandy
Puttalam	Galle
Polonnaruwa	Matara
Moneragala	Hambantota
	Anuradhapura
	Badulla
	Ratnapura
	Kegalle

Source: Gunawardena 2002

Gunawardena (2000) confirms the findings of previous studies that poverty in Sri Lanka is a rural phenomenon, and confined largely to landless agricultural laborers and operators of mini holdings of about a hectare in extent. In terms of numbers, it is concluded that the incidence of poverty moved from 25 percent of the population in 1985/86 to 19 percent in1990/91 and to 30 percent in 1995/96. The rural sector is estimated to account for over 88 percent of the poor, with over 50 percent located in the Uva, Sabragamuwa, North Central and North Western provinces. No relationship appeared to exist between size of landholding and poverty, except in the case of paddy holdings. Nearly 80 percent of the poor did not own any paddy holdings.

As Mellor and Desai (1985) pointed out, "mitigation of poverty requires knowledge of what are now recognized as enormously complex causes. Empirical identification is made difficult because of conceptual issues involved in defining the many dimensions of poverty, data constraints in measuring its incidence, and econometric problems in estimating relationships between causal factors and poverty levels." The Gunawardena study concerned itself with the consumption/income dimension of poverty in Sri Lanka. This study proceeds to collate the information on food insecurity and malnutrition to provide a more holistic dimension of the poverty problem in Sri Lanka.

Food Availability, Food Consumption and Food Insecurity

The poor are likely to be food insecure. Food security is defined in terms of food availability and food accessibility, and their stability over time. Seasonality in production as well as other shocks can bring about insecurity and this necessitates bringing stability into the equation. Stability here denotes not only environmental sustainability but also economic and social stability. Availability is determined by food supply, and accessibility by purchasing power or food entitlements. The adequacy of food intake is measured in terms of meeting minimum energy requirements at the physiological level. For Sri Lanka, average per capita food availabilities at the national level are about equal to average per capita physiological requirements. Averages however mask regional and household variations and assume an even distribution. Furthermore, requirements differ from availabilities by an amount equal to cooking losses and plate waste, for which an allowance of 10 percent is usually made.

Food Balance Sheets (FBS) provide the basic information to estimate food availabilities. Food availability compared with food requirements, in terms of energy, protein, fat and other nutrients, provide a measure of food adequacy. Average yearly FBS estimates for the period 1991-1995 are presented in Table 7.4. Per capita energy availability averages around 2270 kcal per head per day. Due allowances will have to made for data inadequacies, cooking losses, wastage and the like, in comparing with energy requirements (see, especially, Jogaratnam and Poleman 1969). Estimations of energy requirements vary from 2250 kcal to 1850 kcal or less and are subject to controversy. As mentioned earlier, how this will affect poverty lines and issues of food security remains to be researched. But it draws attention to the arbitrary nature of such computations.

The available data indicate that per capita food availabilities have been remarkably constant over the period 1955 to 2000 (see Table 7.5). The sharp increases in paddy production have not led to increases in per capita availabilities and only led to a replacement of imports. Availabilities can be compared with actual levels of consumption, as given by the various consumer surveys carried out periodically by the Central Bank of Sri Lanka and DCS. Interestingly, consumption estimates also fall within similar ranges over more or less the same period (Table 7.6). Despite increases in per capita consumption expenditures, per capita energy intake has remained stable. This is in sharp contrast to what happened in countries like Taiwan and South Korea, where energy intake increased with increases in incomes and was also associated with changes in the structure of consumption. Care however has to be exercised in comparing availabilities with actual consumption.

Table 7.4. Production, net trade and gross and net food supply, and per capita availability, by specified food groups, annual averages, 1991-1995

Commodity Group	Production	Net Trade	Gross Supply	Net Supply	Per Capita Availability	
	1000 mt				Kg/Yr	KCal/ day
Rice	2547	176	2723	1695	96	911
Wheat	-	628	628	606	36	339
Other	41	-	41	36	2	19
Grains	441	-	441	320	19	70
Roots and Tubers	69	406	475	459	26	284
Sugar	48	68	116	111	6	58
Pulses	628	-	628	528	36	58
Vegetables	74	50	124	73	4	42
Onions	132	12	144	142	8	22
Fruits	48	1	49	48	3	12
Meat	48	-	48	47	3	13
Eggs	232	64	296	200	11	54
Fish	286	36	322	263	15	65
Milk	923	-	87	601	3	324
Nuts, Oils and Fats		50	3		4	

Source: DCS. Food Balance Sheet.

Unlike FBS data that are available only on a national basis, consumer survey data enable comparisons between sectors and income groups (see Table 7.6 and 7.7). Energy intake is highest in the estate sector, followed by the rural sector, probably reflecting their higher activity levels. As is to be expected, energy intake also increases with increasing incomes. But here, time series data and cross sectional data do not tally. Table 7.8 indicates that energy inadequacy occurs among all income groups, ranging from over 70 percent in the lowest income decile to about 35 percent in the highest. It suggests that low incomes are not the only

factor explaining energy inadequacy. The income- food consumption relationship is one of the well established regularities in economics. The proportion spent on food declines with increasing incomes. As Table 7.9 indicates, per capita real incomes have increased in the urban sector, although only slowly, but declined in the rural and estate sectors. But, as indicated above, per capita energy intake has increased in all three sectors. Whether there has been a substitution of low cost high energy foods, like roots and tubers, remains to be researched.

Table 7.5. Per Capita Availability of Calories 1970-1999

Year	Per Capita Availability of Calories Per Day
1970	2371
1975	2127
1980	2169
1985	2517
1990	2292
1995	2260
1999	2332

Source: DCS. Food Balance Sheet (various years)

Table 7.6. Per Capita Energy Consumption by Sectors, kcal/day

Period	All Sectors	Urban	Rural	Estate
1969/70	2264	2161	2268	2459
1973	1936	1957	1837	2345
1978/79	2283	2240	2230	2763
1980/81	2239	2001	2210	2122
1981/82	2271	2229	2246	2639
1986/87	2205	2094	2194	2554
1996/97	2337	2195	2336	2674

Source: Central Bank of Sri Lanka. Consumer Finance and Socio-economic Survey (various years).

Table 7.7. Per capita daily energy intake by income quintiles

Income Quintiles	Energy Intake (calorie)		
	1981/82	1986/87	1996/97
1	1850	1901	2049
2	2078	2039	2193
3	2232	2188	2325
4	2367	2323	2430
5	2569	2453	2571

Source: As above

Table 7.8. Proportion of persons with daily energy consumption below 2,260 calories

Income Decile of Spending Units	Urban	Rural	Estate	All Sectors
1	77.4	70.9	45.9	70.2
2	73.9	71.1	43.9	70.1
3	73.0	64.2	36.0	64.0
4	70.6	62.9	39.5	62.7
5	73.2	56.8	38.6	58.0
6	49.0	49.4	40.8	48.9
7	62.2	45.0	19.6	45.7
8	48.9	42.8	29.1	42.9
9	47.8	35.9	29.4	37.2
10	34.0	30.0	24.4	30.1

Source: Central Bank of Sri Lanka (1999), Consumer Finances and Socio Economic Survey – 1996/97 (Part I).

Table 7.9. Average one month real income of income receivers, by sectors, 1978/79 to 1996/97 (1980 prices rupees)

Sector	1978/79	1981/82	1986/87	1996/97	Percent Change 1978/79-1996/97
Urban	1123	1299	1489	1450	29.1
Rural	837	860	850	826	-1.3
Estate	409	359	408	394	-3.7

Source: Central Bank of Sri Lanka. Consumer Finance and Socio-Economic Surveys (various years).

Evidence across the developing world indicate that the income elasticity of demand for food is low, but its interpretation is a subject for debate. Evidence from Sri Lanka also show that income transfers to the poor are not entirely spent on food. Thus, income poverty and energy inadequacy are not strongly correlated.

Poverty and food inadequacy lead to malnutrition. Malnutrition slows down growth, increases the risk of illness, affects cognitive development, and affects work capacity and labour productivity as children become adults. While malnutrition in general has declined, relatively high levels still persist, with the problem of underweight children being most acute. Nearly 30 percent of all children 3-36 months old are underweight, ranging from 20 percent in the urban sector to 30 percent in the rural sector and 44 percent in the estate sector (Table 7.10). While nationally stunting and wasting affect about 14 percent of all children, stunting is more serious in the estate sector. It reports an incidence of nearly 34 percent, as against 13 percent in the rural sector. Wasting is reported to affect nearly 16 percent of children in the rural sector, but only 13 percent in the estate sector. The urban sector reports the lowest figures, with stunting and wasting each affecting eight percent of all children. Stunting or chronic under-nutrition reflect the cumulative effects of long-term influences, while wasting or acute under-nutrition reflect short-term changes. Thus the incidence of poverty in the rural sector is likely to be more transient than in the estate sector. There is also a close association between education and malnutrition. While over 80 percent of women in the urban and rural sectors are reported to have had secondary school education, only 25 percent of estate women are reported to fall into this category. Moreover, 25 percent of estate women have never attended school. What is disturbing is that nearly 20 percent of the underweight children have mothers who have had more than secondary school education (Table 7.11). This draws attention to the importance of the care aspect of nutritional security. Even more disturbing is that Sri Lanka reports the highest incidence of underweight women in the developing world (FAO 2002).

Table 7.10. Prevalence of Under-nutrition (among 3-36 month olds)

Sector	1975/76	1980/82	1987	2000
A. Stunting				
Rural	33.3	30.3	26.2	12.8
Estate	61.1	57.5	60.0	33.8
Urban	-	29.6	19.3	8.0
All Island	-	32.0	27.5	13.5
B. Wasting				
Rural	13.6	18.8	13.6	15.9
Estate	16.8	19.8	7.1	11.8
Urban	-	12.4	12.0	8.2
All Island	-	17.8	12.9	14.0
C. Underweight				
Rural	-	-	-	30.8
Estate	-	-	-	44.1
Urban	-	-	-	19.8
All Island	-	-	-	29.4

Source: Osmani (1994); DCS(2000). Note: Year 2000 data relate to children 3-59 months old.

Table 7.11: Prevalence of Under-nutrition Among Children 3-59 months, by Age and Education of Mother, Year 2000

Age in Months	Stunted	Wasted	Underweight
03-05	3.9	1.3	0.7
06-11	5.7	10.3	20.2
12-23	16.2	18.2	28.8
24-35	12.4	13.3	34.0
36-47	13.4	13.9	30.7
48-59	19.1	15.9	37.9
Education of Mother			
No education	35.7	18.4	48.0
Primary	23.8	15.9	41.4
Secondary	12.7	15.0	31.7
More than secondary	8.0	11.4	19.5

Source: DCS.2001. Statistical Abstract.

Concluding Remarks

Not all of the available data is presented in this review, admittedly brief, of the poverty, food security, and nutrition situation in Sri Lanka. There is also a problem of having to reconcile data from different sources. But given that poverty presents different faces, it appears that income poverty does not fully explain food insecurity, and that malnutrition is not fully explained by inadequate energy intake. Importantly, they also have their chronic and transient faces and, more importantly, symptoms will have to be distinguished from causes. Moreover, the incidence of poverty, food insecurity, and malnutrition vary across sectors and districts, and do not always move in unison. Individually and collectively, they do not always move in the same direction, and sometimes move in opposite directions. To echo Aturupane et al (1999), it is not the absolute level but the changes that are important and need to be studied. Poverty, food insecurity, and malnutrition are considered as violations of human rights, and acting on any one of these does not in itself remove these violations. Policy interventions, by their very nature, and not only in Sri Lanka but across the developing world, tend to focus on symptoms and not causes. They thus become fiscal burdens and unsustainable in the long run. Income transfers are a case in point. The relationship between income and food demand evokes considerable discussion. As this presentation has attempted to show, food or income poverty, food insecurity, and malnutrition do not appear to correlate well. A composite indicator, taking all three factors into account, awaits development.

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CHAPTER 8

Reflection on Food and Nutrition Security[1]

1. Introduction

Food security is achieved when all people at all times have access to enough food for a healthy and productive life. It is determined by the availability of food, access to food and the utilization of food. Availability is determined by food supply, primarily at the national level, while access depends on income at the household level, and utilization depends on intra-household distribution of food and the health status of the individual. A distinction is made between food security and nutrition security, with food security defined in terms of food availability and accessibility and nutritional security in terms of food security, adequate care, and health. While these three are held to be necessary conditions for achieving nutrition security, none of the three are said to be sufficient in isolation.

Food security is determined by the availability and accessibility of food, and their stability. Food supply at the national level can be considered adequate if it can meet the energy requirements of the population. But averages can mask regional and household variations. Furthermore, seasonality in production as well as other shocks can bring about insecurity and this necessitates bringing stability into the equation. Stability here denotes not only environmental sustainability but also economic and social stability. Access to enough food will be determined by purchasing power and incomes. In Amartya Sen's terminology, entitlements to food or food entitlements will depend on assets, transfers of resources, and one's labor power.

Care is defined as "the provision in the household and the community of time, attention, and support to meet the physical, and social needs of the growing child and other household members." Typically, women are

[1]Reproduction from a chapter in Economic and Social Development under a Market Economy Regime in Sri Lanka (2012), Buddhadasa Hewavitharana Felicitation Volume 2, Eds. Saman Kelagama and Dileni Gunewardena, Vijitha Yapa publication. 291-302. ISBN: 9789556651515

considered to be the main caregivers, especially of children, and care giving is influenced by maternal health and education, employment, family support systems, and substitute childcare, among others.

Health is determined by factors that operate at the levels of the community, household, and the individual. The quality of the environment, the availability of services such as water, electricity, sewage, waste disposal, housing, medical facilities, and food and nutrient intake are some of the important factors. The sections that follow consider the status of food and nutrition in Sri Lanka in the context of the framework of reference given above.

2. Food Availability

Food Balance Sheets (FBS) provide the basic information to estimate food availabilities. Food availability compared with food requirements, in terms of energy, protein and fat, provide a measure of food adequacy. Gross production net of changes in stocks and trade, adjusted for seed, feed, wastage, industrial use, and extraction provide an estimate of food available for human consumption. This is then converted to kilocalories and nutrients, and per capita availability derived. Food balance sheets for Sri Lanka have been published by the Department of Census and Statistics from 1983, although such information is said to have been available from 1950. Average yearly estimates for the period 1991-1995 are presented in Table 8.1.

Available data indicate that food availabilities have been remarkably constant over the period 1955 to 2007, fluctuating between 2110 and 2300 kcals (see Table 8.2) below. It is noteworthy that the lowest availability of food was in 2007. Availabilities can be compared with actual levels of consumption, as given by the various consumer surveys carried out periodically by the Central Bank of Sri Lanka and the Department of Census and Statistics. Interestingly, consumption estimates also fall within a range of 2200 to 2300 kcals over more or less the same period. The consumer surveys also indicate consumption by urban, rural and estate sectors, whereas FBS data are available only on a national basis. The adequacy of the diet can be evaluated by comparing with food requirements, and this is considered in Table 8.2.

Table 8.1. Production, net trade, gross and net food supply, and per capita availability, by specified food groups, annual averages, 1991-1995

Commodity Group	Production	Net Trade	Gross Supply	Net Supply*	Per Capita Availability**	
	1000 mt				Kg/Yr	KCal/day
Rice	2547	176	2723	1695	96	911
Wheat	-	628	628	606	36	339
Other Grains	41	-	41	36	2	19
Roots and Tubers	441	-	441	320	19	70
Sugar	69	406	475	459	26	284
Pulses	48	68	116	111	6	58
Vegetables	628	-	628	528	36	58
Onions	74	50	124	73	4	42
Fruits	132	12	144	142	8	22
Meat	48	1	49	48	3	12
Eggs	48	-	48	47	3	13
Fish	232	64	296	200	11	54
Milk	286	36	322	263	15	65
Nuts, Oils and Fats	923	-50	873	601	34	324

Notes: * Quantities set apart for Seed, Animal Feed, Waste, Manufacturing are excluded.

** (Production + Imports) – (Change in stocks + Exports)

Source: Department of Census and Statistics, 2009

Table 8.2. Per Capita Availability of Calories 1970-2007

Year	Per Capita Availability of Calories Per Day
1970	2371
1975	2127
1980	2169
1985	2517
1990	2292
1995	2260
1999	2332
2007	2118

Source: Department of Census and Statistics, 2009

3. Food Requirements

Energy requirements depend on height, weight, age, sex, and activity levels. Because information is not available on all these factors, many countries depend on guidelines given by FAO/WHO and these are adjusted to suit local conditions. In Sri Lanka the adjustments have been made by the Medical Research Institute. An energy requirement level of 2200 kcal is used in nation-wide analysis. It is not considered appropriate for regional or community-specific analyses as it does not control for differences in activity levels. A recent publication by FAO (2002) suggests that in calculating energy requirements, physical activity norms for adults be specified in terms of the following:

Light activity- sitting at a desk or behind a counter with reliance on automated appliances;

Moderate activity- as in light industry or during off-season farm work;

Heavy activity- as in agricultural production, mining or steel work.

Approximate daily energy requirements for men of height 1.71 m and with a lowest acceptable body weight of 54 kg are set at:

2335 kcal for light activity;

2682 kcal for moderate activity;

3164 kcal for heavy activity.

Similar norms for women with heights of 1.59 m and a lowest acceptable body weight of 47 kg are:

1846 kcal for light activity;

1941 kcal for moderate activity;

2154 kcal for heavy activity.

Region specific or community specific norms in the assessment of energy adequacy are said to be essential. It is also likely that the poor are engaged in heavy physical labor and their energy requirements will be higher than indicated by national averages. At the same time, it has also been suggested that the energy requirements of the poor and malnourished may be lower because of the ability of the body to adjust itself to lower calorie intake.

Available data suggest that, on average, food availabilities are just sufficient to meet energy requirements. What in fact is likely to occur is under-consumption by a part of the population, presumably the poor. What one really needs to know is how serious such shortfalls are and who the affected groups are. Food balance sheet data cannot shed light on this problem.

4. Food Consumption

Data from the various consumer surveys enable an evaluation by sectors and income groups. The most recent information comes from the Central Bank consumer survey of 1996/97. There are difficulties in comparing availabilities derived from FBS with consumption estimates from consumer surveys, and care must be exercised in interpretation. Trends in energy consumption are shown in Table 8.3.

While the estate sector reports the highest level of consumption followed by the rural sector, it should be noted that activity levels in these two sectors are likely to be higher. Energy inadequacy occurs among all income groups, ranging from 65 percent in the lowest income decile to 35 percent in the highest (see Table 8.4).

Table 8.3. Per Capita Energy Consumption by Sectors, kcal/day

Period	All Sectors	Urban	Rural	Estate
1969/70	2264	2161	2268	2459
1973	1936	1957	1837	2345
1978/79	2283	2240	2230	2763
1980/81	2239	2001	2210	2122
1981/82	2271	2229	2246	2639
1986/87	2205	2094	2194	2554
1996/97	2337	2195	2336	2674
2006/07	2118	1906	2138	2420

Source: Central Bank and Department of Census and Statistics, Sri Lanka, 2009

Table 8.4. Proportion of persons with daily energy consumption below 2,030 calories, 2006/07

Sector/Province	Percent
Sri Lanka	50.7
Urban	65.0
Rural	49.2
Estate	32.7
Western	59.7
Central	45.5
Southern	47.5
Eastern	45.2
North-Western	48.7
North – Central	46.9
Uva	38.4
Sabaragamuwa	50.7

Source: Department of Census and Statistics, Sri Lanka, 2009

It suggests that low incomes are not the only factor explaining energy inadequacy. But energy intake has increased across sectors and income groups over the period 1981/82 to 1996/97 (see Tables 8.5 and 8.6 below):

Table 8.5. Per Capita Daily Calorie Intake, 1981/82- 1996/97, by sectors

Sector	Energy Intake (calorie)			
	1981/82	1986/87	1996/97	2006/07
Urban	2095	2094	2195	1906
Rural	2240	2194	2336	2138
Estate	2879	2554	2674	2420
All Sectors	2261	2204	2337	2118

Source: Department of Census and Statistics, Sri Lanka, 2009

Table 8.6. Per capita daily energy intake by income quintiles

Income Quintiles	Energy Intake (calorie)			
	1981/82	1986/87	1996/97	2006/07
1	1850	1901	2049	1615
2	2078	2039	2193	1867
3	2232	2188	2325	1985
4	2367	2323	2430	2006
5	2569	2453	2571	2108

Source: Department of Census and Statistics, Sri Lanka, 2009

5. Income and Income Distribution

The level of incomes and the pattern of income distribution determine to a major extent access to enough food at the household level. This section examines trends in incomes and income distribution in Sri Lanka. Per capita incomes have registered substantial increases over the last forty years or so, increasing from Rs.635 in 1960 to Rs.66, 790 in 2000.at current prices, and from Rs.615 to Rs.2630 respectively at 1952 constant prices, and from US $133 to US $880 respectively at market prices. Income distribution, as represented by the Gini ratio, improved from 0.46 in1953 to 0.35 in 1973, but worsened to 0.46 in 1986/87 and improved marginally thereafter to reach 0.43 in 1996/97. Sectorally, the estate sector reports the lowest incomes and the least inequality. Conversely, the urban sector has the highest incomes and the greatest inequality. Real incomes over the period 1986/87 to 1996/97 improved considerably for the rural sector, marginally for the urban sector, and fell in the estate sector. There was a significant improvement in real incomes

between 1996/97 and 2006/07 (see Table 8.7). There may have been a fall in real incomes in 2008 due to sharp increase in prices, especially of food.

Table 8.7: Real average per capita income, by sectors and selected occupational groups, 1986/87 and 1996/97 and 2006/07 (Rupees)

Sector and group	1986/87	1996/97	2006/07
All sectors	577	631	6335
Rural	493	581	5713
Estate	370	343	3637
Farmers	664	630	
Farm workers	236	306	
Estate workers	357	339	

Source: Calculated from data in Central Bank of Ceylon 1999. Consumer Finance and Socio-economic Survey 1996/97, Colombo.

6. Poverty and Malnutrition

The information on food availability and accessibility indicate a considerable level of food insecurity. Poverty is a major determinant of food insecurity and food insecurity in turn leads to under-nutrition. The availability of sufficient food and the means to acquire enough food at the household and individual level do not ensure proper utilization of food and good health. The nutritional status of an individual depends on food as well as non-food factors. Non-food factors include clean water supplies, good sanitation, acceptable housing, and health care, besides others. This section takes a closer look at poverty and malnutrition in Sri Lanka.

Poverty is said to have many faces or facets, and can be approached from many different angles. It means deprivation, and deprivation of basic needs such as food, clothing, shelter, as well as health, education, potable water and the like indicates poverty. Poverty is also defined in terms of absolute poverty and relative poverty. Absolute poverty is said to occur when minimum requirements or standards of any of the above factors are not met. Relative poverty exists when people feel deprived of some essential need in comparison with some other reference group, in which case 'poverty will always be with us.' Concern in the developing world is with absolute poverty, and major attention is paid to food

poverty or consumption poverty. In the case of food poverty, a poverty line based on the cost of an average food consumption basket or bundle is constructed, and those whose food expenditure fall below this line are considered to be poor. In the case of consumption poverty, an allowance of about 20 percent is made to account for non-food expenditures.

Attempts to measure poverty in Sri Lanka have come up with different estimates. These have to be explained in terms of differences in definition, methodologies, poverty cut-off lines and the like. There however seems to be general agreement with the findings of a World Bank study that suggested that consumption poverty declined sharply in the period 1965 to 1985 from a level of about 30 percent, and has continued to decline thereafter. A more recent study concluded that the incidence of poverty moved from 25 percent in 1985/86 to 19 percent in 1990/91, but increased to 30 percent in 1995/96. This is explained in major part by the poor paddy harvest in 1995. It appears to have declined thereafter. The Department of Census and Statistics, using different criteria and a different methodology, concluded that the percentage of poor households declined from 30 percent in 1990/91 to 27 percent in 1995/96. There was a reduction in poverty in the urban and rural sectors in 2006, but the estate poverty increased. Most of the poor reside in rural areas where the poverty level has been estimated at 27 percent compared to 14 percent in urban areas. Again the high rate of inflation, especially food inflation, in the last two years may have not only swelled poverty but increased under-nutrition.

There is however a general consensus that poverty in Sri Lanka is predominantly rural, accounting for over 80 percent of the poor. Landless laborers and operators of small- holdings under one hectare are most likely to be poor. The incidence of poverty by districts is shown in Table 8.8.

In regional terms, over 50 percent of the poor are estimated to be located in four provinces, namely Uva, Sabragamuva, North Central and North Western provinces. Contrary to general perceptions, poverty in the estate sector is estimated to be relatively low. This may be because energy requirements have not been calculated specifically for the estate sector, and this holds for the rural sector too. Consequently, poverty incidence is likely to be underestimated in the estate and rural sectors.

Table 8.8. Incidence of Poverty by Districts (percent), 2006/07

Under 20	21-30	31-40	Over 40
Colombo	Kegalle	Moneragala	
Gampaha	Ratnapura	Nuwera-Eliya	
Kalutara	Badulla		
Matale			
Kandy			
Galle			
Matara			
Hambantota			
Ampara			
Batticaloa			
Polonnaruwa			
Anuradhapura			
Kurunagala			
Puttalam			

Source: Household Income and Expenditure Survey 06/07, Department of Census and Statistics, Sri Lanka, 2009

Poverty is a major determinant of malnutrition, or more precisely under-nutrition. Malnutrition appears to be a widespread and persistent problem in Sri Lanka. While there appears to have been some improvement in recent years, the relatively high levels still persist, with the problem of underweight children being most acute. The estate sector is worst off (see Table 8.9):

Malnutrition slows down growth, increases the risk of illnesses, affects cognitive development, and affects work capacity and labor productivity as children grow into adults. The prevalence of stunting (chronic under-nutrition) and wasting (acute under-nutrition) reflect the cumulative effects of long-term influences and short-term changes, respectively. The data also show a close association between under-nutrition in preschool children and age of children, and education of mothers (Table 8.10).

Table 8.9: Prevalence of Undernutrition in Sri Lanka (among 3-36 month olds)

Sector	1975/76	1980/82	1987	2006/07
A. Stunting				
Rural	33.3	30.3	26.2	16.7
Estate	61.1	57.5	60.0	42.2
Urban	-	29.6	19.3	13.7
All Island	-	32.0	27.5	18.0
B. Wasting				
Rural	13.6	18.8	13.6	15.2
Estate	16.8	19.8	7.1	12.6
Urban	-	12.4	12.0	14.9
All Island	-	17.8	12.9	15.0
C. Underweight				
Rural	-	-	-	21.7
Estate	-	-	-	29.7
Urban	-	-	-	16.6
All Island	-	-	-	21.5

Source: Osmani (1994); DCS (2008) (Excluding North East Province).

Table 8.10: Prevalence of Under-nutrition among Children 3-59 months, By Age and Education of Mother

Background Characteristics	Stunted % below – 2SD	Wasted % below – 2SD	Underweight % below – 2SD
Age in Months			
<6	9.7	15.8	12.1
6-8	9.5	10.4	12.0
9-11	15.6	11.9	
12-17	18.6	13.4	18.5
18-23	22.7	15.9	22.9
24-35	21.9	14.6	23.4
36-47	19.8	15.1	24.9
48-59	15.7	17.5	25.3
Mother's Education			
No education	42	15.9	34.9
Primary	29.8	19	33.7
Secondary	18.8	15.8	22.7
O/L	13.8	19.2	17.6
Higher	10	11.9	13.8

Note: SD – Standard Deviation

7. Concluding Remarks

Not all of the available data is presented in this brief review of the food security, poverty and nutrition situation in Sri Lanka. There is also a problem of having to reconcile data from different sources. The overall picture that emerges is one of food insecurity that appears to have in general improved over time nationally. There are however sectoral variations. The food insecurity is associated with the problem of access to food rather than with the availability of food. Despite the dramatic increases in paddy production, per capita calorie availability has not changed. This suggests that production increases have gone to meet population increases and replace imports, and not gone towards increasing per capita availability. Per capita incomes have increased over time, but there have been no marked improvements in income distribution, and there are wide regional disparities. Under-nutrition is high and chronic. Whether there is a Sri Lankan dilemma on the lines of the South Asian dilemma, given the high physical quality of life indicators, remains to be researched (although incomes, per capita food availability, and health and environmental quality are higher in South Asia than in Sub-Saharan Africa, so is the share of malnourished children). The impact on adult labor productivity is another problem needing attention.

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CHAPTER 9

Socio-economic Dimension of Poverty[1]

Executive Summary

This paper is one of a series to identify and appraise possible interventions to alleviate poverty in Sri Lanka and the implications for the program of the U.S. Agency for International Development in that country. The study examines the nature and the extent of poverty in Sri Lanka and suggests alternative policies to address the problem.

No great effort was devoted to define a poverty line or to discuss methodology in any detail, since these aspects of the problem are well known. In Sri Lanka, in particular, numerous authors have concentrated on methodological considerations to such an extent that poverty alleviation policies have played second fiddle to such activities. This paper tries to readdress this balance by concentrating on mapping the socioeconomic characteristics of the poor and examining policy alternatives.

Has poverty increased over the past decade? The conflicting evidence available gives no clear indication. The most recent estimates done for the World Bank suggest that from 1978 to 1987 all-island poverty rose from 22.3 percent to 27.4 percent of the population. There is some evidence to suggest that income distribution worsened over this period, especially with the elimination of food subsidies for poor groups. This conclusion must be tempered by uncertainty over data, price series, and methodological problems.

There is general agreement that the poor are concentrated among landless laborers, smallholders; urban, unskilled, informal-sector workers; and unskilled estate workers. However, few studies in the literature identify vulnerable groups by these sorts of socioeconomic characteristics and most concentrate on identifying the poor by decile and geographic location (estate, urban, or rural). The poor are a heterogeneous lot. What helps one may hurt another. Thus an increase in the price of rice may help the marginal farmer with a small marketable surplus, but hurt the

[1] Reproduction from a study prepared for the U.S Agency for International Development with M.J.D. Hopkins.

casual laborer, who must purchase his rice. Such heterogeneity makes targeting of the poor difficult if not impossible. We need to know much more about those who fall below the poverty line to target with precision policy measures toward the poor.

The poor have smaller than average household sizes and contain slightly more young people than the island average. - Ethnicity does not appear to be a major determinant of poverty, with the exception of the Indian Tamils on the estates. The poor have lower levels of education than the nonpoor to the extent that anyone who has achieved O' level or more is almost certain to be above the poverty level. Most authors argue that unemployment and poverty are closely linked, but this study finds that conclusion unproven.

Poverty has been identified across the socioeconomic spectrum in Sri Lanka, with the largest group being the landless laborers. However, if a very restricted definition of poverty is used - that by Sahn for the ultra-poor - then pockets of extreme poverty are more prevalent in the urban than the rural areas. We conclude that no amount of provocation of the ultra-poor to self-drive themselves out of poverty will work, since their circumstances are too desperate for them to have the energy and vigor to do this. But the ultra-poor are a small group (5 to 8 percent of the population) compared with the large numbers of poor identified when poverty lines are set at higher levels. Direct grants are probably the main solution for the ultra-poor and should not be too onerous on the exchequer since there are relatively few ultra-poor.

The next group of poor can be helped more to help themselves. For example, the provision of small-scale training facilities at the village level plus modest payments for attendance could start this process, and aspects of the revised Janasaviya program seem to appreciate this point. But, no amount of training will help on the supply side if the demand for skills is lacking. Thus a reexamination of Sri Lanka's macro development strategy is also required.

Section One

Introduction

This study is one of a series to identify and appraise possible interventions in poverty alleviation in Sri Lanka and their implications for the Sri Lanka program of the U.S. Agency *f*or International Development. The other studies in the series have looked at poverty, malnutrition, and health (Khan, 1989), the nature of the employment problem in different segments of the labor market (Kannapan and Nelson, 1989), and a third study is to focus on opportunities for low-cost housing. The present study is designed to provide specific insights into the nature of the poverty problem, its contextual relationships, and possible policy interventions.

The macroeconomic backdrop to the study is well known from government documents and the work of the World Bank and will, therefore, not be repeated here. Poverty in Sri Lanka poses a most urgent political problem to the government as well as the donor community. Its alleviation ranks first among the priorities of the Government elected to office in early 1989, as instanced by its ambitious poverty alleviation program, *Janasaviya* - literally, "strength of the people." There is considerable skepticism about the program, but donors, and in particular the World Bank as well as USAID, - acknowledge that special efforts are required to address the problem of poverty.

The measurement of poverty lines, the identification of the poor, and the medium term tendencies are all difficult to establish with certainty. Some estimates put the number of poor at over 50 percent of the population, while others estimate the ultra-poor to be of the order of 3 to 8 percent depending on geographical region. The interest in and attempts to measure poverty in Sri Lanka, among both national and international scholars, have been extremely high as a glance at the attached bibliography attests. However, this widespread interest and the plethora of documents do not make the analyst's job easier, particularly as the documents are often contradictory and the further one delves into the problem the more difficult understanding becomes. In particular, the 'necessary information to understand the different sorts of poverty by socioeconomic group is generally absent.

The Objectives of the Study are:

1. To identify the socioeconomic characteristics of the poor using secondary sources and discuss whether this has changed over the late 1970s to mid-1980s.
2. In the light of an overall strategy to bring about growth with equity, to identify specific policies to ameliorate poverty in the medium term.
3. To identify the most promising potential USAID interventions to help alleviate poverty over the medium term.

The chapter is organized as follows. Section Two looks at how poverty has been measured in Sri Lanka. It presents a number of different authors' definitions and their findings, and suggests what an appropriate poverty measure could be. This is followed by a discussion of the underlying data. Section Three uses existing studies to map the socioeconomic characteristics of the poor. This is done in turn by socioeconomic groups, nutritional status, employment characteristics, the demographics of poverty, and poverty by educational level. The section ends with an impressionistic commentary on what has happened to poverty since the last survey of 1986/87 was taken. Section Four provides an overview of the main causes of rural poverty, and is followed by a section that documents the major government policy responses to poverty over the past two decades. Section Six examines a number of possible alternative strategies and policies that could potentially ameliorate poverty before ending with some suggestions on possible areas of assistance for USAID and other donors. Section Seven presents some concluding remarks. Two short appendices are added. The first relates current concerns on the environment with poverty, and a second presents the fiercely contested argument that Sri Lanka's high scores on many social indicators were achieved at great cost in terms of economic progress.

Section Two

Measurement of Poverty

The Various Poverty Measures Used[2]

It is not the purpose of this section to go into great detail on the concept and measurement of poverty lines. The poverty literature in Sri Lanka has covered these in great detail, and good accounts can be found in Kahn (1989) or Alailima (1988). There is no objective way in which a poverty line can be set (see the discussion below on poverty and nutrition). The most common methodology is to set a line based on nutrition standards, by calculating the expenditure or income that a household or individual requires to satisfy their nutrition requirements. Since 60 to 70 percent of a poor families' expenditure is allocated to food, this shows that an attempt to base a poverty line on food consumption is a reasonable approach. Of course, people are poor because they lack not only food but decent housing, clothing, and access to education, health services, and so forth. Methodologies to estimate poverty lines to include such items are discussed in the literature (see for example Hopkins and Van Der Hoeven, 1983).

How then should a poverty line be set? [3]As there is no objective way in which poverty lines can be set (and a glance at Table 9.1 shows the many efforts that have been made for Sri Lanka), the only way is to try and achieve a consensus on what is a poverty line. While this line may be justified by the numbers of poor below an income necessary to purchase basic needs, or simply be a reasonable figure given by a politician, consensus must be obtained. It is worth repeating that there is no objective or technically undisputed way to set a poverty line.

What does the Sri Lankan literature say about poverty*?* Most studies in Sri Lanka have used the concept of absolute poverty, in which a fixed poverty line was used to delineate the poor. The minimum subsistence level or minimum nutritional requirement to be physically efficient has been usually used to fix poverty income lines. The earliest endeavor to quantify absolute poverty, according to Alailima (1988), was reported in

[2]This review section has drawn liberally from Alailima's Ph.D. theses which she kindly made available for our study

[3]Thanks to R. Kanbur for discussion on this

the Social Services Commission Report in 1947 and followed the approach used by the celebrated Beveridge Report (1942). A subsistence level was derived by estimating the cost of minimum living for individuals. The numbers in poverty were not quantified and the Commission simply noted that there was a large proportion of the population living below the poverty line. The Dudley Seers International Labor Organization (ILO) report of 1971 estimated the minimum amount of money required for nutritional adequacy to be somewhere within the income group Rs. 100-200, depending on the household size and cost of living in the area. It was noted that "quite a large fraction of households are in this twilight zone (35 percent) and some below it (8 percent)," but the report concluded that "in judging these figures one must bear in mind Ceylon's free education and health services, its social security and its food subsidies programme."

Table 9.1. Percentage of Population in Poverty (1969/70-1986/87)

Year	Source	Urban	Rural	Estate	All Island
1969/70	Bhalla (1985)	4.9	12.8	11.1	11.2
1973	Khan (1989)	-	-	-	16.7
	Anand (1985)	22.7	31.6	8.1	27.6
1978/79	Gunaratne (1985)	19.4	25.0	7.6	22.3
	Kahn (1989)	-	-	-	11.8
	Gunaratne (1985)	16.0	22.7	5.9	19.5
	Anand (1985)	24.4	23.8	8.9	22.7
1980/81	Bhalla (1985)	16.9	25.9	25.0	24.1
	LFSE – 1980/81	51.5	50.9	42.7	50.5
	Kahn (1989)	-	-	-	39.2
1981/82	Gunaratne (1985) Table 15	17.7	26.1	12.3	23.6
	Anand (1989)	19.6	23.2	13.8	21.9
1985/86	Kahn (1989)	27.6	45.7	5.7	39.7
	LFSE – 1985/86				
	Gunaratne (1989)	12.3	32.4	5.9	27.4

The poverty lines used in the previous studies are presented below.

Poverty line Rs. Per month	**Year**	**Remarks**
N/A	1969/70	Equivalent poverty line using derived average price changes.
26.50 (per capita income)	1973	Minimum Cost Bundle Method.
N/A	1973	Equivalent poverty line using derived average price changes.
70.00 (per capita monthly food expenditure)	1978/79	Used the average per capita monthly food expenditure.
50.80 (per capita income)	1978/79	Minimum Cost Bundle Method.
N/A	1978/79	Households having food expenditure below a level required to meet nutritional requirements.
N/A	1978/79	Equivalent poverty line derived using average price changes.
N/A	1980/81	Equivalent poverty line derived using average price changes.
1466 for urban 1100 for rural 845 for estate per household)	1980/81	Monthly income required to purchase minimum nutritional income) requirements and other basic needs.
110 (per capita income)	1980/81	Minimum Cost Bundle Method.
N/A	1980/81	Equivalent poverty line derived using average price changes.
N/A	1981/82	Equivalent poverty line derived using average price changes.
175.00 (per capita income)	1985/86	Minimum Cost Bundle Method.
1920 for urban 1619 for rural 1451 for estate (per household income)	1985/86	Monthly income required to purchase minimum nutritional requirements and other basic needs.
N/A	1986/87	Households having food expenditures below a level required to meet nutritional requirements.

Note: In Minimum Cost Bundle Method income required to buy minimum consumption bundle is considered.

Table 9.2. Percentage of Households in Poverty (1969/70-1985/86)

Year	Source	Urban	Rural	Estate	All Island
1973	Kahn (1989)	-	-	-	18.5
1978/79	Kahn (1989)	-	-	-	12.5
	Gunaratne (1985)	15.8	21.2	6.0	18.5
1980/81	Kahn (1989)	-	-	-	34.8
	LFSE – 1980/81	58.0	58.7	55.7	57.3
1981/82	Kahn (1989)	-	-	-	12.2
	Gunaratne (1985)	14.6	22.4	10.0	20.1
1985/86	LFSE – 1985/86	32.7	51.1	9.9	44.7
	Kahn (1989)	-	-	-	25.1

More comprehensive assessments were done by Alailima (1978) and the Marga Institute (1978). They used an average minimum intake of 2200 calories per person per day - the average minimum recommended by the Medical Research Institute – to derive poverty lines for 1969/70 and 1973 respectively. Alailima, using per capita calorie consumption data from the 1969/70 survey by the Department of Census and Statistics (DCS), estimated that those in urban areas with monthly household incomes less than Rs.200 and those in rural areas with monthly, incomes less than Rs.150 could not meet their minimum calorie needs, while all those in estate areas attained the norm. Using calorie consumption data from the 1973 survey done by the Central Bank of Ceylon (CB), the Marga study calculated that spending units with Rs.100-200 per month achieved marginally adequate intakes. They took the average per capita income of Rs.36.5 per month for this group as an all-island poverty line. Alailima concluded that 18 percent of the population was in poverty in 1969/70 while the Marga study found that 24 percent of the population in 1973 was in poverty. Using a derived food consumption basket for 1977, since no consumption survey was available for that year, Alailima further estimated that 38 percent of the population was not satisfying its minimum nutrition requirements. Nevertheless, the different methods used to estimate poverty in 1970 and 1977 probably account for part of the substantial increase in estimated poverty between these two years.

Visaria (1979) recorded a much higher incidence of poverty using the same 1969/70 data. He assessed the poverty population on the basis of a norm of 2220 calories per capita per day and 2750 calories per adult

equivalent. He obtained, unsurprisingly, higher estimates for those in poverty of around 52 percent for 1969/70.

Sahn (1985), using the FAO/WHO (1973) recommended daily calorie allowances, found that 43 percent of the population did not achieve this level in 1980/81. However, since this standard assumes that there is no stunting of growth in the population, he felt that it *o*verstated the real needs and preferred to work with a categorization in terms of the "ultra-poor" and the "nutritionally-at-risk.". The ultra-poor were defined as those who achieved less than 80 percent of their calorie needs but were spending more than 80 percent of their expenditure on food. The nutritionally-at-risk were those who satisfied less than 80 percent of their calorie needs but spent less than 80 percent of their expenditure on food (Table 9.3). Using the ultra-poor definition unsurprisingly gave substantially lower estimates of poverty of 8.1, 3.7, and 3.8 percent for urban, rural, and estate areas respectively. What was surprising was that extreme poverty or malnutrition showed up more in the urban area; this is contrary to many of the estimates of poverty given in Tables 9.1 and 9.2 and suggests that more analysis should be done about the depth of poverty below the poverty lines.

Table 9.3. Achievement of Calorie Adequacy by Households, 1980/1981(Percent)

	Urban	**Rural**	**Estate**
Less than 100% of requirement	49.0	42.9	32.6
Less than 100% of requirement	24.5	20.4	13.3
-ultra-poor	8.1	3.7	3.8
-nutritionally –at- risk	16.4	16.7	9.5

Source: Sahn (1985) Table 2.13

Bhalla (1985), Anand and Harris (1985), and Gunaratne (1985) used the average per capita monthly food expenditure of the bottom 40 percent of households ranked according to per capita food expenditure to derive a poverty line for 197*8/7*9 of Rs. 69; equivalent poverty lines were then obtained for the periods 1969/70 and 1980/81; 1973, 197*8*/79 and 1981/82; and 197*8*/79 and 1981/82, using three different intersectoral price indices. Table 1 gives the estimates of poverty these three authors obtained for the period 1969/70 to 1981/82. Their results show that most

poverty is in the rural areas, followed by the estate and urban areas. Over 1978/79 to 1981/82 the authors, except Anand, showed slightly increased poverty. Anand showed slightly reduced poverty. From this contradiction it is evident that different degrees of poverty incidence have been arrived at according to the various ranking and other criteria used. Even within the same study, the use of different price indices can give different estimates for the same year, despite using the same data base.

Kahn (1989) did a detailed study on nutrition, health and poverty for USAID. He estimated a poverty line using a minimum cost bundle method and showed that poverty increased sharply from 1978/79 to 1985/86 (from 11.8 percent of the population to 28.6 percent). His low figure for 1978/79 (others such as Gunaratne (1985 and 1988) or Alailima (1988) were giving figures of 19.5, 22.3, or 35.4 percent) was probably due to price estimation difficulties and inconsistencies. The last estimate obtained was from Gunaratne (1989) for The World Bank; he estimated the number of households having food expenditure below a level required to meet nutritional allowances[4], and is the first to have presented results using the 1986/87 Socio-Economic Survey (SES). He showed (Table 9.1) that poverty increased from 19.5 percent of the population in 1978/79 to 27.4 percent by 1986/87. Most of this increase was in the rural and estate sectors while urban poverty decreased. Has poverty increased over the past decade? · The conflicting evidence of Tables 1 and 2 does not tell us. Over 1978 to 1987, GNP per capita grew at 3.3 percent a year[5], but according to Gunaratne (1989) all-island poverty rose from 22.3 percent to 27.4 percent of the population. To obtain such a result in the face of such high income per capita growth suggests that the distribution of income worsened considerably over the period 1978 to 1987. There is some evidence that the income distribution did worsen over the period, especially with the elimination of food subsidies for poor groups. Nevertheless, substantial worsening of income distribution must have occurred for poverty to have increased at the rate

[4]Full details are not yet available on how he made his estimates

[5]Calculation based on deflated GNP figures and population estimates in Kannappan and Nelson (1989).

it seems to have done on the basis of Gunaratne's figure[6]. In conclusion, poverty apparently increased over the decade 1978 1987, or at least was not reduced by much if at all. This conclusion must be tempered by uncertainly over data, price series and methodological problems.

Assessment of Existing Data Sources and their Value In Developing a Taxonomy of Poverty

As seen, an accurate assessment of the magnitude and incidence of poverty is hampered by the lack of good quality data. While differences in concepts and definitions cloud the issue, data that is often poor in quality and deficient in coverage compound the situation. In this section a closer look is taken at the data available for poverty studies in Sri Lanka.

Poverty is a dynamic variable, and the study of dynamic processes on the basis of cross sectional studies has inherent dangers. Poverty studies in Sri Lanka have depended substantially on data from the Consumer Finance Surveys conducted by the Central Bank of Ceylon, and the Socio-Economic Surveys carried out by the Department of Census, and Statistics. These were for the years 1953, 1963, 1973, 1978/79, and 1981/82 by the CB, and 1969/70, 1980/81, and 1985/86 by the DCS. It is inevitable that, over time, coverage and accuracy would have substantially improved. But lack of comparability, differences in definitions and timing of surveys, under-reporting of incomes, over-reporting of expenditures, inaccurate price indices, all present the investigator with many problems. Thus it should come as no surprise that, while there is broad agreement on the magnitude of the problem,

[6] There is reason to suspect that the growth rate figures used by Guneratne are incorrect because of faulty GNP deflators. Also, according to Alailima (1988), the studies by Bhalla, Anand, Harris and the earlier 1985 study by Guneratne suffer from two major weaknesses. First, using a poverty line based on the average expenditure on food consumption of the lowest 40 percent of households to determine poverty will generally identify a number around 20 percent of the population as being in poverty; these are very nearly the results for the years closest to 1978/79. Second, these studies used average price changes for the entire population to determine the poverty lines for the years 1969/70, 1973, 1980/81 and 1981/82, despite the fact that Bhalla's estimates show that price changes for the lower quintiles were substantially greater than for the higher quintiles.

estimates of poverty vary, sometimes widely. This has resulted in the current uncertainty on trends in poverty.

It has been said of poverty, that it has many faces - like beauty it is easily recognizable when seen but difficult to quantify (Orshansky, 1969). Consequently, definitions, measurements, and solutions depend on the particular facet of poverty being studied. Studies in Sri Lanka have generally emphasized the concept of absolute poverty, and used either the income or nutritional approach to estimate numbers living in poverty. The income approach defines the poverty line in terms of the income required to buy a minimum consumption bundle, though the composition of this minimum bundle, presumably consisting of basic requirements for bare survival, is rarely made clear. The usual approach is to calculate the minimum income required for a particular year, and make adjustments for the period under study, using some appropriate index. How this index is calculated is also often not made clear.

In the nutritional approach, discussed above, an average per capita intake of 2250 calories or 2500 calories per adult equivalent, is used to delineate the cutoff point for poverty. The arbitrariness in determining the minimum income of the calorie cutoff point is acknowledged. To overcome this problem, the concept of relative poverty is used[7]. A standard measure is to examine the ratio between the average income of the top to the bottom of the decile income distribution. In a sense, a poverty line that looks at the bottom 30 or 40 percent is a measure of relative poverty. Only two such studies, namely those of Visaria (1981) and Alailima (1988), resort to this approach. But, while the concept of absolute poverty emphasizes the dynamic aspects, the concept of relative poverty assumes that the poor will always be with us.

The CB surveys collect information on the basis of spending units, and per capita estimates are made on the basis of the size of the spending units. The DCS does so on the basis of households. While it is sometimes assumed that the two units of measurement are interchangeable, this need not be so. Again, there is no consensus in the literature on whether the household or the per capita estimate is the better indicator of poverty. Lipton (1983) argues in favor of using per capita estimates

[7]As Alailima (1988) comments, to devise a standard relative to what is acceptable to a community also involves a large number of assumptions.

because family size differences can obscure whether individuals within a family are poor or not. And a fixed poverty line based on an assumed average household size might record some large households to be over the poverty limit while an individual line might include each individual to be in poverty. On the other hand, Alailima (1988) suggests that per capita estimates overlook the economies of scale in household expenditures, and that in any case government policy programs are directed at households and thus analysis in terms of households proves more useful.

It has been clearly shown that, in making comparisons, the representativeness of the years under study should be kept in mind. The possibility of underestimating or overestimating the movements in the magnitude of poverty exists. Fields (1988), for example, asserts that in comparing the survey estimates of 1969/70 and 1980/81, due regard must be given to the fact that 1970 was an unusually good year for the economy while 1980/81 was an exceptionally poor one.

Judgement of the overall representativeness of the sample surveys in question and the quality of the data have been made on the basis of tests of internal and external consistency, using data from census and food balance sheets. Edirisinghe (1987), Anand and Harris (1985), and Khan (1989) have all checked survey data with national income estimates. While Edirisinghe and Anand and Harris express general satisfaction with such checks of external consistency, Khan reports that survey estimates of both income and expenditure were lower than the national mean, and that such underestimation was greatest for the 1985/86 survey. Furthermore, Alailima (1988) comments that national income estimates themselves are often dependent on survey estimates. Even the accuracy of census data ranges from about 95 percent in the United States to 50 percent or less for some of the developing countries, and the components of food balance sheets can carry error ranges anywhere from about 15 to 100 percent (Jogaratnom and Poleman, 1969).

All surveys seriously under-report income, and this is indicated by reported expenditures exceeding reported incomes over most income groups, except perhaps the highest. Khan (1989) reports that for the 1973 and 1980/81 surveys, mean expenditures exceeded mean incomes. by 30 percent, a divergence which he considers high enough to raise serious questions regarding data quality. Mean incomes by income class are reported to show the same divergences, with the expenditure for the poorest group as much as 20 times that of income! In recent years, such discrepancies have widened, perhaps due to the implementation of

targeted income transfer programs. It is also clear that such under-reporting can vary by sectors. Thus the degree of such under-reporting is expected to be much less for the estate sector, due to the resident labor force.

It is argued that expenditure, and food expenditure at that, should be used rather than incomes as a more reliable welfare indicator. But Khan (1989) shows that expenditure is subject to similar biases, since it is spread out over time and over different items. In addition, expenditure information is more likely to suffer from memory lapses than income. Korale and Premesaline (1989) describe under-reporting of food expenditure in the 1985/86 survey, and suggest that the decline in food expenditures from 65 percent to 54 percent over a five-year period casts doubts on the validity of the data.

It is widely acknowledged that commonly used deflators, namely the implicit GDP deflator or the Colombo Consumers Price Index, grossly underestimate price increases (see Fields, 1986 or Alailima, 1988). Some attempts have been made to construct new indices, but these cannot be evaluated because the basis of their construction is not known. The official rate of growth in per capita incomes has been questioned[8]. Similarly, the rates of growth in living standards have been contested. While this may affect the growth versus distribution debate, it has more serious implications for a proper understanding of the causal mechanisms of poverty. Using one index, one concludes that real wages have increased. Using another, real wages are estimated to have decreased." Thus while Anand and Harris conclude that living standards improved over the period 1973 to 1981/82, Khan on the basis of incomes adjusted for underreporting asserts that the conclusion reached by Anand and Harris is invalid, and that, if anything, living standards dropped.

At a different level, a study of the policy responses of the government and their impact is hampered by a lack of reliable production data, especially for the agricultural sector. The DCS and the Department of Agriculture both collect agricultural statistics and these are often contradictory. Production estimates are often made on the basis of per

[8] Fields (1986) in his argument cited later in this paper argues that growth rates were less than 1 per cent per capita per year over the 1970s in real terms compared with the official estimates of around 3 percent.

capita consumption. Or production data are based on estimates of area and yield at the village level by different sets of officers. The variations and contradictions reflect the subjective judgments of the officers concerned. Estimates of paddy production based on crop cutting samples are not likely to be seriously affected, but the likelihood of errors creeping in cannot be ruled out (Jogaratnam and Poleman, 1969).

The above, therefore, throws into question the reliability of surveys and the poverty estimates based upon them. In particular, the representativeness and accuracy of the Labor Force and Socio-Economic Surveys of 1985/1986 must be reassessed in view of the unsettled conditions under which it was carried out.

Section Three

Socioeconomic Characteristics of Poverty in Sri Lanka

In this section, existing surveys, villages studies *(*for example, the MARGA study), and qualitative assessments will be used to build a picture of who the poor are and whether different groups are being affected either seasonally or over a number of years. The analysis will attempt to map changes from around 1977/78 to the present, and poverty will be analyzed under a number of headings.

Poverty by Socioeconomic Groups

There is general agreement that the poor are concentrated among landless laborers; smallholders; urban, unskilled, informal-sector workers; and unskilled estate workers. However, few studies in the literature identify vulnerable groups by these sorts of socioeconomic characteristics and most concentrate on identifying the poor by decile and geographic location (estate, urban, or rural). Consequently, it has been, and continues to be, difficult to hone policy measures directed with precision toward the poor. Recent analyses that go some of the way to identify the poor by socioeconomic groups are the study of six villages by the Marga Institute (Marga, 1981), which identifies the poor in relation to their specific activities, and the study by Alailima (1988). The former study is informative but suffers from not being nationwide. The latter study is wide ranging and comprehensive in many respects, covers the whole nation, looks at socioeconomic poverty groups in terms of occupational

groups, and adopts an interesting and useful approach through closely observing the habits of poor people in different environments[9].

Using the 1969/70 Socio-Economic Survey, Alailima (1978) found that 88 percent of the low income receivers in the bottom 35 percent of households belonged to 10 occupation groups[10]. These then fell into two major groups - (1) landless laborers in rural areas and estates and in small-scale industry, particularly textile, wood product, and food-crop hired laborers; and (2) small farmers cultivating food crops mainly with family laborer. The Marga study of 1978 broadly supported this but also identified the significance of female income earners in estate areas. Alailima also states in her study that households at the lower end of the income scale had a very much smaller than-average household size and a higher dependency ratio. Visaria (1979) found that the highest incidence of poverty measured in terms of inadequate calorie intake per adult equivalent was among the Sinhalese in rural and estate areas and among Indian Tamils in urban areas[11]." Sahn (1985) found that, for 1981/82, nutritional standards were low across a wide spectrum of households where the main income earner was an agricultural or husbandry worker, a laborer, a cultivator, or a farmer.

Alailima (1988) examined the characteristics of poor households by occupation and income earner over time. She found that just six occupational groups - agricultural and animal husbandry workers, farmers, labor *(*not elsewhere categorized), construction workers, spinners and weavers, domestics, and those without occupation - accounted for 83 percent of the poor income receivers in 1969/7*0* and 72 percent in 1981/82. In this period all these groups, with the exception of farmers, had an increasing proportion of their members coming within the group of poor income receivers, suggesting that in relative terms these occupational groups were falling behind. On the other hand, farmers began moving out of the poverty category during this period, indicating more favorable income performance; but in 1981/82, 39

[9] And this is why much of the material presented here was drawn heavily from Alailima (1989). She used a poverty line defined as the cutoff for the bottom 40 percent of the population classified according to household income to be poor.

[10] Evidence drawn from Korale (1989)

[11] These are only around 2-3 percent of the population in urban areas

percent still remained among the poor. Among the less significant categories, miners, stenographers/typists, tailors/dressmakers, and salesmen showed increasing representation among poor income receivers, while food and beverage processors, working proprietors, and protective service workers had a fairly steady proportion of their members in the poor group.

When looking at geographical regions and occupational status, Alailima (1989) found that agricultural and animal husbandry workers (which include the landless and marginal smallholders) and other laborers were the most significant categories of poor income receivers in urban, rural, and estate sectors. The urban poor had a more diversified range of occupations with steno/typists, domestics, tailors, and construction workers poorer in 1981/82 than in 1969/70. The rural sector showed a sharp fall in the proportion of cultivators and farmers (although they still constituted 15 percent of the poor income receivers in 1982); the representation of miners, food and beverage processors, tailors and office staff among poor rural income receivers among the poor also increased.

In the estate sector, workers are dependent on work provided in the estate due to lack of mobility, no access to land, and poor educational status. They are particularly vulnerable to changes in world market prices for tea, rubber, and coconut. Although minimum security is provided since basic requirements can be obtained from the management on credit, it is the number of days of work offered each month and the wage rate negotiated in the Wage Board that determines the income status of estate households.

Poverty in the rural sector is characterized by insecurity due to wage incomes varying through the season, and the casual nature of the work available. In the first half of the 1970s, income earning opportunities in the village (as elsewhere in the economy) did not expand at the same rate as the work force. The main market for labor outside the village (except in areas adjacent to towns) has been the estates in the Wet Zone. However, recently, movement from villages to estates has been small due to ethnic rivalry and suspicions.

Income receivers without occupation are largely pensioners. The problems associated with old age are more prevalent on estates and in urban areas. In the rural sector, property and assets, though small, provide the aged some independent means and they fare less badly.

For 1978/79, Alailima analyzed data on income from all sources available and found that most of the poor derive 15-25 percent of their income from sources other than their main occupation. The real value of income received for the main occupation improved for agricultural workers, farmers, and laborers (not elsewhere counted) between 1973 and 1978/79; but all categories suffered significant declines in real incomes between 1978/79 and 1981/82. Farmers' income declined by as much as 67 percent over this period, so their movement out of the poverty group, noted above, arose through an increase in other income sources. Income-in-kind contributed almost as much to total income as income from their main occupation in 1979 (Table 4), so that a change in the valuation given to home-consumed food as a result of increased market prices during this period would have had a substantial impact on total income. If the improvement in the relative income position of farmers was due to a change in the valuation of their income-in-kind, their movement out of poverty might have been more apparent than real. In other words, their real incomes may not have improved.

For seven of the nine main categories of poor income receivers, 75-80 percent of income came from their main occupation, with transfers from government making a significant contribution to their total income (Table 9.4). Income receivers without occupation relied mainly on local transfers (42 percent), pensions (21 percent), and transfers from government (15 percent). Transfers from abroad are insignificant for poor income receivers.

Poverty and Nutrition[12]

In numerical terms, the most serious nutritional problem in the world (as in Sri Lanka) is that of protein energy under-nutrition. Of all the leading nutritional deficiency diseases, this is the most difficult to manage, because it cannot be cured through the usual food fortification programs for combating other deficiency diseases, such as goiter or nutritional anemia. The cure is an elevation of the daily intake of protein itself up to levels, or cutoffs, deemed satisfactory. There is no agreement as to what these cutoffs should be because of the variation in climatic,

[12] Thanks to Seneka Abeyratne of USAID, Colombo for providing a first draft of this section.

genetic, demographic, occupational, and physiological characteristics within a country. Consequently, economists have been unable to agree upon income cutoffs that correspond to adequate nutritional levels.

Table 9.4. Distribution of Income of Poor Income Receivers from Main Occupation by Source, 1978/79 (Percent)

	Main Occupation	Sub Occupation	Rent Govt	Transfers	Other Local	Income in kind	Other Sources	Total
Agriculture and Animal Husbandry	79	4	2	6	3	5	1	100
Farmers & Cultivators	28	13	8	14	9	24	4	100
Labour n.e.c	76	2	3	9	4	4	2	100
Salesmen etc.	81	2	3	6	4	3	1	100
Working Proprietors (wholesale and retail)	80	2	3	7	3	4	1	100
Spinners and weavers	80	2	2	7	5	5	1	100
Carpenters, Brick layers, Construction, Workers	72	3	3	10	3	5	4	100
Domestics	84	1	1	4	5	2	3	100
Income Receivers without occupation	-	-	8	15	42	8	27[a]	100

Note: (a) 21 percent is from pensions.

Source: Central Bank of Ceylon (1983) Part II Tables 4.328 - 4.406 (cited in Alailima, 1988).

In Sri Lanka, information available on poverty is derived from the large (island-wide), cross-sectional surveys carried out separately by the DCS and the CB every five years or so. The same surveys also yield data on dietary intakes. Two or three separate cross-sectional surveys have also been undertaken that provide data on anthropometric indicators but

which, unfortunately, do not relate to underlying socioeconomic factors such as income. The first (island-wide) study that attempted to relate income to dietary patterns and nutrient intakes was the 1969/70 Socio-Economic Survey (Special Report) published by the DCS. This study reported that the bottom 43 percent of households in terms of per capita income) had an average daily per capita intake of calories less than the recommended allowance of 2200 calories. It did not, however, say whether this estimate was "efficient," or, in other words, if the average energy intake level of the poor was, in statistical terms, significantly lower than the levels of the other income groups.

The socioeconomic survey reports published since that time (by either the DCS or the CB) do not all address the per capita, income-nutrient relationship directly; thus it is not possible to build a continuous longitudinal picture since 1969/70. That this exercise has not been done is remarkable, given that all it takes is some additional processing, analysis, and interpretation of the raw data. The two main surveys deficient in this respect are the 1973 and 1985/86 surveys undertaken by the CB and DCS respectively. This deficiency needs to be corrected if the impact of economic liberalization on nutrition is to be assessed.

Kahn (1989) noted, using 2500 calories, per AEU per day as the cutoff, that the proportion of calorie-deficit households in 1969/70 was around 22 percent. If the same cutoff is applied to the 1978/79 survey data (CB), the proportion is around 38 percent. By the same criterion, the proportion of calorie-deficit households in the 1981/82 survey (CB) is also around 38 percent (Khan, 1989). Because of gaps in the data between 1969/70 and 1978/79, it is not possible to say if this worsening of the nutritional situation is directly attributable to the '1977 economic liberalization. Nevertheless, the results broadly suggest that the prevalence of malnutrition increased substantially after the economic liberalization of 1977.

Alailima (1989) noted that per capita daily calorie consumption data for 1979, 1981, and 1982, whether the population is ranked by household income or per capita expenditure (Table 9.5), show that the consumption level of the poor has fallen to a very low level - well below the recommended minimum. The nonpoor, on the other hand, have shown major improvements in their daily calorie consumption in 1979 and 1982, with a slight dip in 1981.

Table 9.5. Nutritional Content of Per Capita Daily Consumption Selected Ye*a*rs

		Ranked hold by Total Household Income Group		**Ranked by Per Capita Expenditure**
		Calories	**Proteins (gms)**	**Calories**
1969/70	Poor	2064	47	2024
	Non-poor	2352	56	2925
1973	Poor	2072	n.a	n.a
	Non-poor	2141	n.a	n.a
1978-79	Poor	1834	41	1710
	Non-poor	2574	60	2692
1980/81	Poor	n.a	n.a	1640
	Non-poor	n.a	n.a	2639
1981/82	Poor	1865	40	1635
	Non-poor	2700	62	2711

Source: Alailima (1988)

Most households in the bottom three deciles (the bottom 20 to 30 percent) were unable to recover from the impact of price changes that occurred during 1979/80, while about 70 percent of other households improved their calorie consumption from the relative deterioration seen in 1980/81 (Edirisinghe, 1987). The consumption of the lowest decile fell as low as 1181 calories per person per day in 1981/82 (lower than in 1973 for this group) *(*Alailima, 1985). There was a reduction in quantities consumed of the staple foods (rice, wheat flour, bread, sugar, and coconut) for spending units in the lowest quintile between 1978*/7*9 and 1981/82 *(*Central Bank of Ceylon, 1986 Report, Table 6.16). In contrast, the highest 40 percent of the population achieved higher consumption levels in 1982 than they had in 1979 or 1970.

The 1986/87 survey data *(*CB) are yet to be published in full. These data are critical for determining whether poverty and malnutrition continued to worsen in the mid- to late-1980s.

For the national planner, protecting the poor against the adverse short-term effects of macroeconomic reforms designed to promote development of the economy in the long run is a difficult task. Cuts in consumption benefits release resources for investment, and an overall increase in the price level occurs as subsidies are eliminated. Thus, an

increase in the prevalence of malnutrition and poverty in the short run is almost an inevitable consequence of Sri Lanka's current development model. A safety net - an income supplement, consisting of cash or a staple food basket or a combination of both such as food stamps in Sri Lanka – is a device that governments use to ensure that the problem of hunger is minimized. In order to ensure that the size of this safety net is correct, the planner needs to have correct figures on the size of the nutritionally vulnerable group (or groups). However, it is here that difficulties start. Defining the right cutoff (whether it be an anthropometric index or a recommended nutrient allowance) is one part of the problem. The other is to estimate the target groups accurately on the basis of that standard. The lack of an agreed standard and the fact that some groups may be protein deficient and others calorie deficient and that these deficiencies occur at different times during the year all lead to the conclusion that there are different sets of poverty and, consequently, targeting to reduce malnutrition is very difficult.

Poverty and Unemployment

The International Labor Organization standard definition of the unemployed is those who have been actively seeking work in the week preceding the survey, have not worked for more than one hour, and are aged between 15 and 65. With such a restricted definition, one might expect the unemployed to consist of few very poor people simply because they have to perform some sort of activity, however menial and unproductive, in order to scratch a living. If this is accepted, then poverty is largely related to underemployment where the poor toil for long hours but cannot satisfy their minimal basic needs[13]. The fact that poverty is concentrated in the rural and estate sectors attests to this thesis that underemployment is the major issue, and not unemployment per se: Yet most authors (such as Alailima, 1988; Richards and Gooneratne, 1980; Korale, 1988; and Fields, 1986) emphasize the strong relation between unemployment and poverty. Korale (1988) notes that unemployment has been a critical issue during the past two decades. The Labor Force and Socio-Economic Surveys have consistently shown the overall rate of unemployment to be high, ranging from around 17 percent in 1971

[13]See Hopkins, 1983 for a discussion of this issue.

(population census) to 14 percent in 1985 (Labor Force Survey). Some doubt has been expressed on the comparability of the definitions used over time (see Nelson, 1989) and, if justified, is probably why the aforementioned authors stress the relation between unemployment and poverty. There does not appear to be a well-documented account of this and it is something worth investigating further.

Despite seeming inconsistencies in the data, one can assert that there has been a wide variation in the unemployment rate among geographical areas with the bulk of the unemployed located in the more densely populated Wet Zone region. The unemployed are largely young with as many as 75 percent of the unemployed less than 30 years of age. The majority of the unemployed, according to Korale (1989), have been first time job seekers who have sought employment after completing their education, and lacked any job experience. All this points to unemployed youths waiting to find jobs while, more than likely, supported by (and increasing the burden of) their families. Richards and Gooneratne (1980) refute this view. They note that the male poor have higher unemployment rates, proportionately more are young, and, whatever their level of education, the poor have greater difficulty in finding employment. Female unemployment is distinguished by a greater age and education spread between income groups, and female unemployment probably does not weigh most heavily on the poor.

Alailima (1988) also concludes that poverty in urban and rural areas is closely related to increasing unemployment (her data are reproduced in Table 9.6) as well as declining real incomes of income receivers in these households. She finds that unemployment rates are high and have increased for the poor in urban and rural areas while for the non-poor they have decreased between 1969/70 and 1980/81. In the estate sector, unemployment rates have fallen for both groups to very low levels, and poverty is related more to underemployment and very low incomes per income receiver.

The Demographics of Poverty

As well as economic activity, poverty is a function of such demographic factors as the number of income earners in the household, and their age, ethnic background, sex, and location. In order to analyze these demographic characteristics Alailima (1988) used a poverty line that broadly delineates an equivalent group of income receivers and

investigates the characteristics of this group. The poverty line was chosen so that the percent of income receivers below it was the same over the four survey periods chosen for the analysis during 1969 to 1981. The poverty line in 1981/82 was chosen to be R*s*.700 per capita. Thus households with all income earners below this sum were deemed to be poor in her analysis, parts of which are reported here.

Table 9.6. Unemployment Rates for the Poor and Nonpoor Over 10 Years of Age by Sector, for 1969*/70* and 1980/81

	Poor		**Non-poor**		**All**	
	1960/70	**1980/81**	**1969/70**	**1980/81**	**1969/70**	**1980/81**
Urban	18.2	20.7	17.3	17.2	17.4	18.1
Rural	11.3	14.5	15.9	13.1	14.3	13.7
Estate	8.7	6.2	9.1	4.4	8.9	5.0
All Island	11.2	14.5	15.4	13.0	13.9	13.5

Note: The definition of unemployment used by Alailima makes it about 4 percent less than given in the 1971 and 1981 Censuses in each year.

Source: Alailima (1988) who used Department of Census & Statistics Special Tabulations of 1974 and 1983.

Between 1970 and 1982 the major change that occurred in the sectoral distribution of the total population was the decline in the estate population, both in absolute terms and as a percentage of the total population, mainly due to repatriation to India. Between 1973 and 1979, there was also a movement out of rural areas with the proportion in rural areas falling from *7*2 percent to 69 percent, this trend was reversed between *1*979, and 1982. There were minor changes in the proportion of the population that was poor and in their location. The poor in urban areas climbed from 3 percent of the total population in 1970 to 6 percent by 1979, but fell back to 4 percent in 1982, while the proportion living in rural areas went from *27* to 26 to 30 percent in the same period. The estate poor, however, declined steadily from 5 to 3 percent of the population.

According to Lipton (1983), historically, poor households tended to be small, but he argues that now poverty is strongly linked to (big) household size. This is not so in Sri Lanka, where poor households tend to

be smaller-sized than non-poor households (Table 9.7), averaging 4.1 persons per household in 1981/82 compared with the non-poor's *5*.6. Further, the trend is toward smaller family size. Rural areas tend to have larger families than either estate or urban-located families, which have, on average, more or less the same size family.

Table 9.7. Average Size of Poor and Nonpoor Households

	1969/70[a]		1973[b]		1978/79[b]		1981/82[b]	
	Poor	**Non-Poor**	**Poor**	**Non-Poor**	**Poor**	**Non-Poor**	**Poor**	**Non-Poor**
Urban	4.8	6.7	3.9	6.0	3.5	5.4	n.a	n.a
Rural	5.0	6.6	4.4	6.5	4.1	5.9	n.a	n.a
Estate	4.4	6.6	4.0	6.7	3.6	5.7	n.a	n.a
All Island	4.9	6.8	4.3	6.4	4.0	5.7	4.1	5.6

Notes: n.a. not available.

b. Spending Unit

Source: Alailima, Table 6.4 (1988).

The age structure of the population changed over the decade of the 1970s (Table 9.8), with the proportion of those under 13 years falling from 39 percent in 1970 to 34 percent by 1981, and those aged between 14-55 years increasing from 52 to 57 percent. The trend was the same for the poor as well as the non-poor with the poor tending to have slightly more young people aged 0 to 13 than the non-poor.

The ethnic composition of poor income receivers (Table 9.9) also changed over this period, as a result of the government's policy of repatriating the stateless Indian Tamil estate workers. The proportion of Indian Tamil income receivers among the poor declined steadily between 1973 and 1981*/82*, even as the proportion of the poor in the estate sector declined. The low-country Sinhalese, Ceylon Tamils and other (minority) groups had higher incomes per income receiver in 1981/82 than the Kandyan Sinhalese and the Indian Tamils. Kandyan Sinhalese income receivers suffered the sharpest decline between 1973 and 1981*/*82.

The Indian Tamils remained concentrated in the estates - in 1973, 86 percent were in the estate sector and represented *7*9 percent of the total population; in 1982 the figures were *77* and 7*8* percent respectively. This,

together with the traditionally low per capita incomes in the estates sector, resulted in Indian Tamil income receivers being the worst-off ethnic group in both 1973 and 1981/82.

Table 9.8. Age Distribution of Poor and Non-poor Population 1969/70, 1973, 1978/79, 1981/82

	Population Age Distribution (%)			
	0-13	**14-55**	**Over 55**	**Total**
1969/70				
Poor	42	48	9	100
Non-Poor	38	53	9	100
All	39	52	9	100
1973				
Poor	40	51	9	100
Non-Poor	38	54	8	100
All	39	53	8	100
1978/79				
Poor	37	54	9	100
Non-Poor	33	58	9	100
All	34	57	9	100
1981/82				
Poor	37	54	9	100
Non-Poor	32	59	9	100
All	34	57	9	100

Sources: Table 6.5 of Alailima (1988)

Nevertheless, ethnicity does not appear to be a major determinant of poverty as the Kandyan Sinhalese, the low-country Sinhalese, and Ceylon Tamils are fairly evenly represented among poor and non-poor income receivers, especially in 1981/82. Only the Indian Tamils are disproportionately represented among the poor due to their concentration on the estates.

In terms of poverty and sex, an increasing proportion of income receivers are female (Table 9.10). Starting with 40 percent in 1970, the proportion of poor income receivers who were female increased to 41 percent in 1973 and 44 percent in 1979 but fell back to 40 percent by 1982. Among the non-poor however, there has been a steady improvement in the proportion of female income receivers from 9 percent in 1970 to 15 percent in 1982, indicating that females, though

still a small percentage of wage earners, are making steady inroads into better-paid jobs.

Table 9.9. Distribution of Income Receivers and Average Monthly Income by Ethnic Group, 1973 And 1981/82

	Distribution of Income Receivers (%)				Average Income or Poor Income Receivers 1973-1981/82			
	1973		1981/82		1973	1981/82	1981/82 (at 1973 prices)	Real Change %
	Poor	Non-poor	Poor	Non-poor				
Kandyan Sinhalese	12	14	14	14	104	383	82	-21
Low country Sinhalese	16	24	20	25	101	397	85	-16
Ceylon Tamils	5	6	5	5	102	426	91	-11
Indian Tamils	14	2	10	1	89	361	78	-12
Others	2	5	2	4	113	420	90	-20
Total	49	51	51	49	99	390	84	-15

Notes: Income data by .ethnic composition was only available for 1973 and 1981/82.

Source: Table 6.7 of Alailima (1988)

Table 9.10. Income Receiver by Sex and Real Monthly Income, 1969/70, 1973, 1978/79, 1981/82

	1969/70		**1973**		**1978/79**		**1981/82**	
	Poor	**Non-Poor**	**Poor**	**Non-Poor**	**Poor**	**Non-Poor**	**Poor**	**Non-Poor**
Sex Distribution %								
Male	60	91	59	90	56	83	60	85
Female	40	9	41	10	44	17	40	15
Real Income (Rs.)								
Male	59	n.a	64	n.a	54	n.a	52	n.a
Female	48	n.a	44	n.a	43	n.a	41	n.a

Sources: Table 6.8 Alailima (1988)

The much higher proportion of female income receivers among the poor compared with female non poor is due to the higher ratio of female workers on estates, who come into the poverty group because of their relatively low wages. The real incomes of poor female income receivers have remained two-thirds of that of male income receivers between 1970 and 1982, except in 1973.

Poverty and Education

The improvement in formal educational levels that took place during the 1970s and 1980s is reflected in the improved educational levels of poor income receivers (Alailima, 1988). Between 1970 and 1982 the proportion with no schooling or only primary education fell from 79 percent to 65 percent, while those with secondary schooling together with those who had passed their GCE 'O' level examination increased from 21 percent to 35 percent (Table 9.11).

Table 9.11. Poor Income Receivers by Educational Attainment and Real Monthly Income, 1969/70-1981/82

	Distribution of Poor Income Receivers (%)				**Average Real Income (Rs.)**				**1969/ 70- 1981/ 82 % Change**
	1969/ 1970	1973	1978/ 1979	1981/ 1982	1969/ 1970	1973	1978/ 1979	1981/ 1982	
No Schooling	30	33	25	23	50	55	46	43	-14
Primary	49	46	38	42	57	58	60	47	-18
Secondary	19	18	30	27	57	60	51	50	-12
Passed 'O' level	2	3	6	7	57	62	53	53	-7
Passed 'A' Level	-	-	1	1	63	77	51	63	-
Degree	-	-	-	-	-	-	59	70	-
Total	100	100	100	100	55	57	51	48	-13

Sources: Department of Census & Statistics (1974); Alailima (1988)

However, the increase in educational attainment did not bring with it an increase in real income for the poor (Table 9.11). Income receivers with secondary schooling in 1982 were earning in real terms what their

counterparts with no schooling were earning in 1970. Between 1970-1973 all educational categories improved their real income, but thereafter those with no schooling, primary, and secondary education suffered real income declines. Only those with GCE 'A' Level qualifications managed to recover (by 1982) the real income they earned in 1970. The primary-school educated suffered an 18 percent decline in real incomes and a narrowing of differentials with those who had no schooling.

The decline in real income was probably associated with the lack of productive employment for the secondary school educated throughout the 1970-1982 period and led to the systematic upgrading of qualifications for jobs.

Lack of education and poverty are closely associated to the extent that those who succeed in passing 'O' levels and higher are practically assured of avoiding poverty. Evidence for this is in Alailima (Table 9.11 above) and is backed up for later years by Korale (1989) who used the 1985/86 socioeconomic survey (Table 9.12). In that table persons are ranked according to their per capita income, allocated to deciles and the average educational attainment is recorded. Surprising is that the percentage of people in the lowest decile who have passed 1-4 grades is larger than those with no schooling. This is probably a statistical quirk - a small sampling error for example – since all other figures confirm the general conclusion expressed earlier in this paragraph. Unfortunately, a similar table that measures skill acquisition or ability against income decile is not available but it is most likely that the same result would hold namely, the higher the level of skill acquired the higher the income.

Qualitative Assessment of Poverty from 198*7* *to* the Present

The poor are a heterogeneous lot. What helps one may hurt another. Thus an increase in the price of rice may help the marginal farmer with a small marketable surplus, but hurt the casual laborer, who must purchase his rice. So we need to know much more about those who fall below the poverty line.

It was estimated that about 6 million people lived in poverty in 1985/86, of whom nearly 5 million were in the rural sector, 900,000 in the urban sector, and about 50,000 in the estate sector (Dept. of Census and Statistics, 1987). It was also estimated that about 5.1 million were in employment while about 840,000 were unemployed, of whom 5*67*,000 were in the rural sector, 236,000 in the urban sector, and about 35,000 in

the estate sector. Of those employed, about 1.*7* million were estimated to be below the poverty households. The figures for the rural and estate sectors were 52 percent and 5 percent, respectively. While, as indicated elsewhere, the database is not all that satisfactory, the above figures provide some rough orders of magnitude. The figures for the estate sector are, however, highly suspect. They indicate drastic falls in numbers living in poverty, from about 440,000 in 1980/81 to about 53,000 in 1985/86.

Table 9.12. Distribution of Persons by Educational Attainment by Per Capita Income Deciles - 198*5/*86 (Percent)

Per Capi. Deciles	**No Schooling**	**Passed 1-4 Grade**	**5 -9 Grade**	**GCE 'O'**	**GCE ' A'**	**Degree**	**Post-Grad**
1	14.5	15.1	10.2	5.1	2.3	0.6	0.8
2	14.6	14.1	10.3	4.2	3.3	1.9	1.7
3	13.1	12.2	10.3	5.4	3.6	1.5	0.0
4	11.4	11.9	10.6	7.1	4.8	1.1	0.8
5	11.0	11.1	10.7	7.3	5.2	0.4	3.3
6	10.2	9.7	10.3	7.9	7.0	2.3	1.2
7	8.4	8.4	10.6	10.7	9.5	3.4	1.1
8	7.5	7.1	10.0	13.0	13.8	7.2	8.5
9	5.5	5.7	9.2	19.0	21.4	25.5	9.2
10	4.0	4.8	8.0	20.3	29.6	56.1	73.5
Total	100	100	100	100	100	100	100

Source: Korale (1988)

What has happened to poverty since 1986/*8*7, the date of the last socioeconomic survey*?*[14] Clearly such an assessment has to be of a qualitative and impressionistic nature. The years since 1983 have seen an escalation of ethnic violence in the north and east, and an associated breakdown of the civil administration since about 1985. Violence erupted in the deep south with the arrival of the Indian Peace Keeping Force in 1987 and engulfed several other parts of the country through 1988 and 1989. The violence appears to have abated in areas outside of the north

[14] Only preliminary figures are so far available and these were cited in Table 9.1.

and east. Under these circumstances, the quality and coverage of any data collected since 1983 leaves much to be desired.

Arguably, the macroeconomic picture serves as an appropriate backdrop to recent developments in respect to poverty. Political violence and social unrest have helped to keep growth, exports, and foreign investments low. Budget deficits have increased and the balance of payments continues to deteriorate. Although the relationship between macroeconomic indicators and poverty in Sri Lanka is not entirely clear and is worthy of further research[15], it is felt that the worsening social and economic conditions have affected the poor adversely. Fiscal and budgetary deficits have intensified inflationary pressures, and when budgetary deficits are financed from expansionary sources, it is the poor who bear the greatest burden (see Central Bank of Ceylon, 1988). In the process of raising revenues and cutting expenditures, the likelihood of social welfare measures being curtailed cannot be discounted. Thus, for instance, the real value of food stamps targeted at the poor continues to fall, while a ceiling has had to be placed on the number of beneficiaries and the value of benefits.

Given this background, one does not expect any improvements in the poverty situation after 19*87* and, from the evidence cited earlier, it appears that recent events have aggravated an already worsening situation. In other words, an acceleration in the incidence of poverty since 1977, significant reductions in the food intake of the poorest when food rationing was replaced by food stamps, increased unemployment and underemployment, and falling real agricultural wages.

In recent years poverty probably has been most affected by three factors: civil strife, climatic changes, and price escalations. To take civil strife first, there was or must have been substantial drop in production, both agricultural and other, in the north and east because of the collapse of the civil administration and disruption of supplies, especially of agricultural inputs, and services such as transportation, marketing, and electricity. The large-scale displacement of people will have compounded the situation. It is not only the landless laborers and marginal farmers who have been hardest hit. Even those operating viable units, especially

[15]For example, subsistence farmers may be largely unaffected by macroeconomic phenomena

the market gardeners, artisans, and petty traders, are likely to have been driven into poverty. The curtailment of all fishing activity has affected not only the fishermen of the north and east, but also the migrant fishermen of the west and south. The spread of political turmoil to the south, beginning from about July 1987, is likely to have had similar repercussions.

Second, in the short-run, weather changes are likely to be much more important than technological change. Crop failures, especially those associated with floods and drought, have important implications for poverty. Some evidence from India indicates that variations in the incidence of poverty between a good year and a bad year can be as high as 50 percent. Drought conditions in 1987 and 1988 affected large parts of the Dry Zone and the hardest hit would have been those dependent on rain fed farming. Floods in mid-1988 affected the southwestern coastal lowlands and the Ratnapura District. While drought and flood relief operation may have helped to alleviate the situation somewhat, the effect of seasonal Crop failure is well known - it drives those affected into penury.

Third, inflation has both positive and negative effects on the poor. Net purchasers of food such as the landless and marginal farmers accounting for about 40 percent of the rural poor are adversely affected. Official statistics indicate an acceleration of the inflation rate between 1986 and 1989 (Department of National Planning, 1989). For wage labor, the relationship between wages and prices is crucial. Using rice prices to deflate wages, Khan (1986) reported a consistent declining trend in real daily wages for the years 1983 to 1986. Considering the price increases in rice, sugar, milk powder, and wheat flour during the latter part of 1989, the situation has undoubtedly deteriorated even further. There is no evidence to show that falling real wages have been offset by increasing employment. Finally, if we look at the nutrition and health situation in the country, the general impression is of a deteriorating situation. This affects the urban slum dwellers, the estate labor, the new settlers in the Mahaweli irrigation schemes, the Dry Zone rainfed farmers, and people caught up in conflict areas, particularly in the north and east. Increased morbidity rates, increased anemia among pregnant women, and low birth weight of babies are reported. It is surprising that infant mortality rates appear to continue to fall. How this can happen in the face of rising poverty is puzzling and must mean that infants survive, but at a lower level of well-being. Eventually, this will undoubtedly have a negative

impact on infant survival rates even if this has not so far been revealed by the data.

Section Four

Long-Term Causes of Rural Poverty

Griffin (1978) attributes poverty to unequal ownership of land and other productive assets, allocative mechanisms which discriminate in favor of the owners of wealth, and a pattern of capital accumulation and technical innovation which is biased against labor. Characteristics associated with poverty which may lead to or intensify poverty are the pressure of population on resources, unemployment and underemployment, poor nutrition, poor health, illiteracy, unfavorable price-wage relationships, seasonality of production, an inhospitable physical environment, natural and man-made disasters, civil strife, wars, and so forth.

The poverty problem in Sri Lanka has attracted considerable attention in recent years, but there has perhaps been a preoccupation with the definition and measurement of poverty, and less, much less, on its determinants. While information on the magnitude, incidence, and location of poverty are important in the efforts to mitigate the incidence of poverty, one may well echo Paul Streeten (1982) when he says that. the proportion of "the GNP earned by the bottom 40 percent and the Gini coefficient are just as inadequate and, by themselves, misleading measures of what we are getting at when we try to reduce inequality, as GNP is an inadequate measure of productive capacity.... Some of the most important obstacles to the eradication of poverty and the promotion of greater equality lie in areas in which measurement is still very difficult or perhaps impossible."

Poverty estimates for Sri Lanka vary anywhere from about 10 percent of the population to over 50 percent. Even the interpretation of poverty trends is inconclusive because of different criteria used to rank and define poverty, as we noted in earlier sections. Within the same study, the use of different price indices can give different estimates for the same year, despite using the same database. The accuracy of the database has also come into question, as discussed earlier. Nevertheless, the broad picture. that emerges appears to find general acceptance: that substantial sections of the population live in poverty, with a heavy concentration in the rural areas, and with landless and small farmers being most seriously

affected. We now take a closer look at some of the factors that may cause or intensify poverty in the rural area.

Given the high concentration of the poor in the rural sector, estimated at about 75 percent of all people living in poverty' or about 5.9 million people in absolute terms (Korale and Fernando, 1986), attention in the rest of this section will be given to some of the major characteristics of rural poverty. Evidence cited here has shown that the largest group of people below the poverty line are the landless and near-landless. Thus factors such as the physical environment, the type of farming system, tenancy and its terms and conditions, security of titles to land, fragmentation, and so forth, all help cause or exacerbate poverty. Each is looked at in more detail.

Landlessness

Accurate information on the number of landless and their temporal and spatial distribution is not available. A recent study quoting the Population Census of 1971 and the Central Bank's Land and Labor Use Survey of 1975 estimated the rural landless to be 200,000 persons and 330,000 persons, respectively. According to the Census of Agriculture 1982, 11.2 percent of the land operators did not own any land. If, as an ARTEP report estimates, those reporting home gardens only are also counted among the landless, the proportion increases to 51 percent of all operators (ILO/ARTEP, 1986). The report considers this an underestimate of the landless, as those who neither own nor operate land were not included. According to the Socio-Economic Survey of 1980/81, 53 percent of the agricultural and animal husbandry workers did not own any land (ILO/ARTEP, 1986). This category alone would account for about 40 percent of the rural poor.

Farm size

The size distribution of holdings together with the type of farming practiced affects to an important degree the levels of employment and incomes of farm families. If the size of the farm becomes too small to support a family, assuming modern techniques and average management and average family size, poverty moves in unless off-farm employment is readily available.

Information on the size distribution of agricultural holdings is available from various agricultural censuses, the most recent of which was conducted in 1982 (DCS, 1985). About 43 percent of the holdings are under one acre in size. Another 22 percent range from one to two acres. Earlier studies have shown that farm holdings under two acres in extent cannot be considered viable (Fields, 1986), and unless farm earnings can be supplemented with off-farm employment, operators of holdings under two acres must be counted as poor (Jogaratnam and Schickele, 1970).

The lack of comparable data makes it difficult to map developments over time in great detail. However, the number of holdings under one acre increased from 36 percent in 1962 to 46 percent in 1973, but declined to 42 percent by 1982. The average size of holdings under one acre and from one to two acres increased marginally from 0.33 acres to 0.37 acres, and from 1.26 acres to 1.27 acres, respectively, over the period 1973 to 1982. On the other hand, the average size of holdings in the two to three acre category fell slightly from 2.26 acres to 2.23 acres. The distribution of holdings by agroclimatic zones and districts is available only from the 1973 Census of Agriculture (DCS, 1975). It reported that the incidence of holdings under one acre in the Wet Zone and in Jaffna, Batticaloa, and Ampara in the Dry Zone was over 50 percent of all holdings. It is most likely that operators of such holdings fall below the poverty line.

Patterns of Farming

In discussing patterns of farming, it is useful to distinguish between the two major agroclimatic zones, namely the Wet and Dry Zones. A third Zone called the Intermediate Zone is also identified but is not of major importance. As Mellor (1986) commented, differences in agroclimatic conditions result in considerable variability in the initial conditions of poverty. Those initial conditions interact with new technology and price changes to further increase variability in the incidence of poverty. Neither the incidence of poverty nor the means of its reduction can be understood without reference to these underlying agroclimatic conditions.

About 42 percent of all holdings are in the Dry Zone. However, 63 percent of the homegardens are located in the Wet Zone. If, as indicated earlier, operators of homegardens are included among the landless, then the bulk of the landless and thus the poor are in the Wet Zone. If

however, homegardens are excluded, then 75 percent of the balance of holdings is in the Dry Zone and subject to the vagaries of the Dry Zone climate. If these farmers do not have access to irrigation, then even those farmers operating relatively large farms of about five acres or more can face poverty (Jogaratnam and Schikele, 1970).

Agricultural land is classified into lowland, highland, and homegarden and typically a traditional farm consisted of all three components. With increasing pressure of population on land, this pattern appears to be breaking down and smallholdings may now be of the single or two-component type rather than the three-component type. It is estimated that about 40 percent of smallholdings are of the single-component homegarden type. Homegardens by definition are subsistent in character. Lowlands, by and large, are under paddy. Another 10 percent operate only highlands. If single-component homegardens are excluded, then the large majority of farms are of the two- or three-component type and about 67 percent of such holdings are estimated to have a paddy component. This has implications for policy options since these are the farmers most affected by seasonality and weather fluctuations.

Tenurial Relationships

The limitations imposed by the small size of a holding can be further exacerbated by the distribution of operational holdings between landlords and tenants. Tenancy in Sri Lanka is confined by and large to the paddy sector. Data available from the 1946 and 1962 Census of Agriculture indicate that about 30 percent of the paddy land was cultivated by share croppers. Data for 1977 do not show much change (Ministry of Agriculture and Lands, 1977). Tenancy appears to be a major problem in the central south and southwestern parts of the country where the pressure of population on lands is also greatest. It is not tenancy itself but the terms and conditions under which it operates that have implications for income distribution and welfare. High rentals with insecurity of tenure are the main problems associated with tenancy. Nevertheless, though in other countries of South Asia tenancy is associated with poverty, the evidence from Sri Lanka is inconclusive (Goonetilleke, 1979).

Fragmentation of Holdings

This has led to many small and unviable land holdings. Fragmentation continues as the prevailing customs of inheritance together with population pressure lead to even further subdivision. The lack of data prevents any conclusions being drawn on the impact of parcelization on productivity or its relationship to size of holdings. However, fragmentation leading to rotation of land among several owners and finally to landlessness is all part of a vicious cycle leading to poverty.

Titles of Land

The lack of clear titles to land is another problem that small farmers are faced with. The undesirable socioeconomic consequences are well known and are not dealt with in detail here (Land Commission, 1985). For example, it is estimated that over 80 percent of land is owned by the state, which in turn gives the parcels out via grants, leases, or land permits. However, the lack of clear title to the land is not normally acceptable to lending institutions. The Land Commissions of 1935, 1957, and 1985 have all commented on the seriousness of the problem. It limits access to credit and undermines attempts to raise productivity. But there is little information on numbers involved and how many of the poor are faced with this problem.

Access to Irrigation

The constraints imposed by small size and climatic variability can be mitigated to a considerable extent if there is access to irrigation facilities. Irrigation in Sri Lanka is synonymous with paddy cultivation and successive governments have given priority to expanding the area irrigated in pursuing the goal of self-sufficiency in rice. It is estimated that about 35 percent of the area under rice is covered by major irrigation schemes, and of this 90 percent is in the Dry Zone. Another 27 percent is served by minor irrigation schemes, of which 60 percent is in the Dry Zone. The balance is entirely rainfed of which, again, 60 percent is in the Dry Zone.

Within the Dry Zone there is marked variability in the availability of irrigation facilities. The more favored districts in this regard are Polonnaruwa, Anuradhapura, Ampara, and Hambantota. The standard allotment of land in the major irrigation schemes have varied from 5

acres of lowland and 3 acres of highland in the earliest schemes, through 3 acres of lowland and 2 acres of highland, to about 2.5 acres in recent settlements in the Mahaweli areas. Despite legal impediments, it has been shown that subdivision, renting, and outright sales have been widespread, and that these practices are to be seen even in the newly developed Mahaweli settlement schemes. Such practices have been associated with marginalization, increasing income disparities, and impoverishment of the peasantry (Jogaratnam 1975, Shamugaratnam 1980, Samaranayake 1982).

The mere availability of assured irrigation facilities does not ensure that maximum use is made of the facility. Cropping intensities even under major irrigation schemes are relatively low (ILO/ARTEP), 1986). Low cropping intensities are explained by numerous factors, some of the more important being poor delivery systems, overuse of irrigation water, encroachment and unauthorized extensions of command land area, nonadherence to cultivation schedules, and overdependence on rice.

Despite these problems, there is general agreement that the irrigation schemes have helped poor settlers, with some estimates putting this at over 100,000 allottees benefiting.

Access to Agricultural Credit

Farmers at or near subsistence level have little capacity for channeling additional resources into their farms. Sri Lanka has a long history of government-sponsored credit schemes designed to provide ' cheap and easy credit to farmers and wean them away from non-institutional sources which are generally considered exploitative. Credit schemes on the whole have been directed towards the paddy sector and, from 1967 onwards, to a lesser extent to field crops. The plantation crop sector has been ignored.

Government efforts to reach out to the small farmer, among whom are included large numbers of poor, do not appear to have been successful. It is estimated that institutional sources accounted for about 25 percent of loans to small farmers in 1969, and that the tightening of lending criteria in mid-1978 increased the reliance of small farmers on the money market sector (Sanderatne, 1977). More recent data indicate that, under the New Comprehensive Rural Credit Scheme, only 41,390 borrowers benefitted in Maha 1986/87 and 20,813 in Yala 1987. About 75 percent of crop loans in 1987/88 were for paddy cultivation and of the

total of 102,055 acres for which credit was granted, 78 percent was in major irrigation schemes. During Yala 1988, 80 percent of the 33,177 acres financed was under major irrigation schemes (Central Bank of Ceylon, 1988). The small farms involved and the high concentration on paddy (and that too in the major irrigation schemes) should be noted. One can only conclude that poor farmers are most likely to be beyond the pale of the institutionalized credit schemes.

Plantation Agriculture

The discussion so far has drawn attention to the domestic food sector with emphasis on paddy, and therefore by implication the Dry Zone. Two other important subsectors in agriculture that deserve attention are the estate subsector and the smallholding subsector, both devoted to export crops and located in the Wet Zone.

The Estate Sector

The characteristics of the estate sector are well known (see, for example, ILO/ARTEP, 1986). Estate labor dependent entirely on wage earnings forms by far the largest occupational group. Their problem is one of low remuneration per day and insufficient number of work days per year. Given an initial condition of poverty, their condition has worsened due to a steady erosion of real wages (ILO/ARTEP, 1984).

The Smallholdings Sector

While physical conditions are much more favorable and encourage the cultivation of a wide variety of crops, both annual and perennial, the pressure of population on land would appear to more than offset this advantage. This sector probably supports a major proportion of the landless and near landless. The village expansion schemes launched by the government probably have had the greatest impact here. One estimate places the number benefitting at about 300,000 persons, but adds the rider that the allotments were mainly small homestead plots (Alailima, 1988).

While most smallholdings in the Wet Zone are likely to have a paddy component: they are unlikely to produce enough to meet their own requirements. The bulk of such deficit farmers are estimated to be

concentrated in the southwestern coastal lowlands (Moore, 1980). Sources of cash income arise primarily through tree crops, the more important of which are tea, rubber, and coconut. The evidence shows extremely low productivity and labor absorption in these small holdings (ILO/ARTEP, 1984) and the operators of such smallholdings must be counted among the poor.

The Urban Area

There is little information available on the urban poor, made up primarily of casual labor, living in congested surroundings, and having little or no access to any productive assets. The more restricted definition used by Sahn (see Section Two) showed that the ultra-poor, although less numerous than the numbers most observers consider to be poor, were concentrated in the urban areas. Their plight is so desperate that only a combination of economic growth to stimulate employment opportunities and direct targeting is likely to work. But, if that policy is seen to be successful, it is likely to encourage rural to urban migration which in turn could exacerbate the poverty situation in the cities.

Section Five

The Policy Response of the Government to Poverty

Government policy programs have had multiple objectives that have not always been directed at the alleviation of poverty. While policy goals have been specified in terms of achieving self-sufficiency in rice, earning and saving foreign exchange, rehabilitating the plantation sector, and addressing problems of unemployment, it is only in recent years that poverty as a major problem has attracted attention. This is not to say the poor were bypassed. Many programs, especially those concerned with social welfare, may have had spill-over benefits, while others may have had adverse consequences, and some which sought to reach the poor directly may not have had the desired effects. In the paragraphs that follow the major policy programs that have affected the rural sector and in particular the agricultural sector are outlined, followed by a brief discussion on how they affected the poor.

The policy of aided land development, irrigation, and settlement in the Dry Zone. This policy, enunciated in the 1930s and embodied in the Land Development Ordinance of 1935, continues to be pursued. It can be

expected to diminish in importance as potential irrigable lands become exhausted. Since those eligible for selection as settlers were confined mainly to the landless, it can be expected that the poor benefitted to some degree from this program. As noted previously, unconfirmed estimates place the number of beneficiaries at about 100,000 over the period 1930-1980. But this effort has not been without problems. Since land development and settlement require heavy capital investment, there have been relatively small numbers involved and, as indicated earlier, there has been a lack of sustained development and a tendency for interregional and intraregional disparities to widen.

Tenancy reform aimed at benefitting sharecroppers, generally considered to be among the deprived, was sought through the Paddy Lands Act of 1958 and the Agrarian Services Act of 1978. The objective was to regulate the terms and conditions of tenancy agreements. As is well known, the actual implementation of these policy measures ran into problems leading to un-forseen developments such as large-scale eviction of tenants, thus adversely affecting the poor (Alailima, 1988, Wickremasekera, 1985).

A land reform program with a potential for benefitting the poor was enacted in two phases, in 1972 and 1974. All private and publicly owned land exceeding 50 acres was vested in the state with an estimated million acres, or about 20 percent of all cultivable land, taken over. About 66 percent of the acreage under tea, 31 percent under rubber, 10 percent under coconuts, and the balance under other crops were appropriated. Paddy lands were practically unaffected, with less than 25,000 acres under paddy being taken over. The land reform exercise turned out to be a transfer of ownership from private and public lands to the state so that an opportunity for a radical redistribution of land was not realized nor was a major increase in productivity achieved (Alailima 1988, Wickremasekera 1988).

The District Integrated Rural Development Programmes (IRDP), which initially began in the Kurunegala District in 1978, now cover 20 districts. They depend substantially on foreign funding and were designed to cover so-called backward districts not benefitting from the Accelerated Mahaweli Development Programme. One of the objectives was to prevent any major regional disparities from emerging. They cover a wide range of investment activities in different sectors and were expected to benefit the poor through the creation of additional employment opportunities. The evidence to date suggests that investment is spread

out too thinly to be of much benefit and expectations in terms of employment creation have not been realized. Moreover, in Sri Lanka, as in India, they have reflected a big-farmer bias so that the beneficiaries of investment activity, in terms of rural infrastructure, have been the not-so-poor farmers.

Food subsidies to consumers have been an important element of the government's social welfare policies. First introduced during the Second World War, they were continued until 1978 and covered the entire population. The food subsidy was operated through a ration scheme and the quantity and subsidy offered underwent changes over the years. Rice was the major item and the quantity of the rice ration varied from 2 - 4 pounds per person, per week. During certain periods, the distribution of up to two pounds was free. The general consensus is that the rice subsidy in particular benefitted the neediest and contributed to a lessening of income disparities (CB 1983, Gavan and Chandrasekera 1979, Visaria 1979).

However, the food subsidy scheme imposed severe strains on the government budget and, in 1978, the ration was restricted to households with incomes of less than Rs. 300/- a month. In September 1979 it was replaced by the Food Stamps Scheme (FSS). The eligibility for food stamps depends on total household income. Households with incomes less than Rs. 3600/- a year were issued food stamps worth Rs. 15/- a month for each member over 12 years of age. Children under 12 received stamps worth Rs. 25/- and from 8 - 12, stamps worth Rs. 20/-. . Stamps could be used to purchase a basket of commodities with rice being the single most important item purchased. Each household was also given kerosene stamps worth Rs. 9.50 a month (subsequently increased to Rs. 20/-) and these could also be used to buy food items. Although large reductions in the numbers covered were expected over time, the numbers remained more or less the same. There was 'thus a freeze on new issues of stamps in March 1980 and a ceiling was placed on the total nominal value of food stamps. No provision was made to maintain the real value of food stamps.

The major objective of the FSS was to protect the level of consumption of the vulnerable or at-risk groups. As with any such scheme, leakages occurred. Edirisinghe (1987), in an excellent and exhaustive study of the FSS, comments that while a substantial proportion of the intended beneficiaries received transfers, about 30 percent of the households in the poor half of the population did not

appear to have received as much of the transfer benefits as a similar percentage in the upper half of the population. He concludes that attempts to limit transfers to the most needy have been only partially successful.

The FSS will soon be replaced by the Janasaviya or Poverty Alleviation Programme, the lead project of the new government that took office in January, 1989. Originally an ambitious and expensive and impractical scheme, designed to cover 1.9 million families, economic reality has caused a reassessment. Janasaviya is now a significantly smaller scheme, covering up to 200,000 families. The first of several phases was recently introduced but exact details of the program remain unclear. The income cutoff point for participants is set at Rs. 700/- per month, per family. Each beneficiary family will have access to a pool of resources valued at Rs. 2500/- a month during a 24-month period. This amount is divided into two components, with Rs. 1042/going into a compulsory savings account to be used as a guarantee or collateral for credit under a special credit scheme. The monthly savings accumulate to Rs. 25,000/-- in two years. The balance Rs. 14587- a month is for consumption from a basket stocked at the local cooperative store. The family has to offer a minimum of 24 days labor on a productive activity, with nonparticipants losing the Janasaviya benefits.

The beneficiaries are to be selected on the basis of community participation rather than the original idea of self-evaluation. It is hoped that this procedure will cut down on leakages. The Janasaviya program in its new and revised form represents a dynamic attempt at poverty alleviation in that a part of the resources transferred is for investment. However, much will depend on how effectively the government can prevent erosion of benefits through inflation, leakages, and poor coverage of the deprived.

Even more importantly, much depends on how much of a burden even the reduced scheme puts on the treasury. Little information is available on the incentives and opportunities offered for investment and the nature of the income-generating projects to be developed in order to rid beneficiaries of poverty.

Section Six

Alternative Policies to Alleviate Poverty

It is generally accepted that faster growth is the way to reduce absolute poverty. We now look briefly at why Sri Lanka has not grown more rapidly, and then at what the broad macro strategy of the country should be. We then turn to possible policies or strategies that are focused more specifically on poverty, and discuss the implications of their adoption. Finally, we discuss the role USAID can play in helping improve the equity of the policy environment.

Some Debates on the Sri Lanka Experience

The Sri Lankan Conundrum

Why has a resource-rich country with a relatively highly educated, healthy, well-fed population not followed the rapid economic development path of other Asian economies? The often-cited PQLI[16] index puts Sri Lanka at the level of much richer, countries in terms of social indicator achievements when it has a much lower GNP per capita. For example, Morris (1989) ranked Sri Lanka nearly as high as Austria in terms of the PQLI living standards indicator in 1985, though its GNP per capita was $US314 and $US10, 933 respectively.

Bhalla and Glewwe (1986) argue[17] that neither the improvement in living standards nor the 2 percent a year per capita growth rate during the 1960-1978 period of poverty-focused social policy measures were exceptional' in comparison with other developing countries. In contrast, they argue, during the later period of more indirect growth-promoting policies, from 1977 to 1984, growth more than doubled to an average rate of 4.3 percent per capita annually, expenditure inequality did not significantly change, the consumption expenditures of the population,

[16]A weighted index of life expectancy at birth, literacy, and infant mortality.

[17] See Appendix 2

and the poor, generally increased, and several of the living standard indicators showed improvement.[18]

That high levels of literacy and easy access to medical services have not led Sri Lanka to economic take-off raises the question whether the conventional wisdom that increasing the quality of human resources is enough in itself to ensure progress[19]. One response is that social conditions in Sri Lanka' were not as good as they seemed.

Bhalla and Glewwe argue, for example, that the initial conditions of many social indicators in 1960 were already high, and that successive Sri Lankan governments failed to capitalise on them. Fields notes that in the early 1980s living standards still remained low. The average rural household had five members and most of them lived in two or three rooms in cadjan-thatched houses with mud walls. Half obtained their drinking water from rivers, canals, and tanks. Only 7 percent had permanent toilets; 37 percent had temporary toilet facilities and 56 percent had no toilets at all. Kerosene and firewood were used for cooking and lighting purposes, as most of these households lacked electricity. About 65 percent of household income was spent on food and there was a significant gap between family members' actual caloric consumption and the recommended daily requirement of 2200 calories. Sahn (1985) (citing Martens) found that two-thirds of rural people (estate and non-estate) consumed fewer than 2200 calories, with half consuming fewer than 1950 calories. The typical rural family had enough cash income to sustain themselves without risk of starvation but not enough to keep out of financial jeopardy or avoid caloric deficiencies. There was a good chance that they would have to borrow at exorbitant rates of interest at some time in their lives and would end up in perpetual indebtedness as a result.

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[18] Fields (1986) goes even further and suggests that very little growth took place during the 1970s when adjustments are made to the national accounts for distortions in exchange rates and to take account of actual expenditures on baskets of commodities. He estimates that real growth per capita only averaged around 1 percent a year over that period!

[19] One of the present authors proposes that the basic needs approach to development should emphasize the conditions necessary to translate human resource development into private sector development and its associated entrepreneurial activities (see Hopkins and Van Der Hoeven, 1983).

Why was Sri Lanka's growth so low during the 1970s? A commonly held view (Fields again) is that heavy social welfare expenditures on free or subsidized rice, free education, and health clinics channeled, too large a fraction of Sri Lanka's resources toward current consumption and too little toward investment and growth. Further, the investment that was made was inefficient and misdirected. Without going into detail, it is felt that the $US2 billion that went to the Mahaweli project (of which $USI billion was from foreign aid donors) only marginally helped poor groups and had few backward or forward linkages. Undoubtedly, too, the ethnic tensions resulting in serious outbreaks of violence and a redirection of the government's scarce resources to the police and army undermined most attempts at productive investment. Foreign investors have been, and continue to be, reluctant to commit long-term investment in a country of uncertain calm. In particular, the fledgling: tourist industry with much growth potential suffered from the many outbreaks of violence, especially as these are widely reported in the foreign press. Added to this, the rise in oil prices and the worsening terms of trade for tea, rubber, and coconuts in the 1970s had direct negative effects on development.

There is also the suspicion that the heavy involvement of the state in social and economic policy has led to a general air of resignation; Sri Lankans expect the state to sort out most of their difficulties. Misplaced investment, inappropriate skill formation, and a sluggish public sector have all contributed their part to the low growth. The lack of entrepreneurial spirit is obvious, particularly in comparison to Sri Lanka's fast growing neighbors: Singapore, Malaysia, Thailand, and even India.

Arguably, therefore, the resolution of the poverty problem in Sri Lanka is not entirely a question of better-directed poverty alleviation schemes to the most in need. Given that almost half the people in the country are in poverty no emergency scheme will make more than a slight dent in the problem. The solution to Sri Lanka's problems must therefore lie in the realm of overall development strategy.

Issues of Growth Strategy

The economic theories of development economists such as Arthur Lewis (hire rural labor until its marginal productivity is zero), Harris and Todaro (rural development is the solution to urban unemployment), and Michael Lipton (too much urban bias in development economics) are not

overly useful in helping decide upon what next for Sri Lanka. They conclude that unskilled labor can largely be absorbed in the rural sector through labor-intensive rural development. Yet, as Fields remarks, rural workers in Sri Lanka face severely constrained choices. The average-sized landholding in Sri Lanka is too small for an average-sized family to make a decent living. Nor can the rural estates offer much hope for substantially more employment creation at higher wages, given the need for productivity enhancements in order to compete in international markets.

Sri Lanka's apparent surplus of unskilled labor would lead Conventional economist to suggest labor-intensive production for the export market. And this can work to a certain extent, as shown in Sri Lanka's fast-growing textile sector. However, comparative advantage is not fixed, at least as far as human resources are concerned. Human resources can be developed to increase comparative advantage as physical-resource-poor Japan has amply demonstrated.

Irma Adelman (1989) argues against export-led industrialization on the basis of historic evidence, since it leads in the early stages to increased income distribution disparities. She argues that industrialization occurs at the expense of agriculture and services since labor-intensive industries have unskilled-employment elasticities of about 2.5, whereas agriculture has unskilled-employment elasticities of roughly 3.5, and services of 4 or 5[20]. This leads her to suggest agricultural-led industrialization. She avoids recommending that Sri Lanka rely entirely on agriculture and continues her argument to press for labor-intensive, consumer-goods-producing industries and agrobased industries.

There is no quick fix to Sri Lanka's problems and, therefore, it would be desirable for more thinking on what the broad strategy should be. For example, could a balanced growth, human-resource-centered strategy work for Sri Lanka? Neither rural development alone nor industrialization alone will bring about the transformation that Sri Lanka requires. The rural sector cannot be ignored. However, a broad-based strategy that concentrated on industrialization in both rural and urban areas while liberalizing markets and improving human resources through appropriate skill development could well project Sri Lanka's economy on a fast: track

[20] She ignores the fact that industry tends to have growth rates of 8-18. percent while agriculture rarely exceeds 4 percent

growth path. The markets according to this scheme would be both internal and external, and neither one would receive preferential treatment. Steps have already been taken 'in this direction, as instanced by a recent ministerial declaration that the government's role will be to "facilitate rather than regulate industrial development."[21]

Many questions remain and this report is not the place to reflect upon them. For example, should Sri Lanka follow an agriculture-demand-led industrialization path rather than export-led industrialization as Adelman has argued? Will the IMF/World Bank adjustment strategy succeed? Will price hikes and reduced subsidies help the poor, given that they are net food buyers? Will the private sector absorb those newly unemployed because of public expenditure reductions? What should the government's investment strategy be in order to capitalise on Sri Lanka's comparative advantage? What types of skill development should be followed, and who should do it -- the public or the private sector? In sum, what macro strategy and policies should be followed that will bring growth and reduction in poverty?

Antipoverty Policies

It is clear that poverty is widespread. The available' evidence indicates that the absolute numbers in poverty have grown. This has occurred despite large investments in a wide variety of programs that either directly or indirectly sought to improve welfare and reduce poverty. What then can be done to make a dent on poverty?

Demery and Addison (1987) broadly group antipoverty policies into the following categories:

- Increasing access of the poor to productive assets;
- Raising the return on the poor's assets;
- Improving employment opportunities;
- Ensuring access to education and health; and
- Supplementing resources with transfers.

[21] Industry Minister Ranil Wickremesinghe quoted in the Far Eastern Economic Review, January 18, 1990.

Access to Productive Assets

Assets may include land, credit, public utilities, equipment, tools, education, and training. Land constitutes the most important productive asset in the rural economy. Reference was made earlier to the fact that about 80 percent of cultivable land is owned by the state. Land reform legislation brought one million acres within its control. Based on the fact that productive efficiency on large estates is much higher than on smallholdings, it has been argued that the break-up of the estates in the plantation sector is not feasible (Fields, 1986). Even if feasible, and experience in Kenya in respect to tea smallholdings suggests that smallholdings can be highly efficient, political considerations would rule out any large-scale redistribution. On the other hand, large 'rain-fed areas in the Dry Zone could be brought under cultivation, but unfortunately the technology does not exist for its intensive exploitation.

The provision of credit is considered to be an important means of endowing income-generating assets to those without assets. Agricultural credit schemes in Sri Lanka have had little success, as indicated earlier, in meeting the needs of the poor. Since they are largely crop-oriented, they cannot meet the needs of the landless. The Grameen Bank of Bangladesh is cited as a successful experiment in extending credit to the poor, but even it does not appear to have been too successful in reaching out to the landless (Rizwanul Islam and Eddy Lee, 1986). The Grameen Bank's activities and the way it functions may have some useful lessons. It lends for rural, noncrop activities and to those owning 0.5 acres or less. The Bank workers go to the villages, taking Bank services to the villagers' doorstep. The Bank program includes a training component and recovery rates are said to be high (Ahmed and Hossain, 1985). But given that the ultra-poor are in a desperate plight -- a female rural landless worker, for example, who has lost her husband and has children to bring up -- credit is not likely to be the means toward a solution. In this case, direct targeted relief is probably the only answer. The provision of credit assumes dynamism and the willingness to take risks, as well as opportunity. The ultra-poor are not likely to be in this category.

Raising Return on Assets

The number of people owning land in excess of one to two acres, but still living in poverty, are not known, but are sizable. They need access to complementary inputs. The technology is available for paddy, tea and rubber, but much more research in respect to other field and tree crops is required to increase yields. The spread of the new high-yielding varieties has been rapid in the case of paddy, moderate in. rubber, and poor in tea. But yield potentials are nowhere being realized and Sri Lanka lags far behind countries similarly placed such as South India, Kenya, and Malaysia (Wickremasekera (1980), Jogaratnam and Kunasingham, 1983). The modern varieties are known to be neutral to scale but the package of associated practices, such as extension, fertilizer distribution, and product support prices, are biased against the small farmer. A major overhaul of the input delivery system to ensure access to the poorer farmers is required.

Employment Expansion

Employment expansion and a rise in real wages through labor-intensive processes will undoubtedly play an important role in poverty alleviation. Attention has been drawn to the potential for increasing cropping intensities, crop diversification, intensification of work processes such as transplanting and weeding in rice, replantings in the estate sector, and so forth. These have been discussed for several years now and campaigns launched at various times to promote such activities, but no breakthroughs are in sight. The constraints to the widespread adoption of these practices need study.

Attention has been also focused in recent years on special employment creation schemes (SECS) and public works programs (PWP) targeted at the poor. There is no consensus on the impact of such schemes. While they can contribute to poverty alleviation, there is no evidence that they can be organized on the scale required to confront poverty. Rather, they only reinforce the need to confront poverty on as wide a front as possible. It is not the serious intention of these programs that is at stake; rather the sheer magnitude of poverty may call them into question. The depth of these programs, across classes and regions, would have to go beyond the tip of the iceberg (Muqtada, 1989).

SECS are generally focused around self-employment projects that reportedly are heavily dependent on credit and training and skill

development for promoting entrepreneurship. It has also been found that in wage-based employment schemes other than PWP, training is the major component. Such programs also point out the need to target the neediest. The evidence accruing from the region is that the eligibility criterion is almost invariably violated and that a substantial percentage of the beneficiaries are not the poor (Senanayake et al., 1989).

The question of employment creation is not easily addressed and, again, not an area that can be taken up in depth in this paper. Areas regarding further investigation include such things as the conditions under which small and medium-term businesses can grow and flourish, the impact of public retrenchment on employment, the role that privatization of parastatals could have in increasing efficiency and employment, the flexibility of labor and wage practices, and so forth.

Access to Education and Health

This access is widespread in Sri Lanka, although the recent closure of universities has and will contribute to major constraints on the economy. The suspicion remains, however, that education has not led to the creation of a skilled and entrepreneurial class. The feeling is that even the educated await the state to take the lead. The lack of a myriad of services that one finds among, for example, the Chinese of the Malay Peninsular, is remarkable. A major review of education and skill training is required to examine why the system is not working.

Income Transfers

Attention has already been drawn to the food stamps scheme and the *Janasaviya* poverty alleviation program that will soon replace the food stamps. The experience from the food stamps scheme suggests the need for much greater efficiency in implementation, especially in targeting, and the need for some form of indexing (Edirisinghe, 1987). Income transfers are, however, vulnerable to budgeting constraints and precision in targeting is difficult. The government focuses its targeting on households and perhaps it would be better to target directly specific slices of the population known to be in poverty such as single mothers or very young infants of landless laborers.

Organizing the Poor

Demery and Addison do not include this in their first list of antipoverty policies but we add it as a sixth point. Much has been said about the need to organize the poor. Apart from bringing about a balance of political power, NGOs could ensure effective implementation of programs intended to benefit the poor, identify target groups, and monitor results. Very recently, farmer organizations to cover the whole country have been mooted. Previously experience, especially in setting up village-level cooperatives, cultivation committees, and agrarian service centers, makes one skeptical. The main problem is to ensure that such organizations are not hijacked by the rich and the powerful.

The Possible Role of USAID in Alleviating Poverty in Sri Lanka

What are the policy areas that USAID might use for its continuing dialogue with the government, and where could it best intervene to help improve the equity of the policy environment.

There is not a great deal that international organizations can do to prod or nudge a country in one direction or another given the desire not to interfere in democratic institutions. However, given the strong negative feedback of violence on economic expansion, perhaps there are areas of maneuver, especially if the lack of democracy and correct judicial process are contributing to violence. There is a suspicion that is occurring in Sri Lanka. For example, when a prominent member of the Sri Lankan government calls Amnesty International an organization that support terrorists, an international agency can step in and set the record straight.

Areas of Possible Dialogue

Database Strengthening

At a more mundane level, there are a number of areas where an international organization can “prod and nudge.” The database of Sri Lanka needs to be considerably strengthened to identify the poor. More information is needed on an occupational classification of the poor and their spatial location, to design and target appropriately antipoverty programs. The objectives of antipoverty programs are to generate a dynamic process that moves the poor out of poverty and independent of simple income transfers. Data for an understanding of the dynamics of poverty are required.

The available database is unsatisfactory. Different agencies collect data that are not readily comparable. There is a strong need to systematize data collection and design surveys specifically for the purpose of identifying the poor. The Indian National Sample Survey (NSS) may well provide an example.

All-Island surveys should be supplemented with longitudinal studies of the type ably performed by MARGA (1981), though less ambitious but strategically located. Perhaps, more than large surveys, small but well-designed studies could provide greater insights into the dynamic processes underlying poverty.

Research

In the long run, antipoverty strategies in the rural sector will have to focus on productivity increases. There is a great need for a better understanding of the economic and institutional constraints to the realization of yield potentials. As we saw above, there is a need to develop technology for intensive farming in Dry Zone areas, and to study improved input delivery to poor farmers. While several measures have been initiated to improve in-country research capability and training, there appears to be a lack of focus. A well-designed, long-term research program must be put in place.

There is a strong case for developing socioeconomic research capability at the various research industries, as well as research of a technical nature that is lagging behind for the minor field and tree crops. There is a need to know more about macroeconomic developments and their implication for production, productivity, and prices, all of which impact on the poor.

The potential for increasing wage employment, especially in the rural and estate sectors, needs study, as does micro enterprise development. The urban poor would likely benefit from accelerated economic growth, but trickle down effects may take much longer in the rural sector.

Poverty has generated considerable rhetoric both at international and national levels. This has been accompanied by considerable investment in diverse fields. Numerous NGOs have also entered the scene. The net impact does not appear to be encouraging. One could very well say that if not for these efforts, the situation could have been very much worse. But this should not preclude attempts to learn and distil from past experience

and develop long-term plans. Will *Janasaviya* work? Presently it has a two-year focus. It needs to be backstopped by identifying investment opportunities, providing the necessary training and skills development, resource inventorying, and market development. And all this has to be highly location specific.

The costs and benefits of the various targeted poverty alleviation programs of the government have not been analyzed as far as can be seen. The scope for improving the efficiency of ongoing programs that directly or indirectly impact on the poor also needs to be looked into. In this regard, the need for a strong monitoring and evaluation mechanism cannot be overemphasized. And even if the targeting was effective, the use of resources to support food subsidies, food stamps, or the janasaviya program may diverted resources away from productive investment opportunities. Such opportunities, assuming that they exist, could potentially have increased economic activity and, consequently, created the employment opportunities to rid the country of poverty.

In the same vein it would be interesting to look at the costs and benefits of the nearly two decades of political violence in the country. Arguably such protests have brought about improvements in the level of living of the various ethnic groups. However, the material costs have also been high, putting aside the personal suffering that has been caused. Added to this has been the lack of major foreign investment because of the politically unstable situation. A study of this may seem overly academic; however, a clear statement of the winners and losers could potentially help to raise awareness of the sacrifices being made.

Education

Education has been referred to as the great leveller. But in Sri Lanka, the general consensus is that the educational system acts as the 'great sieve. There is a strong case for an all-out attempt to develop skills and entrepreneurial ability. But, before this is done, an in-depth study of the type of skills to be imparted must be made. A needs-based assessment and narrow targeting is called for in order to avoid surpluses in particular fields.

Macroeconomic Considerations

If, as argued in this paper, macro-strategic consideration are fundamental in resolving the problem of poverty, then further investigation is of interest. As well as the balanced versus rural-focused strategy consideration, it would be helpful to analyze exactly what are Sri Lanka's comparative advantages. For example, labor-intensive textile production may be temporarily advantageous but many countries are following a similar strategy and there is a danger that international markets will be saturated or more severe quotas may be installed. In addition, as the supply of labor-intensive manufacturing goods increases, the equilibrium price could fall, thus leaving the country no better off after the investment effort has been made.

Conclusions

USAID could assist the government of Sri Lanka to review the country's social expenditure to date in the light of efficiency criteria, the benefits and costs of agriculture-demand-led industrialization versus export-led industrialization. Other investigations could be made of Sri Lanka's comparative advantage and whether the country is best developing its human resource capital for the strategy eventually chosen for development.

The *Janasaviya* program could form the basis of dialogue when protection of vulnerable groups in the short term is discussed. Is the program targeted at the ultra-poor? Will it create the conditions for self-help or will it have to continue into the distant future? What parts of the program need to be direct grants on a continuing basis and what can be phased out over time? What will its annual burden be upon the treasury?

In terms of specific USAID interventions, many of the points raised in this section have been identified as areas where assistance in research, education, or job development could be useful. Three priority areas stand out that would benefit the poor directly.

Irrigation

Irrigation schemes have helped poor settlers in the past and more could be done. Also, large rain-fed areas in the Dry Zone could be brought

under cultivation but the technology for intensive exploitation is lacking. Some additional research input could help here.

Land Titles

The lack of clear titles to land means that small farmers are unable to sell or raise capital on land that they own. An on-line information system could help the government to clarify this situation.

The Ultra-Poor

The ultra-poor probably can be reached only through direct grants. However, the slightly better off poverty groups could best be helped by allowing them to help themselves out of their own poverty. To do this, one option worth exploring would be to create, or reinforce where they exist already, small-scale skill formation training centers where short courses are offered for people to obtain rudimentary skills. Poor people will not usually attend such centers without receiving a small stipend and provisions; this could perhaps be made out of donor funds. Such an approach assumes that the economy is, or will be shortly, expanding and can use the skills developed under such a program.

Conclusions

One of the main objectives of this study was to map the different aspects of poverty in order to illustrate that there are different poverty depending on whether one is looking at malnutrition, lack of employment, poor sanitation, unequal access to education, and so on. The study has been only partially successful in achieving this goal. This is because the study was forced to use existing data and secondary sources, given the short amount of time in which it was prepared. But, more seriously, few if any relevant studies actually defined poverty with alternative measures and then continued to examine whether the same socioeconomic groups were touched. Alailima's study was a notable exception and her work allowed us to cover some of the necessary ground.

Poverty has been identified across the socioeconomic spectrum in Sri Lanka, with the largest group being the landless laborers. However, if a very restricted definition of poverty is used – that by Sahn for the ultra-

poor- then pockets of extreme poverty are more prevalent in the urban than the rural areas. Such heterogeneity makes targeting of the poor difficult, if not impossible.

For the ultra-poor, the study concludes that no amount of provoking such people to self-drive themselves out of poverty will work, since their circumstances are too desperate for them to have the energy and vigor to do this. But the ultra-poor are fewer in number than the large numbers of poor identified by poverty lines set at higher levels imply. "Direct grants to the ultra-poor are probably the main solution and should not be too onerous on the treasury since they are few in number. The next group of poor can be helped more to help themselves. For example, the provision of small-scale training facilities at village level plus modest payments for attendance could be a good starting point, and aspects of the revised *Janasaviya* program seem to have appreciated this. But no amount of training will help on the supply side if the demand for skills is lacking. And there, a reexamination of Sri Lanka's macro development strategy is called for, perhaps along the lines set out briefly in this paper.

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Appendix 1

Environment and Poverty

There has been increasing interest in recent years in the environment. Little, however, has been written on the relation between poverty I can't read environment. This report has focused on the former issue but it was felt that a short discussion on poverty and the environment would help to orient current concerns.

There have been two authoritative studies of the environment in Sri Lanka in recent years. The first was carried out by a GoSL Task Force with the intention of preparing a national conservation strategy (GoSL, 1988); the second was commissioned by the Norwegian aid agency (NORAD, 1989) to provide recommendations for a program on environmental cooperation between Norway and Sri Lanka. It is these two reports that provide the basis for the discussion here.

The main environmental issues that affect, or are affected by, the poor are (1) drought, (2) land degradation, (3) deforestation, and (4) pollution from poor sanitation. These affect vulnerable groups in different ways.

In the rural sector peasant farmers are continuously affected by drought conditions. The NORAD study reports that in the Dry Zone, 90 percent of paddy lands were affected by drought. Poverty also sets into motion further abuses of the environment as poor people try and eke out an income through cutting trees to sell as firewood or deforest the land to cultivate chena. Others, affected by drought, take to the cultivation of more drought-resistant crops such as tobacco. Activities such as these, especially when carried out on hill slopes, can further degrade available land adding a further twist to long-term poverty. It has been estimated that in 1900 the island had a natural forest cover of 70 percent and a population of about 3.5 million. Today, with a population of 16.5 million, natural forest cover is estimated to be around 25 percent.

Drought relief takes the form of handouts of dry rations. Work camps are organized where farmers can partake in road building, clearing of irrigation channels, repair of bunds, and so on. However, the poorest, such as the disabled and the old, are missed by this form of relief and further marginalized.

Poverty can thus lead rural populations into a vicious circle of damaging the environment in their struggle to survive, which in turn

reduces the resource base upon which their long-term survival depends. Cultivation of tobacco, encroachments on tank reservations, poor farming practices, absence of hardy grain varieties, wasteful use of water when it is available are all such examples. Clearly, education of the harmful effects on the environment can help, but in the long term the main way in which such environmental degradation will stop or lessen will be through alleviating poverty itself. For example, fairer land redistribution would help to prevent forest depletion and provision of sanitation facilities to rural areas - currently the focus of government efforts has been to the urban areas - will help reduce pollution and the environment.

In **urban areas**, the NORAD report estimates that around 170,000 households live in slums and shanty towns under very poor environmental and sanitary conditions, and 40-60 percent of people in Colombo live in slums. The majority of workers from these families are engaged in such informal sector activities as food vending, preparation of street foods, and petty trade, carried out in the squalor of open drains, stagnant pools of water, and rotting garbage. Around 20 percent of urban families have no latrines, and nearly 26 percent use a bucket or pit latrines. In the slums of Colombo, one toilet is shared by 36 persons on average and there is only one water tap for 128 persons.

Despite the proximity of these urban poor to schools, school attendance has very low priority owing to the need for children to work to supplement household income. They learn early in life to beg or steal, and crime, juvenile delinquency, prostitution go on unabated while environmental concerns are the last thing to be taken account of. Sanitation and the provision of safe drinking water is one of the weakest links in development in urban areas. Some of the degradation of the environment associated with poverty in urban areas is self-inflicted. However, shanty towns and slums often have the lowest priority when public expenditure is allocated for the provision of water and sanitation services.

In the **estate** sector poverty takes a different form. Family income is relatively high compared with urban and rural areas, yet environmental hazards exist such as poor housing and lack of adequate sanitation and safe drinking water, and lead to high levels of morbidity and loss of working days.

It is difficult to imagine schemes targeted on the poor that will have an immediate impact on improving the quality of the physical environment in Sri Lanka. Regulation will not work when people are

desperate, as instanced in the case of chena cultivation. This is a cultivation that is best suited to drier environmental conditions when population pressure is low and land readily available. However, although prohibited by law, it continues in many parts of the Dry Zone exacerbating the degradation of already economically unproductive forests. Since chena production forms the main source of subsidiary foods and an important source of income to some of the poorest people, it is bound to continue even though it is progressively self-destructive. The main drive must therefore be a direct attack on the problem of poverty itself, which has been the theme of the main body of this report. But this is a long process and may take longer than the environment can tolerably bear.

There are no quick fixes. Further, higher-level concerns such as the preservation of the gene pool through protecting endangered species, mangrove swamps, and coral reefs or creating national parks are largely immaterial to the poor. In consequence, there are probably few policies that can be targeted at the poor which are 100 percent environmentally directed.

Appendix 2

The controversy over the evolution of living standards and economic prosperity in Sri Lanka

According to Bhalla and Glewwe (1986), two contrasting economic policies were pursued by Sri Lanka from 1960 to 1984. From 1960 to 1977, Sri Lanka followed closed economy policies with substantial expenditure for basic needs (mainly food, health, housing, and education). But since 1978, economic policies were based on a more open approach, with reduced social welfare expenditure in order to achieve faster economic growth. The study focused on the impact of the two approaches on economic growth, living standards, and equity.

Several econometric and statistical analyses were conducted using data from Sri Lanka and 43 selected comparator countries. Here the importance of initial conditions were emphasized. The authors concluded that the improvement in Sri Lanka's living standards over the period of 1960 to 1978 was no better than the average of the comparator countries even though Sri Lanka had a high expenditure on social welfare during

this period. In contrast, between 1977 and 1984, with reduced social welfare expenditure and little progress in some indicators like primary school enrollment and infant mortality, the authors state that substantial economic growth was recorded after 1978 and that this was a more satisfactory situation than before. The authors further concluded that the post-1977 policies were not detrimental to equity objectives.

How robust are these conclusions?

1. Only certain parameters were used in the study and such things as foreign exchange earnings, the dynamics of external resources, and the government's increased dependence on foreign credit were not considered.

2. The economic stagnation during 1960 to 1978 may have been due not only to the BN approach. Such things as the closed economic policies or the nationalization policies undoubtedly had an influence on economic growth.

3. No assessment of comparative performance with other countries was conducted for the period 1977 to 1984 when, arguably, economic growth conditions were more favorable. What comparison was done was only for 1960 to 1978.

4. The reduction of unemployment after 1977 was due not only to internal policy changes, but to external events such as the Sri Lankan labor migration to the Middle East.

5. The authors' own bias may have shown through, leading to excessive praise for the post-1977 era; for example, income distribution (before and after 1977) was not properly compared and this is of particular importance when, arguably, increasing income disparity may have been a major reason for losing social harmony after 1977.

Land Reform and Irrigation Projects

CHAPTER 10

Changes in Land Tenure and Land Development Approaches Affecting Private Lands Subsequent to Gaining Independence[1]

Several major changes have been effected by the Government, since gaining political independence in 1948, in the areas relating to land tenure and land development affecting private land. These have taken the form of statutory provisions, either consolidating or updating the law relating to particular activities, or introducing different concepts of land management to suit the needs of social changes. This section deals with the changes thus introduced.

Law Pertaining to Mortgages

Mention has been made earlier of the law and practice pertaining to mortgage of immovable property. The Mortgage Commission appointed in 1943 to report on the functioning of this sector recommended legislation changes to remedy some of the defects of the system which operated then. Mortgage Act of 1949 was introduced on the recommendations of this commission. This made provision for the mortgagee to sue the mortgagor for the recovery of the money due and for a decree from court for the sale of the mortgaged property for the recovery of such dues. Such decree for sale can cover only the land mortgaged and not the other properties belonging to the mortgagor. Any moneys left after recovering the dues are deposited in courts to be claimed by the relevant parties. The system of General Conventional Mortgages, extending to the whole of a mortgagor's property, has been abolished under this Act.

This Act gave power to a few institutions (viz. the Agricultural and Industrial Credit Corporation, the Ceylon Savings Bank, the Ceylon State Mortgage Bank and the National Housing Fund) to have recourse to the

[1] Re-production from a Sri Lanka Study of the Land Market for World Bank, April 10, 1998.

procedure called "parate execution" wherein the creditor, without a pleading to court for intervention, proceeds for the sale of property hypothecated. This facility has now been extended to all state and commercial banks by amendments to the Bank of Ceylon Act and the People's Bank Act, and by the enactment of the Recovery of Loans by Banks (special provisions) Act, No.4 of 1990. The Boards of Management of these institutions are given the power to take decisions regarding sale of mortgaged lands. A certificate of sale issued by the Board, after due process, is registrable under the Registration of Documents Ordinance as a document affecting title to the relevant property. Any excess money on the proceeds of the sale, after recovery of the amount due together with interest and other expenses, is payable to the borrower or any person legally entitled to receive such money; in the event of doubt, such excess is to be deposited in the District Court of the district where the mortgaged property is situated. The Mortgage Act also provides (a) for several mortgages to operate on the same property, (b) mortgages to cover future advances, (c) mortgages for contingent liability, e.g. fidelity bonds, and (d) concurrent mortgages, wherein several mortgagees invest funds upon the same security on the same bond. The Act further provides for creating mortgages of land in favour of an approved credit agency by the deposit of title deeds with such agency and the execution of an instrument, on the specified form. Copy of such instrument is registrable as a document affecting land under the Registration of Documents Ordinance.

Laws Pertaining to Acquisition and Requisitioning of Land

Land Acquisition Act of 1950 updated the law pertaining to acquisition of private land or, servitudes over such land by the state for public purposes. 'Public purpose' is defined as including "a purpose which, under provisions of this Act or any other law, is deemed to be a public purpose". Several laws pertaining to the establishment of public corporations have included provision to consider the needs for land of such public corporations to be public purposes.

The Act provides for identification of land required for the public purpose under consideration, giving due notice to the public, considering objections, survey and investigations into title, award of compensation for any possible appeals to the Board of Review against such award, decisions of the Board which is final and any appeals to the Supreme Court (Court of Appeal) against such decisions, on a question of law, and vesting in state and taking possession of land after an award is made or,

in instances of urgency, vesting in state and taking possession of land immediately after the initial notice is given. Such vesting order is registrable under the Registration of Documents Ordinance, as an instrument affecting title to such land. In instances where lands belonging to temples are acquired the compensation is to be paid to the Public Trustee (and not to the trustee or Viharadhipathi). Such monies are to be utilized for specified purposes such as purchase of land for that temple. Requisitioning of Land Act, 1950, was enacted to provide for requisitioning and use of private land by the State for certain essential purposes or for the use of the services and for the payment of compensation for the duration of such requisitioning. If such requisitioned land was required to be acquired by the State, the provisions of the Acquisition Act will apply.

Law Pertaining to Partitioning of Land

Partition Act, No.16 of 1951 was introduced, repealing the Partition Ordinance, No.10 of 1863 with the objective of enabling co-owners to obtain an indefeasible title with the least delay and expenses. This cast heavy responsibilities on the plaintiff and his lawyer for declaring the rights of parties. This was repealed by the Administration of Justice (Amendment) Law, No.25 of 1975, which in turn amended the Administration of Justice Law, No.44 of 1973. Sections 632 to 663 of the Law dealt with partitioning of land. The current statute governing this activity is the Partition Law, No.21 of 1977.

The Partition Law provides for any one or more of the co-owners of a land to institute an action for the partitioning or sale of such land. Such action is to be instituted in the District Court having jurisdiction over the area where the land is situated. The plaintiff has to provide the following details pertaining to the land in such plaint:

(a) Name, description, extent, location and value of the land;

(b) Names and addresses of all persons who have a claim or interest in the land and the nature of such claims and interests, as far as can be ascertained by the plaintiff;

(c) A statement, with reference to a pedigree, indicating devolution of title of the plaintiff, and, where possible, devolution of title of

the other claimants;

(d) An application for registration of the action addressed to the Registrar of lands of the district.

The court takes action for transmitting the application for registration to the Registrar of Lands and fixes a date before which the plaintiff has to deposit in court the cost of the preliminary survey as determined by court, having regard for the fees stipulated in a schedule to the Law (The rates originally indicated have subsequently been revised more than once, on representations made by the Surveyors Institute of Sri Lanka).

After the Registrar of Lands reports to court, the plaintiff's lawyer has to file a declaration that he has personally inspected the relevant registers in the Land Registry and indicate details of the persons found to be having any type of interest in the land referred to in the plaint.

Thereafter, the summons (to be prepared by the plaintiff's lawyer) are issued to the parties by court, indicating a date before which a statement of claim may be filed by the parties concerned, and copy of notice sent to the relevant Grama Niladhari for exhibiting in his office. Arrangements are made by the Fiscal for copy of notice to be posted on the land and also for proclamation of such notice orally, after beat of tom-tom - costs to be initially borne by the plaintiff.

Any defendant may file a statement of claim setting out the nature of his claim, which may not be in conformity with what the plaintiff had declared in his plaint. A party may even seek to change the limits of the land described in the plaint on sufficient grounds.

At the same time as the issue of summons, the court issues a commission to a surveyor, registered in the panel of the court as a commissioner, to carry out a preliminary survey and submit a report before a date fixed by court. The surveyor carries out this function after due notice to the parties concerned and submits a report and plan to court, verified by affidavit on the lines set out in a schedule to the Law. There is provision in the Law for the court to issue a commission to the Surveyor General, on the request of a party, or on its own, for the verification of the plan prepared by the first surveyor (commissioner) and to prepare fresh plan where necessary.

On the expiry of the period allowed for the submission of claims and on receipt of the surveyor's report and plan pertaining to the preliminary

survey, the court fixes a date for trial. At the trial the court examines the title of each party and hears evidence on the claims of such parties. At the conclusion of the trial the court pronounces judgement in open court and enters interlocutory decree based on such judgement. In such interlocutory decree, the court may order partition or sale of land in whole or in lots; the decree may also order that any specified share be continued to be held in common by specified parties or remain un-allotted. The court, thereafter, issues a commission or commissions for partition and / or sale of land in conformity with the interlocutory decree. Such commissions are issued to commissioners (surveyors and auctioneers) registered in the panel of the court.

If the commission is for partitioning, the commissioner (surveyor) proceeds to the land after due notice, prepares a scheme of partition in conformity with the interlocutory decree and any directions of the commission, demarcates the sub divisions on ground and submits a report and plan of partition to court. The report includes an appraisal of the value of each lot in the sub division, with value for soil, plantations and buildings. On receipt of the surveyor's report and plan, the court fixes a date for consideration of the scheme of partition proposed by the surveyor. On such date, the court, after summary inquiry, may confirm with or without modification the scheme of partition proposed by the surveyor and enter final decree of partition accordingly.

If the decree is for sale of land, the court may issue a commission for the purpose to a commissioner (auctioneer) in the court panel or order the Fiscal to carry out the sale. The court prescribes the conditions of sale. On the date fixed for the sale, the person carrying out the sale first puts up the land for sale among the co-owners; if the highest bid is not less than the value of the land, the co-owner who made that bid is declared to be the purchaser. If no co-owner becomes a purchaser, the land is put up for public auction, wherein the co-owners are also permitted to bid, and the person who made the highest bid is declared the purchaser. A report to court is made accordingly. There is provision in the law for the court to order the issue of a fresh commission for sale, if the money realised in the first instance is less than the value of the land. The persons who are declared purchasers on the above basis have to deposit the purchase money in court in conformity with the conditions prescribed or permitted. After considering any objections the court confirms the sale and enters a certificate of sale accordingly. The money realised in the sale is distributed according to the decree. There is provision for an appeal to the court of appeal.

The final decree of partition is final and conclusive for all purposes and provides the highest form of title. Such final decree is registered in the Land Registry as a document affecting title to land under the Registration of Documents Ordinance.

Law pertaining to Testamentary Proceedings

Law pertaining to testamentary proceedings was updated by the Administration of Justice Law of 1973, and further revised by the Civil Procedure Code (Amendment) Act in 1993.

When a person dies testate, the person named in the Last Will as the executor of the Last Will has to apply to the District Court for Probate, i.e. for the acceptance of the Last Will. If a person dies intestate, leaving an estate of more than Rs.500, 000-00, an interested party can apply to the District Court for Letters of Administration, i.e. for appointment as Administrator of the estate, indicating the heirs. After the necessary inquiries the court directs issue of Probate or the Letters of Administration, as the case may be. Based on that authority, the executor or the administrator can manage and dispose of the estate, in terms of the Last Will, in instances of testate succession or in accordance with the rights of the heirs (which will depend on the law of succession applicable) in instances of intestate succession. There is also provision for the issue of certificates of heirship.

Laws Pertaining to Agricultural Lands

The first of a series of statutes to ensure the efficient functioning of the paddy lands sector was the paddy lands Act of 1953. Its objectives were "to regulate the renting of paddy lands in order to ensure greater security of tenure to the tenants of paddy lands; to restrict the rent recoverable from such tenants; to empower the proper authority to take possession and cause the cultivation of any such lands which are not cultivated" (143). The letting of a paddy land for a period of less than five years was prohibited. The rent was controlled and varied according to the area. This Act was operated in two districts (viz. Hambantota and Batticaloa districts) on a trial basis.

The next statute affecting paddy lands was the Paddy Lands Act of 1958. This provided for security of tenure to tenant cultivators by making

tenancies inheritable. The rent payable was fixed. Provision was made for the establishment of Cultivation Committees to monitor the activities of this sector.

Agricultural Productivity Law of 1972 was aimed at ensuring operation of agricultural activities at an efficient level. When an owner or operator of agricultural land was not maintaining the agricultural operations well, there was provision to place such person under a Supervision Order. If there has been no improvement for twelve months, there was provision to make an order of Dispossession. Such order vested the land in the state. Compensation was payable in instances of dispossession. Agricultural Productivity Committees were set up with defined geographical areas of authority for the promotion and co-ordination of agricultural work.

Agricultural Lands Law of 1973 replaced the Paddy Lands Act of 1958 and aimed at stabilising the changes introduced by the 1958 Act. This law provided for the tenant cultivator to nominate any citizen of the country to succeed him. In the event of a cultivator not having nominated a successor, his rights devolve on the surviving spouse, and failing such spouse, on only one of the relatives listed in the schedule to the Law. Cultivation Committees were established to function as agents of the Agricultural Productivity Committees. This Law laid a restriction on the use of paddy lands for other purposes without the prior written permission of the Agricultural Productivity Committee.

Agrarian Services Act of 1979 repealed the Agricultural Productivity Law and the Agricultural Lands Law and updated the law pertaining to this sector. It aimed at ensuring efficient management of all agricultural lands. This established Agrarian Services Committees. This statute, amended in 1990, 1991 and 1993, forms the current law regulating this activity. Commissioner of Agrarian Services is responsible for enforcing this Act. This fixed a ceiling on the extent of land that a tenant cultivator could cultivate at five acres. Provision has been made for the tenant cultivator to nominate a member of his family to succeed him in the tenancy (this provision has subsequently been removed in the 1991 amendment) and if no such nomination had been made, for the surviving spouse to succeed to the tenancy, failing which, one of the children, in conformity with the requirements of the Act, can succeed to the tenancy. The rent to be paid by the tenant continues to be regulated. Provision has also been made for the owner or tenant to raise funds from a prescribed bank creating a mortgage or a charge on his interest in the

land. In instances of default, the Commissioner can intervene and order the debtor to make payments and if that attempt fails, the bank can file action in the Magistrate's Court of the area for the recovery of dues as for a fine. In instances of neglect of land, there is provision for the Commissioner to place the owner or tenant under a Supervision Order and if there is no improvement, for issuing an order of dispossession and implementing such order. Agrarian Services Committees established under this Act are entrusted with the task of monitoring the functioning of this sector, subject to the general direction of the Commissioner. These Committees are responsible for maintaining registers of agricultural lands. This record forms evidence of the subsistence of such rights. The committees are also empowered to recover an acreage levy on the agricultural lands. There is a restriction on the utilization of paddy lands for other uses. The 1991 amendment permitted a Viharadhipathi or high priest of a temple, kovil or church or any trustee of a mosque to apply to the Commissioner (within 12 months of the enactment of the amendment) to have an extent of land not exceeding two acres owned by such temple, kovil, church or mosque exempted from the requirements of the Act pertaining to tenant cultivators. The 1991 amendment also provided for the establishment of Farmers' Organizations of owner cultivators and tenants to promote the activities related to farming, e.g. formulation of programmes, carrying out construction work, provision of inputs and marketing of produce.

The Nindagam Lands Act of 1968 was passed to abolish the services due from tenants and holders of Nindagam lands to the proprietors thereof and to make such tenants and holders absolute owners of such lands. The proprietors were not to be compensated. The claims were to be heard by the Nindagam Lands Board. The Settlement Officer was given the task of administering the Act. However, this Act has not been implemented.

Land Reform Law of 1972 introduced a ceiling on the extent of agricultural land that could be owned by a person at 25 acres if such land consisted exclusively of paddy land and at 50 acres in other instances. Any land owned by any person in excess of this ceiling was vested in a newly created statutory body called the Land Reform Commission. Such vesting gave the Commission absolute title to such land. Compensation was paid to the former owners after such vesting. Such vesting and payment of compensation were implemented, based initially, on declarations made by the proprietors of such land. The land permitted to be retained by the owner, within the ceiling was called the Statutory

Determination and the excess land vested in the Commission could be disposed of in several ways; alienation by way of sale and rent purchase were two such ways of disposition. Such lands, on completion of the sales, became private lands and were subject to the normal laws applicable for private lands. The following categories of land were excluded from the operation of this Act:

(a) Agricultural land owned by a public company;

(b) Viharagam and dewalagam lands;

(c) Any land owned or possessed by a religious institution;

(d) Any land constituted in a charitable trust under the Trusts Ordinance or under the Muslim Mosques and Charitable Trusts or Wakfs Act;

(e) Any land held in trust under the Buddhist Temporalities Ordinance.

Land Reform (Amendment) Law of 1981 vested all estate land owned or possessed by a public company in the Land Reform Commission.

Land Reform (Special Provisions) Act of 1981 placed a limit on the interfamily transfers of excess land that was permitted in the 1972 Law, at 150 acres. Land Reform (Special Provisions) Act of 1986 provided for the sale of land vested in the L.R.C. for non-agricultural purposes. This Act also has brought back the original concepts of the Roman-Dutch law pertaining to acquisition of title by prescription when it states in section 59A "no person shall, by possession ..... acquire any prescriptive title .... unless undisturbed and uninterrupted adverse possession for a period of over one - third of a century is proved by such person".

The Tea and Rubber Estates (Control of Fragmentation) Act passed in 1958 aimed at reducing the Fragmentation of tea and rubber estates. This law established the Tea and Rubber Estates (Control of Fragmentation) Board, consisting of the heads of the relevant government departments to monitor this activity. Transfer of ownership of tea or rubber estates has been declared to be void unless a certificate of consent of the Board has previously been obtained for the purpose. Similarly, partitioning of such estates with the agreement of the co-owners or the institution of partition action in courts or even mortgaging

a part of a lot as a divided lot can be done only after obtaining a letter of consent from the Board. The consent of the Board will be given (a) if the proposed transfer or mortgage does not involve the division of the estate, or (b) if the proposal involves the division into a number of lots, all of which, or all of those except such of those as are not less than 100 acres, are to be used for an object which is declared to be a housing object under the National Housing Act, or for an industrial purpose or for the development of any town or for a prescribed purpose or are to be merged with an adjoining estate. In the event of the Board not being able to give its consent to a proposed division, if the Board is satisfied that substantial hardship will be caused to the owner by such refusal, the Board may, with the consent of the applicant, recommend acquisition of such estate by the state.

The Tea Control Act passed in 1957 empowered the Tea Controller to maintain a Register of Estates (tea estates) and a Register of Smallholdings (tea small holding defined as land less than ten acres under tea). Such register would form evidence of the information (such as description of land, extent, ownership) contained therein. The Controller was also empowered to issue orders to the owners regarding the maintenance of such land. Any proposal for diversification would be permitted if the Controller was satisfied with the merits of the proposal. In the event of a registered owner failing to carry out an order of the Controller, provision has been made for the acquisition of such land. Under the Sri Lanka Tea Board Law of 1975, the Tea Commissioner exercises the powers of the Tea Controller.

The Rubber Control Act passed in 1956 entrusted the Rubber Controller with similar functions and responsibilities as envisaged to be handled by the Tea Controller under the Tea Control Act. Thus the Register of Estates and the Register of Small holdings maintained by him form evidence of the facts contained therein. Since 1st December, 1993, this institution functions as the Department of Rubber Development with a Director General as the head.

The Coconut Development Act of 1971 established a Coconut Development Authority. Its functions include the formulation of policy and the determination of development priorities. Hence, its decisions can affect land tenure and development in the coconut sector.

Laws Pertaining to Housing and Urban Development

The National Housing Act of 1954 was intended to promote housing and building development. It established a National Housing Fund and provided for the issue of loans out of this fund for housing purposes. Such loans were secured by mortgages of the land, priority of charge for such mortgages is granted over any other charges on such land. Measures for the recovery of dues on such loans, including the provision for sale of the mortgaged property by public auction without having recourse to court action, were laid down in this Act. The Commissioner of National Housing was entrusted with the task of managing this activity.

Rent payable by tenants to landlords was controlled by the Rent Restriction Act of 1948. This law has been updated by the Rent Act of 1972. Premises belonging to local authorities and the Commissioner of National Housing were exempted from the requirements of this Act.

A ceiling on the number of houses to be owned by an individual or a member of a family was introduced by the Ceiling on Housing Property Law of 1973. This ceiling amounted to two houses for an individual who was not a member of a family. The number of houses permitted for a family amounted to the number of dependent children increased by two. Any houses owned by an individual or a member of a family above this number were vested in the Commissioner of National Housing, along with the appurtenant land. The owners of such houses were required to submit a declaration to the Commissioner, and the tenants were permitted to apply to the Commissioner for the purchase of such houses. The owners were paid compensation for the housing property thus vested with the Commissioner of National Housing. This law also placed a ceiling on the floor area of houses to be built by any individual at 2000 square feet. An amendment introduced into this Law in 1980 increased this ceiling to 3000 square feet. The amendment introduced in 1976 excluded persons constructing houses for sale from being considered as owners for the purpose of this Law. By the amendment passed in 1977, the Commissioner was given authority to transfer any of the houses vested in him, where the standard rent was less than Rupees Twenty Five per month, to the tenants free of charge. If any such area was taken up for re-development, such houses could be re-vested in the Commissioner free of all encumbrances. The ceiling on the ownership of houses imposed by the 1973 law has been removed by the Ceiling on Housing Property (Special Provisions) Act of 1988, without prejudice to the vestings effected prior to that.

A law was passed in 1970 for the purpose of holding ownership of individual units in apartments (flats) by separate persons. Prior to that only joint or common ownership was possible. This law has subsequently been amended and updated. The law takes into account the space occupied by a unit in a multi-storeyed building, together with accessory units, if any, forming part of the unit, which unit can be owned by an individual, and the common elements (e.g. ground space, access routes, supporting columns, several service lines) in which every owner of a unit will have a share, to be owned jointly with the owners of the other units. A survey plan has to be prepared for every property coming under this category (called condominium properties) showing the different units and the common elements. Such survey plan (called Condominium Plan) is registered in the Register of Condominium Properties, maintained at the Land Registry with a cross reference to the register maintained for the land under the Registration of Documents Ordinance. Thereafter, normal legal transactions can be taken in respect of units of the condominium property and the related documents registered in the Land Registry.

The National Housing Development Authority established by statute passed in 1979 has as one of its objects, to directly engage in the construction of flats, houses and other living accommodation. Among the several forms of disposition of such property, it has the power to sell them. It has laid a restriction on the disposal of properties sold by the Authority. The purchasers are prevented from disposing of such property by sale, lease or mortgage, other than by way of a gift to a child, parent or spouse, within a period of ten years of such sale without the prior written consent of the Authority. The Authority is given the power to provide housing loans on the security of a mortgage on the land. In the event of any default in the re-payment of such loan, the law provides for the Authority to take action for the sale of such property for the recovery of dues. A certificate of sale, indicating the name of the new purchaser, issued by the Authority in such instances, is a document that is registrable under the Registration of Documents Ordinance.

In 1978, the Government established the Urban Development Authority to promote integrated planning and implementation of such development in areas to be declared as Urban Development Areas. This Authority has been given wide powers for co-ordinating the development activities undertaken in such areas by any agency. It has the authority to acquire and dispose of immovable property by sale or by other forms. Detailed procedures have been laid down for the planning and implementation of such plans. Any developer has to obtain planning

approval prior to commencing such development activity. Sub-division of land and change of use have been classified as forms of development. Development plans prepared by this Authority can include reservation or zoning of land for different purposes and also for the re-distribution and reconstitution of land belong to different owners. Physical planning relating to all urban areas is now handled under the direction of the Urban Development Authority.

Laws Pertaining to Conservation of Environment

Soil Conservation Act aimed at conserving the vulnerable areas in watersheds and similar locations. It empowered the Director of Agriculture to identify and declare such areas as 'erodible areas' and give directions to the land owners on desirable land use measures to be adopted in such areas. The amendment to this Act, passed in 1996, established a Soil Conservation Board for the country consisting of secretaries and officials of the relevant Ministries and institutions. The critical areas were to be identified and declared as 'conservation areas'. The land owners not heeding the directions of the Director General of Agriculture (or of the Divisional Secretary holding delegated powers from the D.G. of Agriculture) could be prosecuted.

The amendment to the Fauna and Flora Protection Ordinance introduced in 1993 has prohibited the establishment and operation of tourist hotels within a distance of one mile from a National Reserve.

The National Environmental Act passed in 1980 established the Central Environmental Authority with wide powers and functions pertaining to environmental conservation. It has the power to formulate land use planning schemes in consultation with the Minister concerned. In terms of the provisions of this Act, prior approval from the project approving agencies is required in specified types of development.

The Coast Conservation Act of 1981, provided for the Coast Conservation Department to prepare a Coastal Zone Management Plan. All development activities, within the area covered by such plan, have to conform to the requirements of the plan. A development permit procedure has been introduced by this Act. This procedure is similar to the procedure for obtaining planning approval for development activities in local authority areas.

The Colombo District (Low lying areas) Reclamation and Development Board, established in 1968, title subsequently changed to "Sri Lanka Land Reclamation and Development Corporation" in 1982, has the power to declare an area as a "Reclamation and Development Area". Thereafter, all reclamation and development activity within such area comes under the purview of this Corporation.

At this stage it is desirable to take note of a policy decision taken by the Government to demarcate reservations for streams through private lands as well. The details of the procedure to be adopted has not been finalised as yet. If no new legislation is expected to be introduced for this purpose, recourse may have to be made to the provisions of the Acquisition Act. In such a course of action, payment of compensation will be involved. In the alternative, it may be possible to implement this policy by way of fresh planning legislation, which may not involve payment of compensation.

Law Pertaining to "Betterment" Levy

The Land Betterment Charges Law of 1976 provided for the declaration of "Benefited areas" and the levy of a betterment charge from the owners of properties benefited by development activities undertaken by the State.

CHAPTER 11

Report of the Re-survey of the Elahara Colonization Scheme in Ceylon, 1971[1]

1. Introduction

The Program of intensive agricultural develoment was first introduced at the Elahera colonizaton Scheme in the Maha of 1967-68. In view of its experimental nature, it was felt that a program of continuous evaluation and assesment would be useful.

Accordingly, the Agricultural Economics Unit of the university Department of Agricultture was invited by the land commissioner's department to undertake a bench-mark survey of socio-ecomimic conditions in the colony in December 1967. The report of this survey was released by the Agricultural Economics Research Unit in June 1968. (see Socio Econimis Survey of the Ekahera Colonization Project Peradeniya, 1968, Mimeo)

The Special Projects program was subdequently extended to cover nine more colonization schemes in the following year. On the request of the land commissioner's department, the Agricultural Econimics Research Unit again undertook bench-mark studies of these nine colonization schemes. The report based on these studies was released in June 1969 (see Summary report of the socio-Economic survey of nine colonization schemes in Ceylon, 1967-68, part I and II, Peradeniya 1969, Mimeo).

In December 1970, the Agricultural Economics Research Unit was invited to carry out a re-survey of the Elahera Scheme with a view to evaluating the progress of the program of intensive agricultural development there. The main objective was to assess the extent to which peasant farmers had adopted the package of practices deemed necessary to secure rapid increases in production and identify the factors hindering the modernisation of the production process.

In Carrying out the survey, it was decided to interview, as far as possible, the same farmers who had been covered in the earlier bench-

[1] Reproduction from a publication by the Agricultural Economics research unit, University of Ceylon.

mark survey. 418 farmers constituting roughly 40 percent of the farmers in the colonization scheme were interviewed. The survey was conducted in January-February 1971 during the middle of the Maha 1970-71 season. The intention was also to interview a small sample to obtain more detailed informaton on specific problems which emerged from the earlier investigations. Unfortunately the disturbed conditions of April prevented this being done.

An evaluation of the progress achieved at Elahera must be made in term of the objectives of the special projects program. The immediate goal is to bring about rapid increases in the level of agricultural production, especially paddy, by a concentration of financial, technical, extension and administrative services and much of the time was spent in making preliminary arrangment and building up the administrative and extension services and developing the farm level institutions.

The main objective of this study has therefore been to assess the change brought about in the agronomic practices followed by farmers and detemine the extent to which this has resulted in increased production, such as changes in farm and tenure, land use, credit and indebtedness, changes in living standards, and farmer's relationship with extension officials.

2. Farm Size and Tenure

The standard allotment at Elahera consists of 5 acres of irrigable low land and 3 acres of high land, though as indicated by the 1967 survey, there are minor variations between farms. The actual extents cultivated by allottees however show wide variations. For instance 12 percent of the farmers surveyed in 1971 operated 7 acres of more. The large majority of farmers amounting to about 46 percent, operated 4 to5 acres each.

The present survey indicates that allottees, on the average, cultivated only 1.94 acres and 3.96 acres of the allotted low land during Yala 1970 and Maha 1970/71 respectively (Table 11.1) problems of water supply affect Yala cultivation and this will be considered later on.

Table11.1: Farm size and tenure

Extents cultivated per farm	Law land		High land	
Acres	**Yala 70**	**Maha 70/71**	**Yala 70**	**Maha 70/71**
Allotted Land	1.94	3.96	0.1	0.88
Land Rented in	0.02	0.12	-	-
Lamd rented out	0.09	0.18	-	-
Encroachments	0.01	0.13	-	-
Chena	-	-	-	0.35
Total	1.97	4.21	0.1	1.23

Water however is not a problem in the Maha and yet there has been a decrease in the extent cultivated over three year period. The decrease in extent cultivated appear to be in major part due to the considerable amount of sub division of allotments reported by farmers.

Sub division of allottments

Nearly 50 percent of the farmers reported sub-division of holding, with sub-lots averaging 2.5 per family (Table 11.2). While these sub-divisions are informal arrangments amongst family members,roughly half of them are worked as independent units.

Table 11.2: Subdivision of Allotments

Farmers Reporting	Number of farms	Per cent of all farms	Extent sub-divided per farm reporting
Sub division	203	49	-
Sub division of low land	198	47	2.5
Sub diviion of High land	36	9	1.8

The 1967 survey reported sub divisions by about 10 per cent of the farmers. This information was not directly sought and, as mentioned in that report, is probably an understatement. Nevertheless, there appears to have been an increase in the sub division of allotments over the years.

It is interesting to note that about 25 percent of the farmers have requested additional land for distribution amongst their children.

Farmers Operating Additional Land

A number of farmers report taking land on lease or leasing out land though the number reporting such practice is small , the extents involved an average of 2 acres per farm reporting (Table 11.3). The expectation of increasing incomes cited as the main reason for leasing in land, while old age and illness are mentioned as the major reasons for leasing out land. Farmers also reported some encroachments of crown land, but the chances are that the proportion of all these practices is much higher.

Table 11.3: Farmers operating additional land Maha 70/71

Farmers reporting	Nubmer of Farms	Per cent of all farms	Acres per reporting
Low land rented in	25	6.0	2.0
Low land rented out	30	7.2	2.6
Encroachments	28	6.7	2.0
Chena	73	17.5	2.0

Nearly 18 percent of the farmers reported chena cultivation and there farmers cultivated on an average 2.0 acres of land. As shown by the previous survey, there is no evidence to indicate that chena cultivation interferes with paddy production.

3. Land Utilidarion and Cropping Patterns

The extent of land cultivated as well as the intensity of land use detemine to and important degree the returns from farming. Land use can be intensified through multiple cropping and a shift towards higher value crops. Where water is not a limiting factor, it should be possible to raise two crops of paddy. However,with the introduction of new short – aged varieties, the possibilities of raising more than two crops should not be ruled out from the point of view of increasing farm incomes and

employment opportunities in agriculture. It is important to increase the proportion of land devoted to high value, labour intensive crops. One of the objectives of the special projects program at Elahera, with its recurring water problems, is to increase the area under subsidiary food crops. But from what follows, it is difficult to escape the general conclusion that three years of intensive effort at agricultural development has brought little change in land use and cropping patterns.

Paddy

Paddy continues to be the most important crop, accounting for about 90 percent of the low land under cultivation. Even on the high land during Maha, 50 percent of the cultivation land was under paddy (Table 11.4). This compares with the 58 percent reported during the earlier durvey. In general, the share of other crops shows a slight increase compared to 1967, from 8 to 12 percent of the total cultivated area in both seasons.

Yala cultivation is again restricted almost entirely to the low land with the acreage sown to paddy being 44 percent of that in the Maha. This shows very little change from the situation obtaining in 1967/68. The serious limitations imposed by the lack of irrigation water were highlighted in the earlier report. The present survey indicates hardly any improvements in the situation. The special projects program had its origins in the Irrigation rehabilitaion program, but it is unlikely that much headway will be made till the Mahaweli Diversion Scheme becomes operational. Once water becomes freely available, farm production for the year should increase by at least one-third. It may even be more as farmers report 50 percent lower yields during the Yala due to insufficiency of water.

Farmers reported irrigation problems even during the Maha season. Nearly 16 percent indicated that their low land allotments were not fully under irrigation. Over 70 percent of the farmers indicated that there had been no improvements in the availability of water over the last three years.

Farmers were questioned about the feasibility of growing a crop other than paddy during the yala season. About 75 percent of them indicated a decided preference for paddy. Of the farmers interviewed, 37 percent felt that paddy gives a better income, while 32 percent stated that it is easier to cultivate paddy. About 8 per cent stated that subsidiary

crop production involved a high level of expenditure and was risky while another 8 percent felt that paddy is important for reasons of domestic consumption. About 10 percent of the farmers indicated the availability of water, primarily seepage water, for irrigating approximately 1 acre of their high land allotments .

Table 11. 4. Land Use by Crops

	All Land		**Low Land**		**High Land**	
	Acres	**% of total**	**Acres**	**% of total**	**Acres**	**% of total**
Acreage sown, All Crops,Both seasons	3186	100.0	2582	100.0	602	100.0
Paddy	2801	87.9	2508	97.2	293	48.6
Other Crops	385	12.1	74	2.8	309	51.5
Maha 1970/71	2312	100.0	1755	100.0	556	100.0
Paddy	2026	87.6	1746	99.5	280	50.3
Other Crops	285	12.4	9	0.5	276	49.7
Yala 1970	874	100.0	827	100.0	47	100.0
Paddy	776	88.7	762	92.2	13	27.5
Other crops	98	11.3	65	7.8	34	72.5
Acreage sown to paddy Maha 70/71 Yala 70		100 38.3		100 43.6		100 4.5
Acreage sown to paddy total per year 1970/71		100		86		14

Subsidiary Food Crops

One of the objectives of the special projects program is to popularise the cultivatioin of subsidiary food crops. Not much information is available on subsidiary food crops from the earlier survey for purposes of comparison. The general impression gained was one of comparative neglect. The present survey however indicates a wide variety of crops being grown, though not on any extensive scale (Table 11.5). As mentioned earlier, there has been a slight increase in the proportion of land under other crops with nearly 40 percent of the farmers reporting some increase in the extents of land devoted to subsidiary crops. This is evident in the use of the high land, especially during the Yala.

Table 11. 5: Extents under subsidiary crops, Acres per farm reporting

Crop	Per cent of reporting	Maha 70/71		Yala 70	
		Low land	High land	Low land	High land
Chillies	6.9	0.33	0.24	0.35	0.30
Maize	2.5	-	0.20	-	0.19
Vegetables	11.7	0.29	0.30	0.38	0.25
Onions	4.0	-	0.11	0.12	0.20
Kurakkan	0.2	0.50	0.50	-	0.32
Banana	0.7	0.75	0.30	0.63	0.24
Ground nut	6.5	0.29	0.22	0.40	0.18
Gingelly	0.2	-	1.06	0.25	0.25
Cowpea	5.5	0.12	0.15	0.32	0.19
Green gram	10.8	0.12	0.32	0.39	0.13
Tobacco	0.5	0.50	-	0.83	-
Manioc	1.7	-	0.32	-	0.28
Soya Bean	0.5	-	-	1.0	-

Permanent Crops

Farmers also reported a variety of permanent crops on their high land allotments, the more important of which are shown in terms of number of trees in Table 11.6. None of these however were to be found as pure stands. There has, at the same time, been no appreciable increase in planting over the last years.

Table 11.6: The more important permanent crops on High land allotments, number per Farm 1971

Crop	No. of Trees	No.of Trees planted during the last 3 years
Coconut	21	5.4
Jak	5	1.1
Mango	5	0.7
Murunga	18	1.2
Orange	1	0.4
Lime	3	0.3

Livestock Enterprises

The livestock population shows only slight changes. There is a slight drop in the buffalo population, from 4.9 per farm in 1967 to 4.6 in 1971. There is also a slight increase in the cattle population, but most marked is in the number of farmers keeping poultry. Only 20 percent of the farmers keeping poltry, as against 45 percent in 1967. The average number of birds per farm remain more or less the same, indicating that fewer farmers are keeping larger flocks (Table 11. 7).

Table 11.7: Livestock Enterprises

Enterprise	Per cent of all farms	Average per farm reportting	Average of all farms
Buffaloes	86	5.4	4.6
Cattle	65	3.7	2.4
Poultry	20	10.3	2.0
Goats	0.5	3.5	-
Pigs	0.2	3	-

4. Farm Labour Force

The farm family averaged 7.4 persons, composed of 6.4 family members and 1.0 relatives. Of these, 5.2 members were available for farm work during Maha 1970/71, with nearly 3.0 members working full time and 2.2 members working part time. The labour available for full-time work shows an increase from the 2.5 members reported available in 1967/68.

The average farm family had 3 children over 16 years of age. Nearly 75 percent of those reporting outside employment belonged to this category. Farmers were questioned on the educational attainments of their children. It would appear that about 25 percent of the children 16 years and over had pass the G.C.E.'O' Level or higher examination.

The size distribution of family labour per farm is indicated in Table 11.8, nearly 20 percent of the farms had 2 workers or less while 17 percent had more than 7 workers. There is a 4 percent increase in the number of farms reporting 7 or more family workers.

Table 11.8. Size distribution of Family labour per farm,1971

Size of Family labour (Full and Part time)	**Per cent of Farms**
2 or less	18.4
3 to 4	38.3
5 to 6	26.1
7 or more	17.0

Farmers continued to hire labour, although there has a drop in the number of labour days hired per farm. Nearly 88 per cent of all farmers hire an average of 117 days per farm reporting during Maha 1970/71 (Table 11.9). This compares with 84 percent of farms hiring 160 days per farm reporting in the Maha 1967/68. There has also been a sharp reduotion in the number of farms reporting the use of exchange labour, frome 33 per cent in 1967/68 to only 2 per cent in 1970/71. The decrease in farm size and the increase in full time labour available may account for the increased reliance on family labour.

The average farm reported a labour input of 224 days made up of 121 days of family labour and 103 days of hired labour. This amounts to about 55 worker per acre of paddy, with hired labour accounting for 45 percent of the labour utilised. These figures are however not comparable with the 62 days of labour per acre reported in the 1967/68 survey. Figures on the number of family labour days worked were not available at that time and certain assumption had to be made in this respect.

Table 11.9: Labour Input per Farm, Maha 70/71

	No.of workers	No.of work-days
Family workers per Farm(all Farms)	5.2	121
Full time	3.0	-
Part –time	2.2	-
Hired workers per farm(all farms)	-	103
Men	-	69
Women	-	34
Hired workers per farm reporting	-	117
Farms reporting wages paid ,per cent of all farms	88 %	
Wages paid per farm(all farms)	360.00 Rs	
Average Daily wage	3.50 Rs	

The distribution of labour by tasks indicates the highly seasonal nature of labour requirements in paddy production (Table 11.10). It is interesting to note that more hired labour was untilised for transplanting in 1970/71, 28 days per workers as against 22 in days 1967/68. This reflects the larger extents being transplanted in 1970/71. The number of hired labour days engaged shows a decrease for all other operations. The supplementary nature of hired labour is brought out by Table 11.11 which compares having more than 2 or less family workers with farms having more than 7 family workers.

The survey throws up some interesting questions about labour utilization which unfortunately could not be followed up. It would be useful to know whether the decrease in hired labour per farm reflects more intensive use of family labour and whether the increase in full-time family labour available reflects a lack of alternative avenues of employment. The question is often posed whether the improved varieties of paddy offer greater employment opportunities. The results of the survey indicate a 50 percent increase in paddy yield in 1969/70 compared to 1967/68. Farmers expected even higher yields in 1970/71, but the labour hire per acre does not reflect any increased utilization.

Table 11.10: Distribution of labour, by operations, Maha 1970/71

Operation		**Number of work days**		
	Family labour	**Hired Labour**	**Total**	**As percent of Total**
Preparatory Tillage	49	34	83	37
Sowing	3	2	5	2
Transplanting	17	28	45	20
Fertilizer application, Spraying and Irrigation	4	1	5	2
Reaping (intended)	14	17	31	14
Threshing, Winnowing and Bagging (intended)	18	15	33	15
Total	120	104	224	100

Table 11.11: Relationship between family labour force and hired labour

Farms With			
2 or less Family Workers		**7 or more Family Workers**	
Family Workers per farm	Nos	1.1	8.7
Full-time	,,	0.6	6.4
Part-time	,,	0.5	2.3
Work Days Hired	Days	328	41
Preparatory tillage	,,	88	12
Transplanting	,,	80	11
Weeding	,,	40	5
Harvesting	,,	60	7
Threshing	,,	50	6

However a comparative study of two groups of 17 farmers each, growing at least 3 acres of H4 and IR8 respectively, indicates that the IR8 group utilizes much higher levels of both family and hired labour for transplanting and weed control (Table 11.12). This table must however be interpreted with a great deal of caution. Because of the small size of the sample and still small numbers reporting different practices and the need to make several adjustments for comparative purposes, the figures may not reflect any accurate estimates of labour utilization. But it is felt that they do reflect the higher levels of labour utilized in IR8. A more meaningful comparison could have been made if information on output had been available.

5. Farm production and increase

The discussion so far has been in terms of the land and labour resources available to Elahera farmers. Farm success must however be measured in financial terms. In this section consideration is given to farm production, receipts and expenses. Unfortunately, production data for Maha 1970/71 is not available and production data obtained for Maha 1969/70 has to be used. The cost data however pertains to Maha 1970/71. Since more than 70 percent of the farmers expected higher yields in Maha 1970/71, the income estimates reported here might be an underestimate.

Table 11.12: Comparison of labour utilization by two group of farmers cultivating IR8 and H4

Operation	**IR8**	**H4**
No. of Farms	17	17
Av. Size of Farms (acres)	5.2	4.8
Av. Extent under principal variety	3.2	4.8
Labour utilized (No. of workdays per farm family, and hired by operation)		
Preparatory Tillage	112	120
Sowing and nursery preparation	4	5
Transplanting	78	7
Weeding	28	10
Fertilizer Application, Spraying and Irrigation	7	5
Reaping	30	35
Threshing	52	38
Winnowing and Bagging	9	10
Total	320	230

Paddy production and disposal

Table 11.13 indicates the approximate income and cost of production of paddy per farm in 1970. Paddy production per farm has increased from 256 bushels in 1967 to 361 bushels in 1970. Despite a decrease in the extent cultivated from 7.1 acres to 6.1 acres. There has been an

increase in yields from 36 bushels per acre in 1967 to 52 bushels per acre in 1970. The cash expenditure on paddy has increased from Rs. 1,100 in 1967 to as much as Rs. 2,000 in 1970. When the value of home consumed paddy is taken into account, the net income from paddy accounts to over Rs. 3,400 per farm or about Rs.285 a month as against Rs. 240 per month estimated for 1967.

Paddy yields per acre show wide variation, with about 20 percent of the farms reporting less than 40 bushels per acre and another 15 percent reporting over 70 bushels (Table 11.14).

The cash expenditure on paddy production for Maha 1970/71 averaged about Rs. 800 per farm, or about Rs. 190 per acre (Table 11.15). Wage payment accounted for about 45 percent of the total expenditure. It would have been higher still if account is taken of payment in kind, principally the mid-day meal. Farmers estimates of such payments however appeared to be greatly exaggerated.

Expenditure on draught power, including intended expenditure on threshing accounted for nearly 35 percent of average total cash farm expenditures. Although, farmers reported the availability of nearly 5 buffalos per farm, an increasing number amounting to about 50 percent reported buffalo hire. A large number also reported the hire of tractors, with average charges for tractor hire accounting for about two-thirds of drought power expenditures. A study of buffalo requirements, especially with regard to timeliness of operations, and the problems involved in maintaining an adequate supply of buffaloes merits attention, as this would be one of the means of cutting down cash costs.

Paddy Disposals

Farmers retained about a third of their production of paddy for domestic consumption. The quantity retained per farm however shows a decrease by about 20 bushels from what was reported in the earlier survey. It may be mentioned here that almost 70 percent of the farmers reported drawing their full quota of rationed rice. Farmers apparently did not face any problems in disposing of their surplus paddy. Nearly 0 percent of the farmers reported sales to the co-operation while another 5 percent did so to the private trade.

Table 11.13: Paddy preparation: Approximate income and costs of production per farm 1970

	Production (Bush)	**Acres**	**Yield Per Acre (Bush)**
Paddy Production per Farm Maha 1969/70	247	4.3	57
Yala 1970	69	1.8	29
Total	316	6.1	52
Disposal: Home Consumption	109		
Cash Sale	190		
Sales in Kind	32		
Total	331 1/		
Cash income from paddy (Rs. 14 per bush.)		Rupees	
(Intel. Sales in Kind)		3110	
Costs of Production Per Farm 2/		1150	
Wages Paid, Maha Rs. 360			
Yala Rs. 231 3/			
Fertilizer Cost,			
Maha Rs. 136			
Yala Rs. 10			
Other Costs Maha Rs. 294			
Yala Rs. 119 3/			
Approximate Net Cash Income		1960	
Value of Home Consumed Paddy		1526	
Approximate Net Income from Paddy		3486	

1/ Disposals exceed production by bushels.

2/ Cost data for Maha 69/70 assumed to be the same as for Maha 70/71.

3/ Yala Wages and other Costs estimated at 44 percent of Maha, because of Yala acreage being 44 percent of Maha.

Table.11.14: Distribution of paddy Yields per Acre by Farms

Yield Per Acre	Percent of Farmers Maha 1969/70	Percent of Farmers Yala 1970
Under 30	6.11	43.53
31-40	14.91	29.70
41-50	24.45	16.18
51-60	21.03	6.76
61-70	16.38	3.53
71-80	8.31	0.29
81-90	4.40	-
91-100	2.69	-
Over 100	1.71	-
Total	100	100

Table 11.15: Average Cash Expenditure on Paddy, Maha 1970/71

Item	Average Cost per Farm (Rs.)	Percent of Total Cost
Wage Payments	360	45
Tractor Hire	174	22
Buffalo Hire	98	12
Seed Paddy	8	1
Chemicals	23	3
Fertilizer	136	17
Total	800	100

The distribution of paddy sales by farmers in 1970 is set out in Table 11.16. It shows that farmers selling 300 bushels or more of paddy comprised only about 24 percent of the farm population, but accounted for about 46 percent of the total sales in 1970. On the other hand, farmers selling 100 bushels or less constituted 23 percent but accounted for only 7 percent of total sales. In comparing the distribution with 1967 however, it can be seen that farmers have had larger surpluses to sell and that the distribution is relatively more even. However while the percentage of farmers selling less than 100 bushels has decreased by about half, their share of total sales has decreased by even more indicating a relative worsening of their position. The question is often

raised as to whether agricultural development leads to widening income disparity between farmers. The available data from Elahera do not provide sufficient evidence to draw any firm conclusions on this point.

Table 11.16: Distribution of Paddy Sales, 1970 and 1967

1970				1967	
Farms Selling		Percent of all farms	Percent of Total Sales	Percent of all Farms	Percent of Total Sales
Less than 100 Bushels	,,	23	7	54	25
101-200	,,	32	23	30	37
201-300	,,	22	25	11	23
301-400	,,	14	22	3	8
401-500	,,	5	9	1	3
More than 500	,,	5	15	1	3

Income from others sources

Farmers also reported various other sources of both farm and non-farm incomes (Table 11.17). Such incomes add up to about Rs. 600 per farm per year, accounting for less than 15 percent of the total income of farmers. While the percentage reporting incomes other than from paddy is small, the amounts appear to be fairly high for farmers reporting such incomes.

Table 11.17: Sources of Cash Incomes per Farm 1970

Sources of Income	Average Incomes (Rs.)	Percent of Total Income
Paddy (Incl. Home Consumption)	3486	86
Other Crops	128	3
Livestock	28	1
Off-Farm Employment	370	9
Other Non-Agricultural Sources	48	2

The sources of cash farm incomes other than from paddy is given in Table 11.18. The relatively insignificant place occupied by subsidiary crops is brought out clearly. It is however likely that a large number of farmers managed to meet their domestic requirements of a number of other crops but no information is available on this. The relatively high level of high incomes derived from crops such as tobacco, mustard, chillies and onions point out to the possibilities open to enterprising farmers.

The sources of off-farm income is indicated in the Table 11.19. Employment in government services accounted for about 40 percent of those reporting outside employment. Skilled labour such as carpentry, tractor driving and tailoring accounted for 20 percent and trade for another 15 percent. About 5 percent reported incomes from gemming.

If account is taken of the various sources of income available to the Elahera farmer, then he should be receiving a cash income of approximately Rs. 370 a month, including the value of home consumed paddy. It is likely that income figures are underestimated and it should also be noted that no account is taken of the values of home consumed subsidiary crops including tree crops.

6. Cultural practices in paddy production, Maha 1970/71

Detailed information was sought on the cultural practices followed by farmers with a view to determining the extent to which farmers have responded to the program of intensive production. This data is presented in Table 11.20 and a comparison with the 1967 survey results is indicated in Table 11.21.

Table 11.18: Income from Crops Other than Paddy 69/70

No	Crop	Percent of farms reporting	Cash Income per farm reporting (Rs.)
1	Chillies	6.9	438
2	Onions	4.1	228
3	Ground-Nut	6.5	254
4	Green-gram	10.8	63
5	Cow-Pea	5.5	79
6	Gram	0.2	300
7	Tobacco	0.5	815
8	Manioc	1.7	84
9	Banana	0.7	82
10	B. Onions	0.2	13
11	Kurakkan	0.2	100
12	Gingelly	0.2	15
13	Betel	0.7	300
14	Soya Bean	0.5	248
15	Mustard	0.2	750
16	Ginger	0.2	30
17	Garden Vegetables	11.7	95
18	Tree Crops	42.3	133

Table 11.19: Sources of off-Farm Income, 1970

Sources	Percent of farmers reporting	Av. Income per farm reporting	Av. Income all farms (Rs.)
Outside Employment	21	1778.00	370.00
Hiring out Equipment	1	325.00	1.50
Rent from Land or House	1	622.00	7.50
Rice Mill	1	1250.00	12.00
Cart Hire	6	190.00	12.00
Sale of Mats, Pottery etc.	1	47.50	0.50
Other	3	487.50	14.00

Table 11.20: Cultural Practices – Paddy Production Maha 70/71

Farmers Reporting Practices			
Practices	**Percent of all farms**	**Acres per farm reporting**	**Percent of Total Paddy Acreage (all Farms)**
Tractor			
First Ploughing	45.2	3.3	35%
Second Ploughing	16.5	3.0	12%
Buffaloes			
First Ploughing	70.3	3.9	66%
Second Ploughing	87.3	4.2	88%
Seed Paddy			
H4	94.0	3.1	70%
IR8	35.2	1.5	12%
H8	27.5	1.3	8%
Sowing			
Broadcasting	83.7	3.2	64%
Transplanting (ord)	62.9	1.9	29%
Row Transplanting	18.4	2.3	10%
Fertilizer Use	76.0	4.0	72%
Weed Control			
Hand Weeding	75.6	3.6	65%
Rotary Hoe	8.4	2.7	5%
Chemical Weeding	11.0	2.7	7%
Pest and Disease Control	40.7	-	-
Threshing			
Tractor	78.0		

Table 11.21: A comparison of cultural practices in Paddy Production, Maha 1967/69

	Percent of farms reporting		**Acreage per farm reporting**		**Percent of Total Paddy Acreage**	
Tractor Ploughing	45	50	3.3	-	32	-
Transplanting	81	41	2.2	1.7	39	14
Weeding By Hand	76	80	3.6	4.3	60	67
Weeding by Rotary Hoe	8	11	2.7	-	5	-
Chemical Weeding	11	4	2.7	-	7	-
Fertilizer Use	76	83	4.0	3.8	66	62
Tractor Threshing	78	65	4.2	-	72	-

Preparatory Tillage

Buffaloes still represent the main source of draught power for ploughing. There has in fact been a slight decrease in the number of farmers reporting the use of tractors. There has also been an increase in number of farmers reporting the hire of buffaloes, from 35 percent in 1967/68 to over 50 percent in 1970/71.

The number farmers relying on the government tractor pool has declined sharply, from 72 percent in 1967/68 to 45 percent in 1970/71. Farmers however seemed to have experienced little difficulty in hiring tractors, with only 9 percent indicating any difficulty, as against the 63 percent in 1967/68. But 38 percent of the farmers did report delays in preparatory tillage, due mainly to labour shortages, illness in the family and rain.

Seed Paddy

Almost all farmers reported some extent under the improved varieties, primarily H4, H8 and IR8. Most farmers reported some combination of these varieties, with only 15 percent reporting some combination of improved and local varieties. Over 60 percent of the acreage was under H4. 70 percent of the farmers reported that they used their own stock for seed (Table 11.22).

Table 11.22: Source of Seed Paddy, Maha 70/71

As percent of Farms Reporting				
Sources	**H4**	**IR8**	**H8**	**Others**
Own	67.3	68.2	72.2	76.0
Co-Op	24.2	17.8	10.9	0.1
Private	5.4	11.1	11.9	20.3
Dept. of Agriculture	3.1	3.0	-	2.5

Method of Sowing

Farmers still depended primarily on broadcast sowing, with about 61 percent of the total acreage being broadcast. About 60 percent of the farmers reported some transplanting, but the total acreage transplanted

was only 39 percent, averaging less than 2 acres per farm reporting. The area transplanted has however, increased from the 14 percent reported in 1967/68. About 90 percent of the farmers expressed a preference for transplanting but were apparently unable to practice it.

Fertilizer Application

Fertilizer application is regarded as the key practice in the strategy of intensive Agricultural development. The use of fertilizer was reported by 76 percent of the farmers on 72 percent of the total acreage. Nearly 4 acres per farm was fertilized with 2.5 cwts of fertilizer per acre. While the number of farmers applying fertilizer has decreased from 83 percent to 77 percent over this period, the total extent receiving fertilizers has increased from over this period, the total extent receiving fertilizers has increased from 62 percent to 72 percent.

The quantity of fertilizers used per acre shows no change, but there has been a marked shift in the composition of fertilizers. Whereas 96 percent of the farmers reporting used ammonium sulphate as the source of nitrogen in 1967/68, about 75 percent of the farmers reporting used area in 1970/71. When urea is used exclusively the rate of application at 2.5 cwts to the acre would approximate the standard recommendation, excepting for IR8 which requires double the quantity. It would however appear that farmers are still not applying the recommended rates of the different fertilizers (Table 11.23). The time of application of fertilizers is indicated in Table 11.24. While nearly half the farmers have used of fertilizers as basal dressing and at tillering and panicle initiation, there still a considerable number left who do not use fertilizer at any of these stage.

An analysis of fertilizer application by varieties is indicated in Table 11.25. While farmers seem to be aware of the need to fertilize some varieties more than others, they still have not reached up to the standard recommendations.

Weed Control

The extent weeded shows an increase from 67 percent of the total acres in 1967/68 to 77 percent in 1970/71. The available cost data seem to indicate that the rotary hoe is the cheapest method of weeding.

Table 11.23: Types of Fertilizer used, Maha 1970/71

Fertilizer	Percent of farms reporting	Quantity per farm reporting (cwt.)	Quantity per Acre per farm reporting (cwt.)
Sulphate of Ammonia	3.9	1.9	0.5
Urea	57.0	4.6	1.1
Super Phosphate	44.0	3.9	1.0
Saphose phosphate	10.6	3.2	0.8
Muriate of Potash	46.4	2.2	0.6

Table 11.24: Application of fertilizer by stages of Growth, Maha 1970/71

Stage of Growth	Percent of farms reporting	Quantity per farm reporting (cwt.)
Nursery Application	1.6	0.5
Basal Dressing	59.4	6.8
Tillering	61.6	3.0
Panicle Initiation	45.2	3.1
Other Stages	1.5	2.6

Table 11.25: Fertilizer Application by Varieties of Paddy, Maha 1970/71.

Variety	Acreage per farm reporting (Acres)	Quantity per farm reporting (cwt.)	Quantity (cwt.)
H4	3.1	5.6	1.8
H8	1.3	2.7	2.0
IR8	1.5	5.3	3.5
Others	1.4	3.3	2.3

Pest and Disease Control

Nearly 25 percent of the farmers reported losses from pest and diseases attacks and estimated such losses at about 20 percent of production. Bacteria leaf blight was the major disease reported, by 86

percent of the farmers reported while stem borer attacks were reported by 20 percent, gall-midge by 16 percent, thrips by 15 percent and leaf eating caterpillar and paddy flies each by percent of the reporting farmers.

Harvesting

Nearly 80 percent of the farmers indicated that using tractors for threshing. The most per acre estimated ranges from Rs. 25 for buffaloes to Rs. 30 for tractors.

7. Farm Machinery and Equipment

Information was sought on the machinery and equipment owned by farmers and it would appear that farmers possessed little else besides mammoties (Table 11.26). Even equipment such as seeders, weeders, sprayers and dusters are not widely possessed and it may be surmised that more widespread adoption of such equipment may favour practices such as row seeding, weeding and control of pest and diseases. It is difficult to accept much progress in the adoption of these practices, which are all part of the intensive agricultural development, without farmers being in possession of the basic equipment. It is however not known whether these were not available to farmers or that farmers were simply averse to buying them.

Table 11.26: Ownership of Farm machinery and Equipment

Item	Percent of farmers reporting	Number of per farmer reporting
Mammoties	97.6	3.7
Wooden Plough	29.7	1.9
Mould Board Plough	86.8	2.2
Paddy Seeders	4.6	1.1
Paddy Weeders	15.1	1.3
Sprayers and Dusters	0.5	1
Tractor-2 wheel	1.0	1
Tractor-4 wheel	0.5	1
Rice Hullers	1.0	1
Gunny Bags	88.8	51.1

8. Credit and Indebtedness

Adequate supply of institutional credit is deemed necessary for intensive production. The information available in this respect is however not complete. This was one of the respects of production which was planned to be studied in greater detail but which unfortunately could not be proceeded with.

Cultivation loans in cash were reported by 64 percent of the farmers, and in kind by 44 percent. This compares with the 82 percent in 1967/68. The average loan per farmer reporting however is higher than the total of Rs. 456 reported in 1967/68. The reason for the decline, in the number of farmers availing themselves of the credit facilities is not known, but is in keeping with the trend in the rest of the country.

Over 90 percent of the farmers had resorted to the co-operatives for their production credit, both cash and kind. A few farmers however still reported going to the private traders. Consumption credit and credit for ceremonials, pilgrimage etc. were entirely from private sources. It is apparent that farmers are still not availing themselves to the full limits of the credit facilities made available to them through institutional sources.

9. Co-operation, Cultivation and Extension services

One of the objectives of the special projects program is to increase the effectiveness of farm level institutions servicing the needs of farmers. These institutions such as the co-operatives, committees and extension services are charged with the responsibility of supplying farmers with production credit and other needed inputs and assist them in marketing surplus farm production, maintain irrigation channels is a good state of repair, hire out equipment as sprayers and dusters, and educate and guide farmers in the modernisation of the production process. The views of the farmers themselves were sought in appraising the effectiveness of these institutions in catering to their needs.

Over 95 percent of the farmers indicated that they were members of co-operatives and 93 percent reported patronising the co-operatives for their purchases of agricultural supplies. Farmers were generally restrained in their criticism of the cooperatives, unlike in the earlier survey. More than 82 percent of the farmers indicated that there was an improvement in the services rendered by the co-operatives. Farmers

however indicated that co-operatives could be of greater service by increasing the quantum of credit (28 percent of farmers), provide farm implements (17 percent), provide a wider range of consumer goods (16 percent), provide agrochemicals and fertilizers in time (8 percent), and relax regulations governing purchases of paddy.

The cultivation committees however come in for a great deal of criticism. Although 70 percent of the farmers reported having paid their acreage tax, near 40 percent were of the view that cultivation committees served no useful purpose and over 50 percent preferred a return to the Vel vidana system. Again, over 40 percent levelled charges of corruption against the management and suggested change in the management. Farmers were in general dissatisfied with the manner in which repairs were effected to irrigation channels and wanted cultivation committees to pay more attention to the improvement of roads and the provision of sprayers and dusters on hire.

Where the extension services were concerned farmers expressed general satisfaction advice offered by extension officers and over 75 percent indicated that they would stand to lose if the advisory services were withdrawn. With a view to ascertaining the degree of contact with field officers, the farmers were asked whether they knew the field officers by name. More than 95 percent of the farmers indicated that they knew the village level worker but only 45 percent knew him by name. Nearly 80 percent knew the Agricultural instructor, but only 20 percent by name. Nearly 75 percent of the farmers indicated that they had been contacted by the village level worker the previous season. About 68 percent indicated having followed the recommendations of these officers.

10. Non-Farm Investments

Information was sought from the farmers on the type of non-farm investment carried out and consumer durable goods purchased over the 3 year period. Only 2 percent of the farmers reported the purchase of additional land while 32 percent indicated extension to their houses. About 12 percent had changed their roofing material while about 40 percent indicated purchases of new furniture.

Farmers also reported purchases of sewing machines (14 percent), bicycles (17 percent) and radios (22 percent). One farmer reported having purchased a motor car. 1.3 percent of the farmers indicated having taken out life insurance policies.

Summary and Conclusion

A bench-mark survey of the Elahera colonization scheme was carried out in December 1967 and the survey was reported in January 1971 with the objective of evaluating the progress of the program of the intensive agricultural development, termed the special project program, initiated in the Maha of 1967. The immediate objective of the program was to bring about rapid increases in agricultural production by a concentration of effort in a high response area. Since the program was hardly three years old, the main objective of the study has been to report on the extent to which farmers have responded to the package of practices deemed necessary to secure rapid increases in production.

The survey indicates a decrease in farm size, due mainly to sub-division of holdings amongst children of allottees. This informal sub-division is likely to continue leading to further decreases in size of farms. Cropping patterns show hardly any change. Farmers continue to rely heavily on paddy production despite problems of water shortages during the Yala season. The hope for shift towards subsidiary food crops has not materialised. Farmers did not indicate a readiness to undertake subsidiary food production in the Yala, given adequate supplies of water. Whether in fact they would do so remained to be seen, as they indicate a decided preference for paddy cultivation.

The project laid heavy emphasis on the rehabilitation of the irrigation system. However, there is little evidence of any improvements. The acreage devoted to Yala cultivation is still less than half that of Maha and Yala paddy yields are very much lower than that of the Maha. These are attributed water shortages during the Yala. Farmers continue to complain about problems in water distribution. The highland allotments still remain unirrigated and there is no evidence to show that any efforts are being made to provide farmers with lift irrigation. Even in the few cases where highland irrigation was possible, farmers have preferred paddy cultivation.

Farmers reported greater reliance on family labour. There is an appreciable decrease in the amounts of hired and exchanged labour utilized. It is not clear whether, because of rising wages, farmers are utilising family labour more intensively or whether more family labour is becoming available because of a lack of alternative avenues of employment. Farm incomes have increased despite decreases in farm size. This has brought about primarily by an increase in paddy yield. But

the income is by no means spectacular. The Polonnaruwa district as a whole reports similar increases.

There are wide variations in paddy yields and it would have been useful to find out whether such variations could be explained in terms of variations in inputs used or practices followed. Unfortunately, the absence of input data from Maha 1969/70 and output data for Maha 1970/71 prevents such an analysis.

Farmers report a higher rate of adoption of recommended practices. But rate of adoption appears unsatisfactory for an area in which there is supposed to be a concentration of effort. Over 70 percent of the acreage is under H4. This was in the Maha of 1970/71. At a time when still newest varieties are being recommended, one would have expected a special project area to spearhead the adoption of these varieties. Similarly, while fertilizer application has increased, they are still not anywhere near recommendations. Large numbers of farmers are either not applying fertilizers or applying at levels which would hardly have any effect. These problems merit closer study.

A smaller percentage of farmers are utilising the credit facilities made available to them through the co-operatives. Even amongst these, very few are availing themselves to the full limit of the production credit they are entitled to. Many farmers indicated the need for consumption credit. Consumption credit is not available through the co-operatives and it is not clear whether this had anything to do with the decrease in the proportion of farmers patronising the co-operatives for credit.

Coming to the farm-level institutions, there appears to be better appreciation of the role of the co-operative. Farmers are channelling their surplus paddy through the co-operative and utilising its services. But the problems of these farmers cannot be neglected and extension officers need to be supported by research which would help provide explanation for the poor performance and indicate what should be done to help.

Finally, an attempt was made to judge the degree of progress achieved by recording the type of non-farm investments undertaken by farmers. Three years is perhaps too short a period in which to asses such changes. There is however very little evidence to indicate any large scale investments in land or in buildings. Farmers do seem to have acquired durable consumer goods such as sewing machines, bicycles and radios and it appears as if the demand for such items is likely to increase sharply.

A common complaint of farmers was that co-operatives, which appear to be the major retail outlets in this area, did not stock enough of consumer goods and that farmers had to travel long distances to acquire many types of consumer goods.

Three years may not be sufficient time in which to evaluate the special project program at Elahera, especially as much of the time seems to have been spent on organizational matters. There have been changes but the pace of development does not appear rapid enough. If special project areas such as Elahera are to serve not only as demonstration centres but as centres of rapid growth that will induce development in surrounding rural areas, then much greater planned effort is called for. Unfortunately at Elahera, apart from the activities of the various governmental agencies supplying assistance to program together with an intensification of the extension programme, there is no evidence of the concentration of resources and effort which is the basis of an intensive program of agricultural development. There is no evidence of any attention being given to the special conditions at Elahera, much less to the problems of individual farmers.

This study has called attention to a number of problems. This is related to sub-division of holdings, irrigation in the Yala, subsidiary crop production, draught power supply, the wide variations in paddy production and incomes, the inadequate response to recommended practices, and the under-utilization of available facilities by farmers, to mention some of the important ones. Further investigations into these problems should prove valuable to policy makers and extension officers and help in the intensification of development efforts.

CHAPTER 12

An Economic Survey of Six Major Colonization Schemes[1]

1. Introduction

This study is based on field survey of six major colonization schemes in the dry zone of Sri Lanka. The survey was carried out at the request of the Additional Land Commissioner in order to obtain first-hand information about farming conditions in the areas which were to be brought under the "Special Projects" programme from Maha 1973/74.

The special project programme in Sri Lanka is based on the concept of intensive agricultural development of high response areas. It was first introduced to Elahera, amongst the major colonisation schemes, in 1967 and extent to cover nine other major schemes the following year. The Department of Agricultural Economics of the University of Sri Lanka had earlier carried out bench-mark surveys of all these projects, including a re-survey of the Elahera project.

The major objectives of the present study is to describe and analyze the actual farm situation in the areas surveyed. More specifically information was sought on resource availabilities and resource use, production capacities, level of technology and level of productivity. Such information is not only expected to provide a bench-mark against which future progress could be evaluated, but also throw light on the impact of current policy measure in agriculture.

The six colonies surveyed are all situated in the north-central sector of the dry zone region of Sri Lanka and would benefit from the Mahaweli Diversion project. It is expected that water supplies would then be adequate to permit at least the double cropping of all existing lowland allotments.

The six colonies between the cover nearly 27,000 acres of lowland and 17,000 acres of highland and support about 8,000 allotees and their families. They vary widely in size, from 500 allotees as Usagala-

[1] Reproduction from a Agricultural Economic Research Unit Department of Agricultural Economies & Farm Management, University of Sri Lanka, Peradeniya, May 1974.

Siyambalangamuwa to 3 acres of lowland and 2 acres of highland at Nachaduwa to 3 acres of lowland and 2 acres of highland in the other colonies. About 100 families at Giritale also received an 8 acre holding. Nachaduwa and sections of Giritale were amongst the earlier colonies to be developed and settled and were thus unaffected by policy changes resulting in a reduction of size of holdings.

2. Methods and Procedures

Information was collected by means of a questionnaire administrated to a sample of farmers in each of colonies studied. A simple random of sampling of farmers was drawn, with the unit of allotment as the basic sampling unit while it was planned to survey a sample of about 15 to 20 percent, the actual percentage sampled varied from colony to colony, ranging from 22 percent at Kandalama and Usgala-Siyambalagamuwa to only 11 percent at Kantalai. The variation were due to problems of accommodation and transport which determined the time spent by interviewers in each area. The samples were drawn from lists of farmers which were available with the cultivation officers. Nachaduwa was exception. The lists made available here had not been updated, probably since the time of the original settlement, and there were serious difficulties in tracing the farmers. Farmers were therefore ultimately sampled on the basis of the allotment numbers.

Nachaduwa was one of the earlier irrigation schemes to be colonised and it would appear that large numbers of the original settlers have given way to newcomers who claim to be the allotees. This however was one aspect of the study on which reliable information was not forthcoming and no attempt was made to probe deeper into the question. Information was collected by the single interview method. Over 1100 farmers were interviewed in April/May 1973 about their activities during Yala 1972 and Maha 1972/73. Information was sought on family size, education and employment, farm size and tenure, land utilisation and cropping patterns, farm Incomes and expenses, paddy production and disposal, management practices, farm and non-farm investments, credit and indebtedness and activity of farm level institutions. There were many problems in getting such comprehensive information by recall at a single interview. The response from farmers and co-operation from field level officials was however very satisfactory. Farmers in fact evinced a keen desire to come out with their problems and many were disappointed that they were not amongst those interviewed.

The interviewers were drawn from final year students in Agriculture with help from few Graduate Trainees attached to the Mahaweli Development Board. Familiarity with the technical aspects of agriculture and with farm level problems proved to be a decided advantage in administering a lengthy questionnaire. However, since University students were involved, the survey had to be carried out during the University vacation and this imposed some limitations. The processing and tabulation of data commenced in July 1973 and was mainly in the hands of temporary Research Assistants who were assisted from time to time by other members of the staff of the Research Unit. Reliance on temporary staff who frequently changed brought in problems of its own and unduly prolonged the analysis of data.

Table 12.1 provides the background information on the colonies studied. It also indicates the number of questionnaires administered during the course of the survey. It was not found necessary to discard any as every questionnaire had some items of usable information. It must however be pointed out that in respect to many items, information was not available for the full sample indicated. Information was most complete for those portions of the questionnaire relating to family size, education and employment, farm size and tenure. In other instances, such as for paddy production, some of the allotees were either not willing to give the information or were not in a position to do so, either because harvesting was not over, or because they had fully rented out their holdings or could not cultivate it because of sickness, or for some such reason.

Table 12 1: Year of Settlement, Unit of Allotment, Number of Allotment Size of Sample, by Selected Colonies[1]

Colony	Year of	Unit of Allotment	Number	Size of

	Settlement 2	(acres)		of Allotees	Samples
		Low Land	High Land		
Nachaduwa	1935 – 1955	5	3	1008	185
Usgala-Siyambalangamuwa	1960 – 1962	3	2	500	100
Kandalama	1954 – 1957	3	2	656	145
Giritale	1956 – 1959	3[3]	2[3]	1350	205
Kaudulla	1958 – 1965	3	2	1894	222
Kantalai	1950 – 1959	3	2	2529	283

[1]Information on number and size of allotments supplied by Commissioner's Department.

[2]Approx. 75 percent of the allotees sampled reported settlement during years indicated.

[3]About 100 allotees had 8 acre allotments

Population Characteristics

Success in farming is to a considerable extent determined by manner in which the farm family utilizes the physical factors available to certain characteristics such as age, education and composition of family have an important bearing on the use of other factors of production such as land and capital.

Family Size and Composition

Information on family size, work-force and employment is in Table 12.2. The typical farmer was about 50 years of age, except at Kaudulla where the average age was 44 years. The size of the average farm family range from 6.7 persons at Kaudulla to 7.9 at Usgala-Siyambalangamuwa. Adult members defined to include all persons 16 years of age and above, accounted for about 60 percent, excepting Kaudulla where adult accounted for only 50 percent of the average family. The school going population, between the ages of 5 to 19 years of age, accounted for roughly 30 percent of the farm population. Adult males outnumbered adult females in all the Colonies, again except in Kaudulla where the proportions were equal. The male/female ratio at Nachaduwa and

Kantalai also appeared to be relatively high compared to the other colonies.

In presenting data, reliance is placed on frequency, distributions and simple averages to bring out the typical and on tabular analysis to bring out the relationship between various factors. These are not only easy to understand but simple to compute. No attempt has been made to introduce any greater degree of refinement or sophistication in the analysis of data. Such procedures were beyond the facilities available. Furthermore, the intention was to place the results of the study in the hands of the Additional Land commissioner in the shortest time possible. Unfortunately, several factors beyond our control have somewhat delayed the submission of this report.

Table 12.2: Family Size, Work-Force and Employment, by Colonies

Colony	**Average Family Size**	**Average Size of Family Work-Force[1]**	**Per cent Working full time on farm**	
			Allotees	**Other Adults**
Nachaduwa	6.8	4.9	79	37
Usgala-Siyambalangamuwa	7.9	5.5	80	60
Kandalama	7.5	5.3	76	42
Giritale	7.7	5.3	76	48
Kaudulla	6.7	4.5	80	52
Kantalai	7.1	5.1	73	39

1 Work-Force in the term of adult male equivalents. 1.5 females and 2.0 children are considered equal to one adult male unit.

Education

More and better general education of farmers appears to be a necessary factor in the continuing development of agriculture. Better educated farmers can in general use the resources available to them

more efficiently and also appear to be more willing to accept required changes.[2]

The surveys sought information on the educational attainments of farmers and their families. The majority of the allotees, ranging from 62 percent at Kendalama to 72 percent at Giritale do not appear to have reached educational levels beyond Grade 5. (see Table 12.3). Less than 5 percent reported having reached Grade 10 levels or above. Nachaduwa was an example and the greater numbers reporting higher levels of education may be due its proximity to Anuradhapura and the better educational facilities available there.

Table 12.3: Educational Attainments of Farm Families, by Colonies

Colony	**Percent of Allotees**			**Per cent of all Family Members**		
	Grade 5 & below	**Grade 6-9**	**Grade 10 & above**	**Grade 1-5**	**Grade 6-9**	**Grade 10 & above**
Nachaduwa	63	28	9	33	27	17
Usgala-Siyambalangamuwa	69	27	4	45	17	5
Kandalama	62	33	5	34	24	11
Giritale	72	25	3	47	24	9
Kaudulla	70	27	3	45	16	5
Kantalai	63	34	3	30	24	9

Employment

The average size of the family workforce ranged from 4.5 to 5.5 adult male equivalents. Approximately 75 to 80 percent of the allotees reported working full-time on their farms. Another 10 to 15 per cent worked part-time. A few reported not being able to work because of infirmity and old age. Other adult males working full-time on the farms ranged from 57 percent at Nachaduwa to 60 percent at Usgala-

[2] See for instance, William I Myers, "The Role of Education in Agricultural Development," in R.N. Discey. Ed., International Exploration of Agricultural Economics. Iowa 1964.

Siyambalangamuwa. The availability of alternative employment opportunities at Anuradhapura, the Kantalai sugar plantations and at the state farm at Kandalama may partly explain the relatively small proportion of other adult males working full-time on farms at Nachaduwa, Kantalai and Kandalama respectively. Adult males working part-time on farms ranged from 1 percent at Usgala- Siyambalangamuwa to 26 percent at Kandalama and 28 percent at Nachaduwa. The number of adult males, other than allotees, working full or part-time on the farms varied considerably, ranging from about 60 percent at Kantalai and Nachaduwa to about 75 percent at Usgala- Siyambalangantuwa.

The proportion of adult males reporting full-time off-farm work was relatively small, varying from about 4 percent at Usgala-Siyambalangamuwa to about 12 percent at Giritale and Kandalama. The fact that 25 percent to 40 percent of adult males, other than the allotee, took no part in farming activities does not however indicate a surplus of manpower as far as agriculture is considered. It will become clear from the subsequent sections that farmers incurred considerable expenditures on hired labour. This is indicative of the highly seasonal requirements of labour, especially in paddy production.

3. Farm Size, Tenure and Water Supply

Farm Size

The physical extent of land available to farmers and the terms and conditions under which it is worked, together with the associated physical factors such as fertility of the soil and availability of water determine to an important degree the returns to the farmer. Information on farm size is presented in Table 12.4. The average holding varied in size from 4.4 acres at Giritale to 6.8 acres at Nachaduwa. Holding sizes reported are in general larger than the average size of alloted extents, but the actual extents cultivated are smaller. Such differences between actual and alloted extents are due mainly to Chena cultivation and encroachment on reservations. The smaller extents actually cultivated appear to be primarily due to difficulties in water supply. These factors are considered in somewhat greater detail below.

The size distribution of sample farmers, by colonies is shown in Table 12.5. In all cases the distribution is highly skewed to the left. There is also very high concentration of holdings in the 2 -4 acre or 4 - 6 acre size-class is evident. Nachaduwa however is an exception in that it is characterized

by a relatively high proportion of farmers operating extents of 2 acres and under. The distribution of area amongst the different size-classes indicates a relatively greater concentration of area amongst the higher size- classes. Nowhere is the inequality in the distribution of land more evident than at Nachaduwa where 22 percent of all sample farmers in the lowest size-class operate only 3.2 percent of the total land whereas 11.2 percent of the sample farmers in the highest size-class operate over 40 percent of the land. At Kantalai too, 3.2 percent of the farmers in the smallest size-class operate only 1 percent of the land, while the same proportion of farmers in the highest size-class operate 14.3 percent of all land.

Table 12.4: Average Size of Holdings, Average Extents Alloltes and Average Extents Cultivated during Yala 72 and Maha 72/73.

Colony	**Average Size of Holdings**			**Average Size of Alloted Extents**			**Average Extent Cultivation**		
							Low Land		**High Land**
	Total	**Low Land**	**High Land**	**Total**	**Low Land**	**High Land**	**Maha 72/73**	**Yala 72**	**Maha 72/73**
	(Acres)			(Acres)			(Acres)		
Nachaduwa	6.8	4.9	1.9	5.1	3.5	1.6	4.2	3.9	0.9
Usgala-Siyambalangamuwa	6.4	3.2	3.2	5.0	3.0	2.0	3.0	1.9	1.1
Kandalama	6.2	3.2	3.0	4.8	2.8	2.0	2.8	0.8	1.2
Giritale	4.4	3.1	1.3	4.4	3.1	1.3	3.1	2.2	0.9
Kaudulla	5.0	2.8	2.2	4.6	2.6	2.0	2.8	0.9	1.2
Kantalai	5.7	3.7	2.0	3.7	2.2	1.5	3.7	0.1	1.0

Previous surveys of settlement schemes indicated a tendency in farmers to enlarge the size of their holdings by encroaching on reservation practicing chena cultivation. Renting of land is also not uncommon. All these practices are to be found in the colonies studied (see Table 12.6). However, the fact that except for Usgala-Siyambalangamuwa, reported alloted extents are smaller than standard units would seem to indicate a considerable amount of subdivision of allotments. This seems most acute for Nachaduwa and Kantalai and it is in these areas that rental arrangements occur most often. Farmers were

reluctant to report such practices and one would suspect that the actual figures would be much higher than indicated in Table 12.6.

Rental Arrangements

Nachaduwa reported a relatively high proportion of farmers renting land. About 35 percent of the farmers reported renting on the average a little over 4.2 acre of land. Most of the farmers had rented lowland, with only 9 farmers renting highland. Not all farmers rented land to enlarge their holdings. Nearly 12 percent of the sample appear to have been pure tenants.

Rental arrangements varied with nearly 50 percent of those renting land paying on a half-share basis. Another 40 percent reported paying a fixed rental of 6 bushels per acre while the rest made cash payments.

Chena cultivation

Chena cultivation is practiced extensively at Usgala – Siyambalan- -gamuwa, with 40 percent of the farmers reporting that Gingelly, Chillies, Kurakkan, Maize and Vegetables, in that order were the most important crops grown on the Chena.

Water Supply

The availability of water for irrigation is often taken for granted in the major colonization schemes, especially in the Maha season. But problems in respect of water supply are present in the colonies studied (see Table 12.7). While a small proportion of farmers appear to be experiencing difficulties even in the Maha season, the situation is much more critical during the Yala. Kantalai and Kandalama are worst off with only 14 per cent and 19 percent of the farmers respectively reporting the availability of water for irrigation during Yala and that too for only portion of their lowland allotments. Giritale is best situated in regard to irrigation with 92 percent of the farmers reporting the availability of water even during the Yala. But here too the average extent per farmer reporting is only 2 acres of lowland as against an average of 3.1 acres available for cultivation. The potential for increased production following the Mahaweli Diversion Projects needs hardly be stressed in these circumstances.

Table 12.5. Distribution of Sample Farms by Size-Classes.

Size-Class	Nachaduwa		Usgala-Siyambalangamuwa		Kandalama		Giritale		Kaudulla		Kantalai	
	% of all Farms	% of Total Acreage	% of all Farms	% of Total Acreage	% of all Farms	% of Total Acreage	% of all Farms	% of Total Acreage	% of all Farms	% of Total Acreage	% of all Farms	% of Total Acreage
2 acres & under	21.0	3.2	-	-	-	-	2.5	0.5	1.8	0.7	3.2	1.0
2.1 – 4	37.0	17.0	3.5	1.9	5.3	3.5	71.1	64.9	25.8	22.4	16.2	8.8
4.1 – 6	12.0	10.3	55.4	45.4	62.9	51.8	14.2	14.5	64.3	61.5	63.6	53.5
6.1 – 8	10.6	11.9	28.3	31.5	18.9	21.8	8.8	13.5	4.5	7.3	5.0	5.8
8.1 – 10	3.3	4.9	7.0	9.8	4.9	8.6	2.9	5.4	3.2	6.7	3.9	6.2
10.1 – 12	4.8	8.3	2.6	4.4	2.8	6.2	0.5	1.2	-	-	1.8	3.4
12.1 – 15	1.1	3.4	0.9	2.0	2.8	6.0	-	-	0.5	1.4	3.2	7.0
15.1 & over	10.2	40.8	1.8	5.0	1.4	4.0	-	-	-	-	3.2	14.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 12.6. Farmers Reporting Panning Additional Land

Colony	Renting in Land		Renting out Land		Encroachment		Chena	
	% of Farmers Reporting	Av. Extent Per Farmer Reporting	% of Farmers Reporting	Av. Extent Per Farmer Reporting	% of Farmers Reporting	Av. Extent Per Farmer Reporting	% of Farmers Reporting	Av. Extent Per Farmer Reporting
Nachaduwa	35	4.2	10	4.6	13	1.4	12	2.2
Usgala-Siyambalangamuwa	6	1.8	4	2.4	17	2.1	40	2.2
Kandalama	2	2.5	3	1.4	17	2.0	17	1.8
Giritale	14	2.8	18	2.4	18	1.3	2	0.9
Kaudulla	12	2.4	13	2.7	12	1.5	4	2.2
Kantalai	18	7.3	4	4.0	7	1.6	9	2.5

Chena cultivation

Chena cultivation is practiced extensively at Usgala-Siyambalangamuwa, with 40 Percent of the farmers reporting on the average a little over a acres of Chena. Gingelly, Chillies, Kurakkan, Maize and Vegetables, in that order were the most important crops grown on the Chena.

Water Supply

The availability of water for irrigation is often taken for granted in the major colonization schemes, especially in the Maha season. But problems in respect of water supply are present in the colonies studied (see table 7). While a small proportion of farmers appear to be experiencing difficulties even in the Maha season, the situation is much more critical during the Yala. Kantalai and Kandalaina are worst off with only 14 per cent and 19 per cent of the farmers respectively reporting the availability of water for irrigation during Yala and that too for only portion of their lowland allotments. Giritale is best situated in regard to irrigation with 92 per cent of the farmers reporting the availability of water even during the Yala. But here too the average extent per farmer reporting is only 2 areas of lowland as against an average of 3. 1 acres available for cultivation. The potential for increased production flowing from the Mahaweli Diversion Projects needs hardly be stressed in these circumstances.

4. Land Utilization and Cropping Patterns

Land Use

The returns from farming are to a considerable extent influenced both by the physical extent of land cultivated as well as by the intensity land use. Land use can be intensified by higher output per acre, through multiple cropping and by a shift to high value crops. In the Dry Zone however all these are directly related to the availability of water. Some idea of the potentials for increasing the intensity of land use through multiple cropping is provided by the "cropping index". It shows the extent cultivated over the year as a percent of total cultivable land (see Table 12.8). An index of 100 would indicate the full exploitation of all cultivable land in one season while anything over 100 would indicate the extent of double or multiple cropping of the same land during the year. Cropping indexes of around 400 to 600 are not uncommon in other parts of the world, especially in places like Taiwan and Hong Kong, and they

indicate the extent to which the same area of land can be utilized to grow different crops over the year. In the Dry Zone of Sri Lanka where water is a limiting factor, it should be possible to raise at least two crops of paddy in the lowland and a cropping index of around 200 should be considered a minimum target.

Table 12.7. Irrigated Extents of Lowland Allotments, Yala 72 and Maha 72/73

Colony	Yala 72		Maha 72/73	
	% of Farmers Reporting Availability of Irrigation Facilities	Average Extent per Farmer Reporting (acres)	% of Farmers Reporting Availability of Irrigation Facilities	Average Extent per Farmer Reporting (acres)
Nachaduwa	59	4.0	93	4.2
Usgala-Siyambalangamuwa	49	2.7	93	3.0
Kandalama	19	2.8	95	3.2
Giritale	92	2.0	97	3.3
Kaudulla	64	2.0	95	2.7
Kantalai	14	1.8	92	3.8

However, as Table 12.8 indicates, farmers in the areas studied are far from utilizing their holdings fully. Difficulties in water supply are part of the problem. This is something that appears to be beyond the capacity of farmers themselves to improve. But farmers can contribute towards better and more efficient utilization of existing supplies of water. This may entail a shift in the cropping patterns, better water control by individual farmers and more effective extension.

It is also clear that highland allotments are poorly utilized. This is s feature common to all settlement schemes in the Dry Zone. This again is associated with the difficulties in providing lift irrigation. Highland allotments are therefore given over to tree crops, except for small extents under field crops grown under rain-fed conditions during the Maha. Greater attention needs to be directed towards the development of the highland, especially as farmers seem to be, more inclined towards chena cultivation than developing their own highland allotments.

Table 12.8: Intensity of Cropping: Cultivated acreage in Per cent of Land Area, by Lowland and Highland, Yala 72 and Maha 72/73

Colony	Lowland Cultivated as Per cent of Lowland area	Highland Cultivated as Per cent of Highland area
Nachaduwa	165	100
Usgala-Siyambalangamuwa	153	66
Kandalama	113	73
Giritale	171	69
Kaudulla	132	55
Kantalai	103	50

Table 12.9: Acreage under Crops as Per cent of Land under all Annual Crops by Seasons

Crops	Nachaduwa	Usgala-Siyambalangamuwa	Kandalama	Giritale	Kaudulla	Kantalai
MAHA						
Paddy	89.0	85.0	93.0	87.0	86.0	94.0
Chillies	5.0	10.0	5.0	4.0	4.0	3.0
Onions	0.5	0.5	1.0	1.0	2.0	1.0
Other annuals	6.0	5.0	1.0	10.0	8.0	1.0
YALA						
Paddy	96.0	88.0	55.0	99.0	96.0	84.0
Chillies	0.6	1.0	8.0	-	2.0	3.0
Onions	-	-	3.0	-	0.5	0.5
Other annuals	4.0	4.0	35.0	1.0	2.0	13.0

Cropping patterns

Existing cropping patterns indicate the predominance of paddy (see Table 12.9). During the Maha, it accounts for about 85 to 95 percent of the cropped area. But what seems surprising is that even during the Yala when water problems are acute, paddy assumes even greater importance. Amongst other crops, the cultivation of chillies has assumed importance, compared to the evidence presented in earlier surveys, and this reflects the increased profitability of the crop in recent times. Farmers also reported a wide variety of other annuals and tree crops.

The actual extents reported under any particular crop were very small and in the case of tree crops only numbers were reported (see Table 12.10.)

Table 12.10: Farmers Reporting Selected Perennial Crops

Colony	COCONUT		PLANTAINS		JAK	
	Per cent of Farmers Reporting	No:Per Farm Reporting	Per cent of Farmers Reporting	No:Per Farm Reporting	Per cent of Farmers Reporting	No:Per Farm Reporting
Nachaduwa	91	48	63	46	74	4
Usgala-Siyambalangamuwa	85	49	40	47	77	4
Kandalama	99	39	34	65	88	6
Giritale	95	40	50	48	82	5
Kaudulla	90	50	82	62	84	5
Kantalai	90	21	36	22	55	4

Table 12.11: Farmers Reporting Livestock Enterprises

Colony	Percent of Farmers Reporting	No: Per Farm Reporting	Per cent of Farmers Reporting	No: Per Farm Reporting	Percent of Farmers Reporting	No: Per Farm Reporting
Nachaduwa	28	8.6	28	3.7	17	11
Usgala-Siyambalangamuwa	30	8.3	28	3.5	18	9
Kandalama	12	4.4	26	4.4	27	8
Giritale	60	2.1	44	1.8	16	9
Kaudulla	57	3.9	28	2.1	14	11
Kantalai	30	4.6	25	3.5	29	7

Livestock does not play any important role in the farm economy (see Table 12.11). Only Giritale and Kaudulla amongst the colonies reported about 60 percent of the farmers possessing draught animals, primarily buffaloes, with the average number of animals per farmer reporting being only 1.3 and 2.2 respectively. Approximately 25 percent of the farmers sampled reported on average of one cow each. Poultry and goats are unimportant.

5. Farm Incomes and Expenses

Farming as a business must be evaluated in financial terms and the incomes and expenses of farmers in the study areas are reported in this section. One must however exercise a considerable degree of caution in interpreting the data presented. It is to be expected that farmers will underestimate production and incomes and inflate expenditures. Very few farmers keep records of any sort and data especially relating to crops other than paddy, tend to be most imprecise. Where expenditures were concerned farmers had a fairly clear idea about hired labour and purchased inputs. But they were very vague about the family labour component, especially by individual operations. Furthermore, expenditure data was sought only for paddy and in detail only for the Maha crop. It is assumed that farmers would have incurred little or no cash expenditures on other crops. Nevertheless, keeping in mind the predominant position occupied by paddy, a fairly clear idea of the income and expenditure patterns of farm can be gained from the data available. Table 12.12 brings together the relevant data on incomes and expenses.

Table 12.12: Average Incomes and Expenses of Fanners, Yala 1972 and Maha 1973 (Rupees)[1]

Colony	Gross Farm Income	Cash Farm Income	Cash Operating Expenses	Net Farm Income	Off Farm Income	Net Farm Income
Nachaduwa	4700	3000	2200	2500	700	3200
Usgala-Siyambalangamuwa	2900	1700	600	1300	300	2600
Kandalama	1800	1000	600	1200	300	1500
Giritale	5000	3400	1200	3800	400	4200
Kaudulla	3600	2400	900	2700	400	3100
Kantalai	4200	3000	1600	2600	500	3100

[1] See text for explanation.

Average gross farm incomes are computed as the value of all farm output. Standard prices were applied to physical output and while even paddy production is likely to have been understated, the figures for other crops, both annuals and perennials mainly used for domestic consumption, appear to be grossly underestimated. However, it has not been found possible to make any suitable adjustments. Average Gross Farm Incomes range from about Rs.1800 at Kandalama to nearly Rs. 5000 at Giritale. Cash Farm Income computed as the gross income derived from sales in cash and kind ranged from nearly Rs. 1000 at Kandalama to about Rs. 3,400 at Giritale. Farmers very often sell in small quantities or

engage in barter as and when the need occurs and here again the likelihood of underestimation must be borne in mind.

Table 12.13: Percentage Contribution to Gross Family Incomes by Selected Categories

Colony	Paddy	Chillies	Onions	Other Annuals	Perennials	Livestock	Off Farm Incomes
Nachaduwa	81	2	-	0.5	3	1	13
Usgala-Siyambalangamuwa	73	7	-	4	4	1	10
Kandalama	72	2	-	2	6	2	15
Giritale	91	-	-	1	-	1	6
Kaudulla	86	1	-	1	1	1	10
Kantalai	86	2	-	1	1	1	10

Cash Operating Expense representing the value of purchased inputs including hired labour, tractor and animal power, but not including rental and interest payments, was computed for paddy production only. It varies from about Rs. 750 at Usgala-Siyambalangamuwa to nearly Rs. 2800 at Nachaduwa, accounting for about 26 percent and 60 percent of Gross Farm Income respectively.

The Net Farm Income, measured as the difference between Gross Farm Income and Cash Operating Expenses ranged from about Rs. 1200 at Kandalama to over Rs. 3800 at Giritale. It is worth noting that the Giritale farmer achieved the highest net farm income amongst the colonies studied despite operating the smallest sized holding. The average farmer at Kandalama, on the other hand, operated a holding next in size to that of Nachaduwa and Usgala-Siyambalangamuwa. The availability of water and its Influence on cropping intensities seem to more than offset the advantage of the physical extent of land.

Off-Farm Income ranged from an average of about Rs. 300 at Kandalama and Usgala-Siyambalangamuwa to about Rs. 515 at Kantalai and Rs. 700 at Nachaduwa. This, an indicated earlier, reflects the greater opportunities for alternative employment offered at Anuradhapura and Kanatalai. Net Family Income defined as the sum of Net Farm Income and Off-Farm Income ranged from an average of about Rs. 1500 at Kandalama to nearly Rs. 4200 at Giritale. Monthly Family Income would thus seem to range from about Rs. 1250 at Kandalama to Rs. 3500 at Giritale.

Table 12.13 provides information on the contribution of various source to Gross Family Income, measured as the sum of Gross Farm

Income and Off-Farm Income. As is to be expected, paddy accounts for the bulk of framers' incomes contributing to about 70 to 90 percent. What is to be noted is that the contribution of paddy is lowest at Kandalama and highest at Giritale, the two colonies with the lowest and highest Net Family Incomes, respectively. Farm incomes vary widely not only between colonies but also within colonies. Table 12.14 shows the distribution of farms by income classes. There is a distinct concentration of farms in the three lowest income classes, but Nachaduwa proves to be an exception in that the greatest concentration of farms occurs in the lowest income class whereas the modal concentration in all the other colonies is in the Rs.2000 to Rs. 4000 income group. Kandalama and Usgala_Siyambalangamuwa report a very high concentration in this group and this is associated with the heavy concentration of farms in the 2-4 acre size-class. Nachaduwa on the other hand reported a relatively high concentration of farms in the lowest size-class (see Table 12.15).

6. Paddy Production and Disposal

Production

It is clear that paddy production is of overwhelming importance and attention is given in this section to the various aspects of paddy production and marketing. Table 12.15 provides information on the area, yield, production and sale of paddy. Two facts clearly emerge. Firstly, the Yala acreage under paddy is much smaller than the average acreages reported for Maha. Secondly, yields per acre of paddy for Yala are also lower than those reported for Maha. These differences can be attributed in the main to deficiencies in water supply.

Giritale reported the highest yields per acre, in both Maha and Yala seasons with 57 bushels and 50 bushels per acre respectively. Nachaduwa reported the lowest Maha yields with 46 bushels per acre and Kaudulla the lowest Yala yields with 30 bushels to the acre. Farmers reported wide variations in yields per acre (see Table 12.16). In a subsequent section an attempt is made to consider some of the factors likely to be associated with such yield variations.

Table 12.14: Percentage Distribution of Farmers by Gross Family Incomes

Income Group	Nachaduwa	Usgala-Siyambalangamuwa	Kandalama	Giritale	Kaudulla	Kantalai
Under 2000	32	12	33	27	25	23
2001-4000	29	47	47	36	38	45
4001-6000	15	31	16	22	21	18
6001-8000	9	5	3	8	7	5
8001-10,000	7	4	-	3	4	2
10,001-15,000	5	-	-	1	3	3
Over 15,001	4		-	-	-	-

Table 12.15: Paddy Production: Average Extents, Yields per Acre, Gross Production and Disposal, Yala 1972 and Maha 1972/73

Colony	Av. Extents (Acres)		Yield per Acre (Bushels)		Average Gross Production (Bushels)	Percentage Sold
	Maha	Yala	Maha	Yala		
Nachaduwa	4.2	2.6	45.9	38.9	306	69
Usgala-Siyambalangamuwa	3.2	1.4	53.0	33.8	198	50
Kandalama	2.9	0.2	46.7	31.7	137	50
Giritale	3.2	2.1	57.0	50.0	294	69
Kaudulla	3.1	0.7	55.6	30.1	202	66
Kantalai	4.6	0.1	55.7	35.0	243	73

Farm Expenses

Table 12.16 gives a breakdown of Cash Operating Expenses on a per acre basis for the different colonies. Expenses on purchased inputs including labour and power vary from Rs. 530 at Nachaduwa to a little over Rs. 200 at Usgala- Siyambalangamuwa. The very heavy reliance on hired labour at Nachaduwa is to be noted, as also the relatively high level of expenditure on tractors at Kantalai and Kandalama. The high level of expenditure on hired labour per acre reported at Nachaduwa is to be partly explained by the high proportion of paddy acreage in large sized holdings and the dependence of such holdings on hired labour rather than on mechanized power. Hired labour and power together account for about three-fourths of average total expenditures, ranging from 72 per cent at Giritale to 87 per cent at Nachaduwa and Usgala-Siyambalangamuwa. Expenditures on purchased seed paddy and fertilizer were highest at Giritale and Kantalai.

If Nachaduwa and Kantalai, with their relatively high levels of expenditure, are excluded, expenditures vary from Rs. 200 at Usgala-Siyambalangamuwa to Rs. 325 at Giritale.

Table 12.16: Average Costs of Purchased Inputs per Acre, Including Labour and Draught Power, by Colonies, Maha 1972/73.

Colony	Labour	Tractor	Animal	Seeds	Fertilizer	Agro-chemicals	Total
Nachaduwa	370	51	35	23	36	16	531
Usgala-Siyambalangamuwa	100	29	47	10	6	10	202
Kandalama	71	112	8	18	27	14	250
Giritale	120	80	34	30	47	15	326
Kaudulla	134	55	54	17	29	15	304
Kantalai	160	133	23	29	48	24	417

Paddy Disposal

Kantalai reported the highest percentage of sales of paddy, in cash and kind, although it was behind Nachaduwa and Giritale in terms of average gross production per farm. Even Kandalama with the lowest production per farm reported sales of 50 percent (see Table 12.15). It is interesting to note that although the survey was carried out soon after the Maha harvest, farmers reported disposing of the bulk of their production. Over 90 percent of the farmers reported sales to the co-operatives under the Guaranteed Purchase Scheme and very few indicated any problems in dealing with the co-operatives.

Information on the distribution of paddy marketing by size- classes of paddy holdings for Maha 1972/73 is presented in Table 12.18. The striking differences between Kantalai and Nachaduwa on the one hand and Kandalama and Usgala-Siyambalangamuwa on the other should be noted.

Table 12.17. Distribution of Farms by Yield Classes, Maha 1972/73

Yield-Class (Bushels)	Nachaduwa		Usgala Siyambalangamuwa		Kandalama		Giritale		Kaudulla		Kanatalai	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Under 30	21	14	4	5	16	15	13	7	13	6	19	8
30 – 39	28	18	15	18	24	22	15	8	21	10	28	12
40 – 49	41	27	16	19	23	21	23	13	29	14	47	20
50 – 59	27	18	26	31	25	23	47	26	39	19	48	21
60 – 69	18	12	13	16	10	9	43	24	40	20	57	24
70 – 79	9	6	1	1	4	4	18	10	25	13	17	7
80 - 99	6	4	5	6	3	3	22	12	22	11	12	5
100 & above	2	1	4	5	4	4	7	4	13	6	6	3

Management Practices in Paddy Production, Maha 1972/73

Detailed information was sought on the various cultural practices followed by farmers during the Maha season. It was hoped that such information would provide useful insights on the levels of technology adopted and the degree of modernization of the farm sector in the areas studied.

Programme to increase production through increased per acre yields are based on the adoption of a package of practices including the use of new and better varieties of seeds, application of fertilizer and the adoption of row seeding or transplanting, and weed and pest and disease control measures. Table 19 provides information on the levels of adoption of some of the more important management practices recommended to farmers.

Varieties

With the exception of Usgala-Siyambalangamuwa, the majority of farmers reported using the new high yielding varieties of paddy, defined to include B.G.11-11, B.G.34-6, B.G.34-8, L.D.66, M.I.273 and the IR varieties. The extent of paddy land under these varieties varied from 23 per cent in Usgala Siyambalangamuwa to about 75 per cent at Giritale. B.G. 11-11 was by far the most popular amongst these varieties. The farmers at Usgala-Siyambalangamuwa and Kandalama favoured the H varieties and they had also a relatively larger proportion of their paddy lands under traditional varieties. However, when one considers the fact that the B.G varieties were released only in 1970, the rapidity with which farmers have adopted them appear to be remarkable.

Table 12.18. Distribution of Paddy Marketed by Farm-Size Classes, Maha 1972/73

Size –Class of Paddy holdings (Acres)	Nachaduwa		Usgala Siyam Balangamuwa		Kandalama		Giritale		Kaudulla		Kanalai	
	Per cent Farmers	Per cent Marketed	Per cent Farmers	Per cent Marketed	Per cent Farmers	Per cent Marketed	Per cent Farmers	Per cent Marketed	Per cent Farmers	Per cent Marketed	Per cent Farmers	Per cent Marketed
1 Ac. & under	12	2	4	1	4	1	5	2	5	1	3	1
1.1 – 2	35	16	7	4	11	4	11	4	23	11	16	4
2.1 – 3	18	10	86	84	82	92	57	52	36	30	62	38
3.1 – 4	9	6	2	3	3	3	10	11	19	20	2	2
4.1 – 5	5	6	1	4	-	-	8	13	12	17	4	5
5.1 – 6	3	3	1	4	-	-	4	5	2	7	2	3
6.1 – 8	4	10	-	-	1	-	5	13	2	7	2	3
Over 8 acres	14	47	-	-	-	-	-	-	1	8	9	44

Table 12.19: Adoption of Management Practices in Paddy Production, Maha 1972/73 by colonies

Practices	Nachaduwa		Usgala Siyam Balangamuwa		Kandalama		Giritale		Kaudulla		Kantalai	
	Per cent Farmers Reporting	Per cent of Total Paddy Ac.	% Fars Reptng	% Total Paddy Ac.	% Fars Reptng	% Total Paddy Ac.	% Fars Reptng	% Total Paddy Ac.	% Fars Reptng	% Total Paddy Ac.	% Fars Reptng	% Total Paddy Ac.
Variety												
B.G.11-11	55	53	32	21	50	41	57	62	84	80	81	57
H4	35	22	62	46	53	47	49	14	25	14	27	30
Traditional	22	12	27	18	6	3	7	8	10	4	19	4
Planting												
Broadcasting	94	91	69	55	76	73	26	31	47	37	95	90
Transplanting	7	9	55	45	35	27	74	65	74	63	20	10
Fertilizer Use	85	88	26	24	54	53	80	83	69	71	85	90
Weed Control [1]												
Hand Weeding	25	21	36	46	40	37	31	48	44	58	53	48
Chemical Weeding	72	79	37	54	68	63	33	52	24	42	43	52
Prep. Tillage [2]												
Buffalo		55	1	81		5		79		70		10
Tractor		45		19		95		21		30		90
Threshing												
Buffalo	60		61		9		27		54		13	
Tractor	40		39		91		73		46		87	

[1] The percentage farmers reporting do not at to 100 as both farmers of weeding may be protected by farmers

[2] The percentage farmers reporting either buffalo or tractor tillage is not indicted as farmers practice both farmers

Planting

Planting practices varied markedly amongst the colonies. Nachaduwa, Kantalai and Kandalama reported a very high percentage of farmers broadcast sowing paddy, while about 50 percent of the farmers at Kaudulla and Usgala-Siyambalangamuwa practiced transplanting. Row seeding was hardly practiced in any of the colonies.

Weed Control

A high proportion of farmers reported adopting weed control measures with extent of paddy land weeded ranging from 58 Per cent at Giritale to 99 percent at Kandalama. It is instructive to note that chemical methods of weed control accounted for between 40 percent of the total extent weeded at Kaudulla to nearly 80 percent at Nachaduwa.

The available data do not indicate any close association between variety of paddy planted, levels of fertilizer application and yields per acre of paddy. While tabular analysis cannot be expected to bring out these relationships clearly, it is still instructive to note that many farmers reported very high levels of fertilizer application irrespective of variety planted and that the yield response was not encouraging. There were large number of instance of farmers reporting very high yields with traditional varieties and little or no fertilizer application. There were also equally large number of cases where farmers report faithfully following the package of practices with disappointing results. The available data did not allow us to proceed further to find out whether the reasons for such disparities lay in environmental differences, poor management practices or on lack of institutional support. But the need for further information on these aspects of production cannot be overemphasized, given the current problems associated with fertilizer supply.

Fertilizer Use

The use of fertilizers in association with the new varieties is one of the key practices recommended to farmers. But the level and timing of application is of crucial importance. The amounts of fertilizer used and the extents fertilized however vary widely between colonies (see Table 12.19 and 12.20). Farmers at Kantalai applied about 2 ½ cwts of fertilizer per acre on about 96 percent of the acreage under paddy whereas farmers at Usgala-Siyambalangamuwa used only a little over 1 cwt. on about 25 percent of the acreage. But what is even more important to note is that the percentage of farmers who report having followed

fertilizer recommendations varied from about 5 percent at Usgala-Siyambalangamuwa to 31 percent at Kandalama and about 60 percent at Giritale.

Draught Power

The increasing reliance on tractor power by farmers for preparatory tillage and threshing operations has been commented on in earlier studies. The present surveys however provide conflicting evidence. While Kantalai and Kandalama depended overwhelmingly on tractor power, Usgala-Siyambalangamuwa, Kaudulla, Nachaduwa and Giritale reported a greater dependence on buffaloes. Variations occur even in the case of threshing operations. While farmers at Giritale, Kandalama and to a leaser extent at Kantalai and Kaudulla, relied heavily on tractors, farmers at Nachaduwa and Usgala-Siyambalangamuwa made greater use of buffaloes.

Table 12.20. Fertilizer use by Colonies Maha 1972/73

Fertilizer Use	Nachaduwa	Usgala-Siyambalangamuwa	Kandalama	Giritale	Kaudulla	Kantalai
Percent of Total Acreage under BG 11-11	53	21	41	62	80	57
Av. Yields (Bush/Acre)	46	53	47	57	56	56
Av. Extents Fertilized per Farm (Acres)	4.1	2.6	2.7	3.3	3.0	4.1
Fertilizer/Acre (cwt)	1.9	1.2	2.3	2.7	2.0	2.6
Per cent of Farmers Using V_1 Fertilizer	59.0	12.0	24.0	74.0	38.0	64.0
Per cent of Farmers Using Urea	77.0	24.0	52.0	85.0	61.0	97.0
Per cent of Farmers Using P & K	5.0	-	14.5	3.2	0.5	7.4

Table 12.21. A comparison of high and Low Income Farmers in Three Selected Colonies.

	Giritale		Nachaduwa		Kandalama	
	High Income Group	Low Income Group	High Income Group	Low Income Group	High Income Group	Low Income Group
No. of Farmers	40	40	40	40	30	30
Cross Income (Rs.)	10,200	2,390	16,330	1,475	6,400	1,440
Per cent Gross Income from Paddy	84	90	71	81	65	86
Extent under Paddy (Acres)	8.0	3.5	14.7	2.3	3.2	2.5
Cropping Index (Lowland Paddy)	170	167	167	144	110	114
Yield/Acre of Paddy Maha Yala	71 58	42 38	55 45	36 21	65 56	31 27
Per cent Cultivating Yala	98	80	75	45	30	30
Cash Operating Expenses Per Acre of Paddy Maha	425	265	285	315	302	215
Per cent Extent Under New High Yileding Varieties of Paddy Maha	83	62	64	44	55	27
Per cent Applying Fertilizer	100	82	95	80	67	37
Fertilizer/ Acre of Paddy (cwt.)	2.9	1.7	1.8	1.3	1.7	0.7
Per cent Adopting Weed Control Measures	55	22	87	87	90	90

7. Variations in Incomes and Yields

Attention was drawn earlier to the wide variations in the incomes received by farmers and in the output per acre of paddy. A more detailed analysis of the factors associated with such variations is attempted here.

Table 12.21 presents a comparison of high and low income farmers in Giritale, Kandalama and Nachaduwa. Giritale and Kandalama were chosen because they reported the highest and lowest average gross farm incomes, respectively, amongst the colonies studied. Nachaduwa was selected because of the wider range in the size distribution of its farms. About 30 to 40 farms in each group, approximating roughly 25 per cent of the sample, was selected for comparison.

As the table indicates, the high income group of farms appear to depend less on paddy as a source of income, but cultivate larger extents. They are also associated with higher yields per acre and better management practices. Giritale and Nachaduwa also report a higher intensity of land use.

Apart from the wide differences in incomes between the high and low income groups, one should also note the big differences between the high income groups in the different colonies. The differences between the low income groups are not as marked. Farm size appears to be the most important factor influencing the level of incomes, although output per acre and intensity of land use also contribute to the higher level of incomes. The influence of Yala cultivation on intensity of land use must be kept in mind. The higher levels of yields reported by the high income groups appear to be associated with higher levels of management. The high income group at Giritale reported the highest level of cash operating expenses and this is associated with the higher levels of management and greater intensity of land use. But what is difficult to explain is the higher level of cash costs reported by the low income group at Nachaduwa.

Table 12.22 attempts to relate for four selected colonies, yield with farm size, the proportion of paddy acreage under the new high yielding varieties and levels of fertilizer use. Given the more or less uniform environmental and water supply conditions within colonies, it may be hypothesized that among the more important factors likely to influence yields are farm size, varieties, management practices and credit availabilities. Unfortunately, detailed information on credit availability is not available, and the information on management practices is incomplete. One needs to know the level and timing of fertilizer applications as well as the effectiveness of weed, pest and disease control measures.

Increasing yields tend to be associated with increasing farm size and the data do not reflect any tendency for small farms to be cultivated more intensively. It is not clear whether the new varieties with their more specific input requirements work to the disadvantage of the small farmer. If so, they call for remedial action and this is an aspect that requires to be further explored. The relationship between yields, and the new high yielding varieties and levels of fertilizer application is not very clear.

The evidence on the yield superiority of the new high yielding varieties over the old improved varieties is also not clear. Table 12.23 compares two groups of farmers selected on the basis of degree of adoption of the new varieties. Only Kantalai provides evidence of the yield superiority of the new varieties. In the other colonies hardly any

yield difference is reported. However, the new varieties are associated with much higher levels of fertilizer application. Unfortunately yield data by varieties is not available for any firm conclusion to be drawn. Even farmers reporting a hundred per cent adoption of the new varieties report wide variation in yields.

8. Farm Equipment and Machinery

Information was sought on the ownership of items of farm machinery and equipment and this indicated in Table 12.24. It can be seen that, except for mammoties and wooden ploughs, farmers possessed little else in this way of farm equipment. In the case of light iron ploughs, there were marked variations between Nachaduwa, Kantalai and Kandalama on the one hand and Kavudulla, Giritale and Usgala Siyambalangamuwa on the other. Very few farmers reported owning equipment such as seeders, weeders, dusters and sprayers. Even an essential item of equipment for the development of the highland allotments, Such as the water pump, is conspicuous by its absence. It is worth noting however that a few farmers did report owning two-wheel and four-wheel tractors.

9. Farm Institutions

The efficient organization and operation of farm level institutions such as co-operatives, cultivation committees, extension services and tractor units could help materially towards the betterment of farm communities. Information was sought from farmers on the extents to which they patronized such institutions and these are reported in Table 12.25. While a very high percentage of farmers reported membership of the co-operatives, not many appear to have utilized its services. The proportion of farmers who report having benefited from the extension services is relatively higher, ranging from little over 50 per cent at Kantalai to about 85 percent at Giritale. The operation of government tractor units, however appear to have had little impact, with the possible exception of Kandalama.

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Table 12.22. Farm Size, Variety of Paddy Planted and Levels of Fertilizer. Application by Yield Classes, Maha 1972/73, in Four Selected Colonies.

		NACHADUWA				GIRITALE					KAUDULLA					KANTALAI			
Yield	No: of Farms	Av.Ext. under Paddy Ac.	Paddy Variety		Fert. Appn. Per Ac (Cwt)	No: of Farms	Av.Ext. under Paddy Ac.	Paddy Variety [1]		Fert. Appn. Per Ac (Cwt)	No: of Farms	Av.Ext. under Paddy Ac.	Paddy Variety		Fert. Appn. Per Ac (Cwt)	No: of Farms	Av.Ext. under Paddy Ac.	Paddy Variety	
Class (bushels)			NHYV	NHYV				NHYV	NHYV				NHYV	NHYV				NHYV	OHYV
			Per cent					Per cent					Per cent					Per cent	
Less than - 30	21	4.2	63	15	1.6	13	3.0	28	72	2.6	13	2.5	77	20	1.1	19	2.3	26	68
30-39	28	3.0	60	21	1.5	15	3.5	35	15	2.4	21	2.2	74	14	2.1	28	3.0	46	46
40-49	41	4.3	51	37	1.5	23	3.4	46	2	2.4	29	2.8	67	28	1.3	47	3.2	33	63
50-59	27	4.3	64	32	1.8	47	3.4	44	-	2.6	39	2.7	78	22	1.9	48	3.8	47	53
60-69	18	5.3	41	23	2.1	43	3.4	45	1	2.7	40	2.8	68	30	2.0	57	4.6	75	20
70-79	9	4.3	79	4	2.2	18	4.1	56	8	3.0	25	3.3	87	5	1.9	17	6.3	87	13
80-89	6	2.3	43	34	2.3	23	3.4	53	13	2.9	22	2.5	70	28	2.4	12	6.0	72	20
100 & above	2	4.5	100	-	2.2	7	3.4	60	-	3.3	13	3.4	78	16	2.5	6	5.7	97	3

NHYV = New High Yielding Varieties, principally BG. 11-11

OHYV = Old High Yielding Varieties, principally H_4

Table 12.23. A Comparison of Farmers by Degree of Adaption of New and Old Improved Varieties of Paddy, Maha 1972/73, in Four Selected Colonies

	Nachaduva		Giritale		Kaudulla		Kantalai	
	New Improved Varieties	Old Improved Varieties	New Improved Varieties	Old Improved Varieties	New Improved Varieties	Old Improved Varieties	New Improved Varieties	Old Improved Varieties
No : of Farms	26	26	27	27	26	26	21	21
Av. Extent under Paddy (Acres)	10.3	3.9	4.6	3.2	5.0	3.0	11.6	3.7
Yield Per Acre (Bushels)	46.5	46.2	57.0	52.5	63.8	61.3	66.5	50.0
Per cent Acreage Under New IV	95	5	100	13	94	4	94	2
Per cent Acreage Under Old IV	2	89	-	58	6	96	6	98
Per cent Acreage Under Traditional Variety	4	6	-	29	-	-	-	-
Fertilizer Amount Per Acre (Cwt)	2.0	1.4	3.0	1.7	2.0	0.7	3.3	1.5
Per Cent Acreage Transplanted	3	5	25	17	75	43	6	4
Per Cent Acreage Hand weeded	-	7	32	23	26	21	14	46
Per cent Acreage Chemically Weeded	70	65	37	25	26	27	29	43

9. Farm Credit

Not all farmers who reported membership of the co-operatives availed themselves of the facilities for credit. The proportion of farmers reporting credit from the co-operatives ranged from a high of about 47 percent at Kandalama to a low of about 11 percent at Nachaduwa and Usgala-Siyambalangamuwa. The average loan per farmer ranged from Rs. 400 to Rs. 600. Fanners availing themselves of private sources of credit ranged from about 17 percent at Giritale to nearly 45 percent at Nachaduwa, with the average loan per fanner reporting ranging from Rs. 385 at Kandalama to about Rs. 962 at Kantalai. It appears clear from the evidence provided by the farmers that quite a high proportion of farmers borrow substantial amounts from non-institutional sources of credit.

10. Non-Farm Investments

A measure of the prosperity of farming communities can be had from the level of non-farm investments. Information was sought on purchases of land, home improvements, ownership of durable consumer goods and the operation of life insurance policies and savings accounts (see Table 12.26).

Farmers reported very little investment on land. But when compared to evidence presented from previous surveys, a fair proportion of farmers appear to be making improvements to their houses and purchasing consumer durables, with bicycles, radios and sewing machines, in that order, being the most popular. It is also worth noting that there is still great room for spreading the saving habit amongst farmers.

Summary and Conclusions

This study was undertaken at the request of the Land Commissioner's Department to provide bench-mark information on farming activities in six major colonization schemes which were to be brought under the Special Project Program, commencing Maha 1972/73. Since these schemes are also expected to benefit from the Mahaweli Diversion Project, which would provide assured water supplies over both the Maha and Yala seasons, the information gathered would be useful in assessing the likely impact of the Mahaweli Project. This study however does not attempt to do this.

Table 12.24: Ownership of Farm Machinery and Equipment

	Nachaduwa	Usgala Siyambalan Gamuwa	Kandalama	Giritale	Kaudulla	Kantalai
MAMOTIES						
Per cent Reporting	93	96	93	94	98	93
Average Farmer Reporting	2.9	2.7	3.3	3.6	1	2.8
WOODEN PLOUGHS						
Per cent Reporting	72	45	17	7	5	8
Average per Farmer Reporting	2.8	2.2	1.9	2.5	1	1.6
LIGHT IRON PLOUGHS						
Per cent Reporting	5	63	15	67	72	13
Average per Farmer Reporting	2.5	2.2	1.6	2	1	1.9
PADDY SEEDERS						
Per cent Reporting	2	-	1	3	1	1
Average per Farmer Reporting	3.5	-	1	1.5	1	1.7
PADDY WEEDERS						
Per cent Reporting	2	-	1	3	2	1
Average per Farmer Reporting	1.5	-	1	1.2	1	1.2
SPRAYERS						
Per cent Reporting	1	-	3	0.5	3	2
Average per Farmer Reporting	1	-	1	2	1	1.1
DUSTERS						
Per cent Reporting	-	-	-	-	-	1
Average per Farmer Reporting	-	-	-	-	-	1
TWO WHEEL TRACTORS						
Per cent Reporting	2.5	-	-	4	3	-
Average per Farmer Reporting	1.0	-	-	1.1	1	-
FOUR WHEEL TRACTORS						
Per cent Reporting	2	-	-	2	2	1
Average per Farmer Reporting	1.0	-	-	1	1	1.7
WATER PUMP						
Per cent Reporting	-	-	-	-	0.5	-
Average per Farmer Reporting	-	-	-	-	1	1

Table 12.25: Farm Level Institutions

	Nachaduwa	Usgala Siyambalan Gamuwa	Kandalama	Giritale	Kaudulla	Kantalai
Percent of Farmers Reporting membership of Co-op	82	90	92	95	95	94
Per cent of Farmers obtaining loans from Co-op	11	12	47	43	36	38
Average Loan per Farmer obtaining Loan (Rupees)	500	400	442	603	440	560
Percent of Farmers Reporting Outstanding Loans to Co-ops	18	32	20	30	35	37
Per cent of Farmers Obtaining Loans from Private Sources	43	34	25	18	31	30
Per cent of Farmers Obtaining Seed Paddy through Co-ops	23	4	48	34	40	37
Per cent of Farmers Obtaining Agro Chemicals from Co-ops	53	35	45	21	59	61
Per cent of Farmers Reporting Satisfaction with Extension Services	55	57	55	83	68	53
Per cent of Farmers Reporting Hiring Tractors from Government Units	0.5	-	15	1.0	-	0.5

Table 12.26: Farm Level Institutions

Percentage of farmers Reporting	Nachaduwa	Usgala Siyambalan Gamuwa	Kandalama	Giritale	Kaudulla	Kantalai
Purchase of Land over last three years	3.8	2.6	2.8	0.5	0.9	0.3
Improvements to the House	27.5	32.7	48.3	37.1	26.1	18.4
Purchase of Furniture	26.5	17.7	20.0	35.1	25.2	22.6
Sewing Machine	35.6	16.8	18.6	36.1	19.8	33.6
Bicycle	54.6	37.2	37.9	54.1	38.7	49.1
Radio	34.6	23.0	26.9	43.9	23.9	32.2
Life Insurance Policy	3.2	0.9	4.2	4.4	-	3.9
Savings Account	18.4	20.2	13.8	35.1	14.0	11.7

The six colonization schemes studied, namely Nachaduwa, Usgala-Siyambalangamuwa, Kandalama, Giritale, Kaudulla and Kantalai, are all situated in the north-central sector of the Dry Zone. Though they are referred to as Major schemes, it does not follow that water supplies are adequate to facilitate double-cropping of the entire irrigable extents. Those familiar with irrigated farming in the Dry Zone will be aware that the irrigation tanks perform more than a supplemental function even during the Wet or Maha season, with the result that water supplies are usually inadequate for full cropping in the dry or Yala season. I t is therefore to be expected that a close relationship will exist between availability of water and efficiency of farming.

Comprehensive information was sought from farmers for Yala 1972 and Maha 1972/73 to arrive at an understanding of the conditions under which they lived and worked. The typical farmer was about 50 years of age, with limited educational attainments, having barely reached Grade 5 level, and working full-time on his farm. His family consisted of about 7 people, including a workforce of about 5, of whom about half were in a position to assist him with his work.

He farmed a holding of approximately 6 acres, consisting of about 4 acres of lowland and 2 acres of highland. Difficulties in water supply prevented the double-cropping of the full extent but this varied from scheme to scheme. The cropping index or the intensity of cultivation varied between 170 per cent at Giritale to a little over 100 at Kantalai, Highland cultivation was almost entirely rainfed.

The cropping system heavily emphasized lowland paddy, which contributed to over 80 per cent of the farmer's gross income. A wide variety of subsidiary food crops and perennial crops were cultivated under rain fed conditions. They mainly catered to subsistence needs and reliable information on cash earnings from such crops was not forthcoming. Livestock played a relatively unimportant role.

The cropping system heavily emphasized low land paddy, which contributed to over 80 percent of the farmers gross income. A wide variety of subsidiary food crops and given the predominant position occupied by paddy, the study devoted attention mainly to paddy production. Paddy yields averaged about 50 bushels per acre in the Maha and about 30 bushels per acre in the Yala. Cash Operating Expenses defined to include hired labour, hired animals and tractor power and the value of the other purchased inputs. But not including the rental and interest payments or the value of family help, amounted to about Rs. 350 per acre. Hired labour and hired power together accounted for about 75 percent of the average total cash expenses.

The typical farmer was not ignorant of the new technology in paddy production. The new high yielding varieties represented primarily by BG.11-11 was in widespread use, though rates of adoption varied between and within colonies. Fertilizer was applied, though not according to recommendations. Weed, pest and disease control measures were practiced, but their effectiveness could not be gauged. Farmers relied as much on chemical weeding as on hand weeding in what would appear to be a labour surplus situation. One is left with the unhappy impression that farmers could not reap the full benefits of the fertilizer and the chemicals they utilized because of a lack of appreciation of the need to strictly adhere to recommendations. But it must also be emphasized that many farmers indicated difficulties in adhering to recommendations because of very wet weather in the Maha, the lack of adequate water especially in the Yala or problems of supply.

In trying to develop a profile of the average farmer, one must also be fully aware of the wide variations exhibited buy the data. There is for instance the wide variations in farm sizes in particular colonies such as Nachaduwa and Kantalai and the problem of the mal-distribution of land. Income of farmers, influenced by size distribution of farms, also vary widely. Yields per acre of paddy vary from about 25 bushels to about 125 bushels but the association between yields and farm size, variety of paddy planted and management practices is not very clear.

In an effort to get better insights into these relationships, groups of farmers selected on the basis of incomes and adoption of new varieties were compared. Incomes appear to be mainly influenced by farm size and to a lesser extent by cropping intensity and yields per acre, Yields per acre appear to be associated more with levels of fertilizer application than with variety planted. The superiority of the new high yielding varieties over the older high yielding varieties is not clear, although almost everywhere the former are associated with higher levels of fertilizer application. This has important implications in the context of the current fertilizer shortage. These relationships however need to be explored at greater depth before any firm conclusions can be drawn

What is however perplexing to note is that the concept of the package approach has not been, fully understood by farmers. New varieties, high rates of fertilizer application, effective weed control as reflected by levels of transplanting and hand and chemical weeding, and pest and disease control are not always associated together. Thus for instance, in a colony with the lowest adoption rate for new varieties, a very high level of transplanting and weeding is reported. Similarly farmers not adopting the new varieties report higher levels of fertilizer use compared to those who do adopt the new varieties. Whether these reflect the influence of environmental factors or deficiencies in input supplies or in management practices is not clear.

These are some of the problems that the Special Projects Program will have to grapple with. The surveys highlight the need for adequate water control. The objective should be to achieve at least the double cropping of the entire extent under lowland paddy. To the extent that the Mahaweli Diversion Scheme ensures an adequate water supply. This should be capable of realization. The full utilization of highland allotments, however, would largely depend on the availability of lift irrigation facilities and this may well prove to be a more difficult task.

The potential for shifting to higher value crops on lowland allotments is not too clear, it demands a very high degree of water control not presently available to farmers. Possibilities may exist in selected areas during the Yala. Farmers at present show little inclination for such diversification and, the surveys do not throw any light on this problem.

The major breakthrough to increased agricultural productivity in the immediate future will thus have to come through increased per acre yields in paddy production. The Special Projects Program has in the past emphasized the package approach which includes the new high yielding varieties, high levels of fertilizer application, weed, pest and disease

control and high levels of management. The wider diffusion of the new varieties should not prove difficult, Farmers have already responded favorably, the major problem would be to ensure the adequate supply of other inputs and impress on farmers the need to adopt the whole package of practices.

Probably what is more important is to identify farmers who are lagging behind. Given the more intensive extension coverage in the Special Projects, this should not be impossible. What is advocated is a more selective approach based on the problems of individual farmers, if this survey highlights anything, it is the absence of any clear relationships between yields, environmental factors input availabilities and management practices. Time and again, instances were brought to light where one farmer would condemn a co-operative for not being able to get his fertilizer in time while his neighbor reported no such problems. There were instances where some farmers found fault with the seed paddy while others experienced no such difficulties, the source being the same. Such examples could be multiple and it is felt that these reflect more basic problems demanding a more individualistic approach.

It is felt, on the basis of this survey, that farmers have proved themselves to be intelligent and highly responsive to development efforts. The Special Projects Program must in turn respond to this climate. It must not be content merely with organizing input, supplies and improving in the extension coverage and leaving it to the farmers to benefit as best as they can from such general improvements. The program must be carried a step further to deal with the specific problems of farmers as the arise.

The current energy crisis and its attendant problems also demand a new approach to development effort. New priorities will have to be worked out as for example in fertilizer distribution and the high response areas should receive due consideration. At the same time, there is also a strong case to be made for a more integrated approach to agricultural development. To just cite one example, the role of animal husbandry, needs reconsideration. No attention has so far been given to them and all dry zone colonies are characterized by the insignificant role that livestock play in the farm economy. Given the shortages of tractor power and fertilizers, it is not too early to consider integrating a livestock development program into the agricultural development effort in these colonies.

CHAPTER 13

The Accelerated Mahaweli Development Programme: Its Implications for the Economy of Sri Lanka[1]

Introduction

The accelerated Mahaweli Development programme (AMP) has been described as the most ambitious development programme undertaken to date in the country (Central Bank of Sri Lanka, 1991). Given the magnitude and scale of resources involved, concerns have been expressed at various times about its economic viability, its inflationary impact, and the disequilibrium effect on the balance of payments, as well as its contribution to the debt burden (*Economic Review,* Nov/Dec 1978; Karunatilleke, 1988). Importantly, it has also been suggested that alternative strategies of irrigation development would have produced greater benefits at lesser cost (Aluvihare and Kikuchi, 1991). Similar concerns have been raised the world over in respect of large irrigation systems (*The Economist,* March 1992). These raise critical issues not all of which can be satisfactorily answered. What is attempted here is to bring together the available information relevant to these questions. The sections that follow set out the methodology of investment analysis, attempt to evaluate in economic terms the direct effects of the AMP and explore its implications for the economy.

The Methodology of Project Analysis

Projects can be thought of investment activities in which expenditures are incurred in the expectation of receiving income. Ideally, such activities should lend themselves for treatment as independent units from the point of view of planning, financing and implementation. A number of projects go to constitute a program which could also be subjected to analysis as a single project. The economic analysis of projects is based on the simple procedure of comparing expenditures with income to determine which alternatives should be selected. Investment or commitment of fund to a particular activity results in the

[1] Reproduction from a paper presented at a symposium held at the University of Zurich, Switzerland, August 22-29, 1992.

formation of capital assets. This in turn results in the generation of stream or flow of benefits over time. For the investment to be acceptable, the value of benefits must exceed the costs. While the procedure itself is simple, in reality it is a very complex exercise.

The quantification of costs and benefits present many problems. Identifying costs and benefits attributable to a project and then determining the proper price to be used in their valuation is an area marked by continuing discussion and debate. There is also the question of the reliability of the basic data on quantity and prices of inputs and output which must be satisfactorily resolved. In the absence of firm data, one has to rely on judgment and errors can lead to wrong conclusions.

A distinction is made between financial analysis and economic analysis. In financial analysis the concern is with the return to the equity capital contributed by the financial entity, be it the farmer or a public agency. The total return to all of the capital used enables an assessment of the financial viability of the project. Economic analysis on the other hand is concerned with the total return or profitability to society or the economy as a whole and thus the emphasis is on the total costs and total returns to society. The basic distinction is based on the underlying principle that what benefits the individual entity may not benefit society. The major procedural distinction is the use of market prices that is the actual prices paid and received, in financial analysis and the use of adjusted prices called “shadow” or “accounting” price in economic analysis. These are considered to reflect better the economic or social values. Thus taxes are a cost in financial analysis. In economic analysis they are treated as a transfer payment, that is they are not considered as payments for any service rendered and so do not have to be repaid. They are part of the total project benefit. Subsidies are considered as a benefit in financial analysis, and a total cost to society in economic analysis. Interest on capital is not separated out in economic analysis as it is part of the total return available to society. In financial analysis, interest on loans and repayment of capital are deducted before arriving at the benefit system. Various other adjustment are also made to actual prices paid and received to remove market imperfections and distortions introduced by government interventions. Thus currencies in developing countries are frequently overvalued and adjustment are made in economic analysis to reveal the true exchange rate. World market prices, also called border prices, are used in tradables and adjustments made to reflect what are considered true values in non-tradables.

Apart from the problem of determining the proper prices, there is also the problem of identifying the cost and benefit stream. It is fairly straightforward in financial analysis because the costs relate to the goods and services used and the labour employed. Benefits arise mainly from the increase in agricultural production and power generation, if it is an irrigation project. These are termed direct or primary costs and benefits as they relate to the project itself. But costs and benefits can arise outside of the project and these are called "secondary" costs and benefits. This problem does not arise in financial analysis. Identifying and valuing secondary or indirect effects pose a major problem in economic analysis.

As an example, the direct benefits from an agricultural project are the increase in the value of the agricultural output less the increase in farm costs associated with the increased production. But the increased production induces or increases activities such as milling, transportation, sale of inputs etc., all of which constitute the secondary effects. Among secondary costs, one which is receiving major attention the world over is the impact on the environment. One convenient way of identifying such secondary costs and benefits is to group them into economic impact upon the immediate vicinity, the effect upon local markets, consequences for linked production sectors, and the influence upon the rest of the public investment programme (Fitzgerald, 1978).

Apart from the secondary effects, there are also the "intangibles". These refer to better income distribution, better life for the rural people, or as in Sri Lanka the satisfaction derived by becoming a land owner. The distinction between secondary effects and the intangibles is not clear. However, the methodology in estimating secondary effects and intangibles is not well developed and in practice project analyses draw attention to them without attempting any quantification (Gittinger, 1982). To the extent that only the direct effects are taken into account, the interactions and consequences of a project with the rest of the economy are not accounted for and this constitutes a serious drawback. Economic analysis ideally seeks to reflect the true costs and benefits to society.

While these distinctions are essential in arriving at the costs and returns in financial and economic analysis, the methodology is the same whether it is the financial or economic return that is being sought. The same benefits and costs are valued in financial and economic analysis, using however market prices in financial and economic analysis and

efficiency or economic prices in economic analysis. The methodology has however undergone refinements in recent years to bring in a wider range of "secondary" costs and benefits and this approach has been referred to as "extended" social welfare analysis (Dixon, John A. and Mayuard M. Hufschmidt, 1986).

But in comparing costs and return, whether financial or economic, a further problem arises. This relates to what is referred to as the time value of money. Investment projects have long gestation periods and benefits are spread over the life of the project which may well extend to 50 years or more, as in the case of irrigation projects. Since money today is worth more than the same amount of money in the future, the problem of comparing costs and benefits spread over different time periods arise. This problem is got over by discounting, a procedure adopted to express future costs and benefits in terms of present values. The interest rate assumed for discounting is called the discount rate. The problem here is to select the appropriate rate for discounting. The common practice is to select what is called the opportunity cost of capital (OCC) that is the rate of return on capital in its next best alternative. If set correctly, it should reflect society's choice between present and future returns on capital. Because of problems in determining the OCC, analysts have usually selected a discount rate of between 10 to 12 percent, or even 15 percent, to reflect the OCC.

Once costs and benefits identified, appropriate prices determined, and the discount rate selected, future streams of costs and benefits are converted to present values to affect a comparison of costs and returns. The generally accepted decision criteria are the benefit cost ratio (B/C), the net present value (NPV), and the internal rate of return (IRR). The (B/C) the ratio of the present worth of benefits to present worth of costs, the NPV is the present worth of benefits - the present worth of costs, while the IRR is the rate of return which just makes the net present worth equal to zero. Any project with a B/C ratio of one or over and NPV which is positive or and IRR greater than the OCC is considered acceptable.

Attention must also be drawn to the fact that project analysis is essentially a comparison of the with project and without project situations. It is not a before and after project comparison. The differences in interpretation lie in the fact that if resources had not been used in the project, they would be used elsewhere and the economy would have continue to grow, at least at historical rates. A before and

after project analysis would incorrectly ascribe to the project the development associated with other activities.

The discounted measures of project work or what economics call partial analyses. The projects are assumed to be too small in relation to the whole economy to have significant impacts on prices. If the projects are relatively large, as in the case with the AMP, then the costs and benefits good exact significant influences on the outside economy. In such cases, partial analysis is not the appropriate analytical tool.

It would not be inappropriate at this stage to mention that investment decisions are influenced by many factors other than economic. As Gittinger remarks, "in the final analysis, any national investment decision must be a political act that embodies the best judgment of those responsible. The function of project analysis is not to replace this judgment. Rather, it is to provide one more tool (a very effective one, we hope) by which judgment can be sharpened and the likelihood of error reduced".

It is not proposed in this study to enter into a rigorous ex-post or terminal evaluation of the AMP. Insect as remarked elsewhere, "no solid retrospective studies exist of the costs and benefits of large dams in developing countries" (the Economist, march 1992). In any case such studies would only be a learning experience to be used in formulating similar projects in the future. The more limited objective here is to take a closer look at the internal economy of the AMP followed by a discussion of the likely impact on the larger economy. A caveat however is in order. The methodological tools available to the Economist are not sharp enough to define accurately the implications of the AMP for the overall economic and social development of Sri Lanka. The impact of global developments, the fluctuations in oil prices, the Middle East war, or of domestic problems such as the insurgency in the south or the militancy in the north or the other development programmes such as the implementation of the integrated rural development programmes in about 15 district cannot be isolated from those of the AMP. All that can be attempted to place the AMP in the perspective of the islands economy and consider the development in critical areas such as food and nutrition, poverty and unemployment, inflation, budgetary deficit and importance in the balance of trade.

Once costs and benefits identified, appropriate prices determined, and the discount rate selected, future streams of costs and benefits are converted to present values to affect a comparison of costs and returns.

The generally accepted decision criteria are the benefit cost ratio (B/C), the net present value (NPV), and the internal rate of return (IRR). The (B/C) the ratio of the present worth of benefits to present worth of costs, the NPV is the present worth of benefits - the present worth of costs, while the IRR is the rate of return which just makes the net present worth equal to zero. Any project with a B/C ratio of one or over and NPV which is positive or and IRR greater than the OCC is considered acceptable.

The Accelerated Mahaweli Programme

The possibilities for harnessing the water resources of the Mahaweli river for irrigation and hydropower development who investigated at different times, beginning from the 1950's. Finally a master plan for Mahaweli development was thrown up with UNDP assistance and the final report released in 1968 (UNDP/FAO). It is not intended to go into details here comma but attention must be drawn to the fact that the project as conceived was estimated to cover 39% of the whole Island and 55% of the dry zone. Construction activities commons in 1970 but economic and political imperatives brought about major changes in the scope and magnitude of the project in 1977. In the meantime, the major construction activities on project one of phase one of the master plan for more or less completed.

The change of government in 1977 so we faced and amended version of the master plan being developed for implementation. This new version came to be called the AMP. As the minister in-charge of Mahaweli development was reported to have said at that time, the decision to accelerate the pace of development was largely influenced by the rapidly deteriorating economic situation (economic review, Nov/Dec, 1987). The escalation in prices largely attributable to the oil price hike, the deterioration in the employment situation, emerging power shortages, and increasing deficit in the trade balances for major symptoms of this deterioration.

It was inevitable that the process of acceleration would lead to changes in the scope and character of the programme. The major features of the master plan, the master plan has implemented, that is project one of phase 1, and the AMP are presented in Table 13.1. The AMP in fact reflects the change in emphasis. The master plan estimated that on full completion, agriculture and power would contribute 19 2.0 % and 8.0 % respectively the total estimated benefits. The AMP placed

greater emphasis on power generation. In terms of installed capacity, the AMP post to deliver 550MW over a 6 year period compared to about 500MW estimated to be delivered by the master plan over 30 years. Additionally, the AMP had provision for adding another 250 MW in the future. The increase in power capacity was at the expense of new land to be opened up for agricultural production. The extent of new irrigable land was reduced from 654 thousand acres in the master plan to 320,000 acres in the AMP and not including the 84000 acres already developed under the master plan that is system H. There was also a reduction in the extent of land already under cultivation to be benefited. It is frequently pointed out that the AMP exhausted the potential for exploiting new irrigable extents (Pannabokke, 1991; de Silva 1991). If so, the benefits for gone by the implementation of the AMP is an added cost to the AMP.

Table 13.1: Main features of the master plan for Mahaweli development and the accelerated Mahaweli development programme

Features	**MASTER PLAN**		**AMP**
	Whole Scheme	**Project 1 of Phase 1**	
1.Area Covered ('000 acres)			
New land	654	84	320
Existing Land	246	102	90
Total	900	186	410
2.Implementation Period (years)			
Scheduled	30	5	6
Actual	-	7	10
Date of Commencement (Yr)	1970	1970	1980
3. Capital costs (current Rs.Billion)			
Proposed	5.6	0.6	22.5
Actual	-	2.0	48.0
4.Projected Benefits			
Agriculture : Rice (000 MT)	1160	10 }	550
Other Crops (")	1500	95 }	
power (Installed Capacity in MW)	508	80	550
5.Internal Rate of Return (Economic)	15.0	17.0	10.7

Source: See text for discussion

The AMP was estimated to cost rupees 22.5 billion in 1979 prices. This is compared with the estimated rupees 27 billion for the master plan, as adjusted for inflation and currency depreciation and expressed in 1978 prices (economic review, Nov/Dec 1978). The AMP is estimated to have a cost of rupees 48 billion by the end of 1990. The sharp escalation in expenditures is in part due to inflation and in part to currency depreciation. Prices as measured by the Colombo consumer price index rose by over 200% over this period and the dollar appreciated in value in rupees from about rupees 15 to about rupees 38. Table 13.2 takes a closer look at the cost structure. Capital costs are present between the head works of dams and reservoirs and downstream development. The significance lies in the fact that the construction of the head works depended heavily on foreign funding. The greater proportion of such expenditures was incurred of the period 1981 to 1986, during which time construction activity was almost completed. Downstream development lag behind and appears to have picked up thereafter.

Table 13.2: Annual Capital Expenditures on the Accelerated Mahaweli Development programme, 1980-1990 (Rs. Million)

Year	**Headworks**	**Downstream Development**	**Total (Rs.)**	**As % of total Government Expenditure**
1980 (Cumulative)	1354	722	2076	-
1981	3073	954	4027	30.1
1982	3847	1206	5053	27.1
1983	6103	1882	7985	36.7
1984	5039	3294	8333	38.3
1985	2973	2747	5720	18.7
1986	2909	1780	4689	13.3
1987	1605	2019	3624	10.5
1988	436	2598	3034	7.7
1989	243	1498	1741	4.7
1990	127	1426	1553	3.8

Source: The Mahaweli Authority of Sri Lanka, The Mahaweli Programme

Capital costs on head works and downstream development identified as direct cost, in terms of the terminology explained earlier. Greater emphasis is given currently to environmental cost associated with loss of forest cover, loss of biodiversity, costs of relocation of people affected by inundation of land, income foregone by such inundation, problems of salinity, alkalinity etc. as evidenced by the recent controversy over the Narmada River dam in western India, such issues as well as the human right issues associated with which development emerging as major considerations amongst donor countries. Although an environmental assessment study of the AMP was undertaken (TAMS, 1981), there is no evidence of such costs entering into the benefit cost calculations. These are the secondary effects referred to earlier.

The benefits from the AMP flow mainly from increase the agricultural production and power generation. This have been summarized as providing increased food production of about 50000 metric tons annually, doubling the countries total generating capacity and creating significant employment opportunities (USAID, 1987). The relative contribution of AMP towards national production of major food items and energy in 1990 was reported as follows (Central Bank of Sri Lanka, 1991).

Table 13.3: Contribution of AMP towards National Production of Major Food Items and Energy in 1990

Food items	**Domestic production ('000 MT)**	**Mahaweli production ('000 MT)**	**Relative share of Mahaweli production (%)**
Rice	2538.0	481.3	19.0
Dried Chillies	39.2	15.4	39.3
Bombay Onions	18.9	7.0	37.0
Green Gram	29.4	3.2	10.9
Cowpea	19.4	1.3	6.7
Soyabeans	7.3	0.3	4.1

Source: Central Bank of Sri Lanka, 1991.

In terms of hydro power generation, installed capacity from the AMP amounted to 613 MW compared to 325 MW from other sources. The wild target in respect of power have been made, there appears to have

been a shortfall in the target set for food production. This can be explained primary in terms of the dealers in downstream development. The number of farm families and settled as of December 1991 60,000 compared to a target of 91000. Irrigation benefits has been extended to only 55% of the targeted area (Ministry of plants, irrigation and Mahaweli development, 1991). Such shortfalls can be attributed in part of the answer to the conditions prevailing in the country.

It can be seen from the table above that nearly 96% of the agricultural benefits came from increased rice production. The implication is that crop diversification which could have significant impact on overall benefits is a long way off. Agricultural production is however likely to be understated to the extent that increased production from areas already cultivated but benefiting from irrigation are not included. Nevertheless the shortfall in agricultural production in physical terms does not appear significant.

The much lower internal rate of return associated with the AMP is to be noted see Table 13.1. If the OCC if placed at 12%, and some would have it at 15%, then the economic feasibility of the AMP is in question. The sharp escalation of cost in relation to benefits of the period 1970 to 1977 probably explains the lower returns anticipated. Inflation is not built into benefit-cost calculations because it is expected that inflation measuring a general increase in the price level would affect both benefits and costs about equally. But the oil crisis sent costs of construction soaring while the very success of the new agricultural technologies dampened any such effects on agricultural benefits.

Developments between 1980 and 1990 would have given the rates of returns still further down. This can be attributed to the fall in oil and rice prices not foreseen in the late 70s. Terminal and expost evaluations of the AMP are still to be undertaken. However a recent study of past investments in irrigation, inside and outside of Mahaweli, concludes that the economic rates of return in excess of 10%. In contrast, and exposed evaluation of the Gal Oya scheme in 1974 came up with an economic rate of return of less than half the estimated value at appraisal. It has been a common occurrence the world over that most projects overestimate rate of return at the stage of feasibility studies and appraisal. Time overruns, cost overruns, and over optimistic assessment of benefits explain such a situation. Despite such experiences, investments in irrigation continue to be made. Recent study concludes that greater benefits are to be derived from rehabilitation and water management (Aluvihare and Kikuchi, 1991).

This contrasts with the findings of a comprehensive, large scale study of the village irrigation rehabilitation project (Herath et al, 1991). It would appear that rehabilitation and better water management will bring about a more stable distribution of irrigation benefit than any sharp increases in overall productivity. Moreover, if the benefits from power and settlements are also built into the equation, then the conclusions cannot be as straight forward as it is made out to be. In any case it is evident that Sri Lanka will have to increasingly opt for rehabilitation and water management because the options for new constructions have been more or less foreclosed.

Documents for less emphasis on capital intensive new irrigation investment is nothing new. The Gal Oya evaluation report (Gal Oya, 1970), the Dudly Seers employment mission (ILO, 1971), the IBRD mission (Economic review, Nov/Dec 1978), and the IMMI study (Aluvihare and Kikuchi, 1991) amongst others, refer to the poor record of such investments. The decision to go ahead with such investments is more political than economic. As has been cogently argued, "which of the answer is to be found in the contradictions inherent in the countries class structure and that the conventional approach to the study of land settlement which one of these factors does not provide a very adequate basis for assessing and intern explaining what actually occurs" (Dunham, 1981).

The AMP and its Impact on the Economy

The magnitude of the AMP and the resources utilized in its implementations are such that even though it may fall short in terms of economic rationality it will impact on the overall economy in different ways. This section considers the likely effects in terms of its contribution to food supply and nutrition income and employment and inflation and debt repayment.

Food Supply and Nutrition

Self-sufficiency in food has been the policy goal of successive governments. Arguments maybe adduced about the cost imposed by such a policy and the likely advantages of a policy of export expansions vis a vis import substitution is desirable development strategies. The farm support policies of the United States, the common agricultural policy of

the European economic community, self-sufficiency in rice in Japan at 6 times world market prices are examples of similar policies in world agriculture. One could argue that if Japan could have opened its rice market to the developing countries then the latter would have done with less aid. Trade and not aid would not then appear rhetorical. But the reality is otherwise.

Data was earlier presented to show the importance of Mahaweli rice production accounting for about 20% of domestic rice production. Domestic production increased from about five hundred thousand metric ton in the early fifties to close upon 2 million 250 thousand metric tons in the 80s. The self-sufficiency ratio defined as the ratio of domestic production total availability is made up of production and imports increased from about 40% to about 90%. The extent cultivated under the Mahaweli currently accounts for about 30% of the area under major irrigation and 15% of the total asweddumizthen ed extent. If self-sufficiency is assessed in terms of with and without Mahaweli production, Mahaweli has made a significant contribution. The import substitution value of Mahaweli rice production has been estimated at rupees 2683 billion in 1989. In value added terms this would approximately workout to about rupees 2000 million.

The increase in rice production has however not resulted in any marked changes in the levels of per capita consumption. Food consumption levels have remained remarkably constant over the period 1950 - 85. Food availability is expressed as a percentage of requirements have ever reached about 100% with some increases in very recent years what seems to have actually happened is that the increases in domestic rice production has substituted for imports with very little impact on per capita consumption. The sharp increases in per capita food consumption associated with countries such as Taiwan and South Korea have not been realised in Sri Lanka. This can only be explained by the slow rate of growth of the economy.

The post 1977 years have seen a worsening inequality in incomes. Food consumption by the lower income group appears to have deteriorated with the removal of the food rationing scheme and the depreciation of the value of the food stamps which replaced rationing. This is reflected in a worsening nutritional situation with increasing incidence of wasting and stunting amongst in preschool children, low birth weight and anaemia among pregnant and lactating mothers (UNICEF, 1989; DCS - UNICEF, 1986). Major weapon in improving the

nutritional status of a population is to keep food prices low. The significant contribution made by the AMP apparently could not bring this about. Low food prices would be in conflict with the needed incentives to promote increased food production. This conflict can be resolved by bringing about reduction in costs which again does not seem to have been achieved in the AMP (Senaratna, 1992).

Income and Employment

It was earlier indicated that a major reason for accelerating the implementation of the Mahaweli program was the deteriorating employment situation. This has been accompanied by widening disparities in income distribution. The poverty alleviation programme being currently implemented focuses attention on the increasing incidence of poverty. Poverty, low incomes and unemployment are all related problems and a massive investment project such as the AMP could be expected to impact on such issues. While it may be premature to make judgement without a proper impact assessment, some emerging trends could still be discussed.

There appears to be a general consensus that poverty has increased since the 1974 but there is no agreement on the numbers involved. Estimates of poverty range from 18% of all households in the early 1972 to nearly 45% reflected in the labour force and socio-economic survey, 1985/86 (DCS, 1988). Within the Mahaweli project area itself, data has been adduced to show that the direct beneficiaries have enjoyed substantial increases in incomes. It is estimated that household incomes are more than double the level of rural incomes. Per acre yields are over hundred bushels to the acre (5.0 tons/ha) (MMD, MASL). Again, much of the area is newly developed. But from the "H" area, the earliest to be fully settled, evidence has accumulated that forms of hidden tenancy and even outright sales of land have occurred despite legal impediments. Even favoured areas with assured supplies of water have been affected by widening disparity is in production and incomes. The tendency for the marginalisation of the economically weaker farmers characteristic of the traditional villages, seems to appear in the newly settled areas also.

Problems in water supply may be part of the problem. Others may lie in access to credit, marketing and extension. The failure of agricultural diversification programs to get off ground in a big way, except perhaps in the "H" area also explain in part the failure to derive any substantial

increases in farm incomes. The high input requirements of the high value crops could possibly exacerbate the income distribution problem. It has been suggested that net incomes of a Mahaweli holding, double cropped with paddy, could scarcely be much higher than that of an agricultural labourer (USAID, 1987). A case is there for made for high levels of crop diversification. This however raises problems of market situation and the shift to export oriented cropping. There is little evidence on such matters. In the meantime, there is growing evidence of falling profit margins from paddy farming, calling into question the viability of existing standard allotments of 1 hectare each.

The AMP at full development was expected to benefit at least about three quarter million people, assuming 140,000 settlers and an average family size of 5.5 persons. If, according to the selection criteria, these are drawn from the poor, then about 10% to 15% of the poor could have benefited. But as pointed out about, it is debatable whether all of the settlers could have emerged out of the poverty trap.

Associated with the problems of poverty and low incomes is the problem of unemployment and underemployment. The population explosion of the 1950 and 1960 has resulted in the labour force explosion of the 1970 and 1980, and Sri Lanka has had a poor record in finding jobs for the increasing numbers entering the labour market. Unemployment rates have increased steadily from about 14% in the 1962 about 24% in the early 1970, falling to about 12% in recent years (Central Bank of Sri Lanka, 1991). Given that poverty is largely a rural phenomenon, with over 70% of the poor living in the rural sector, Hopkins (1988) argues that poverty is related more to employment than unemployment. But others (such as Alailima, 1988; Richards and Gooneratne, 1980; Korale, 1988; Fields, 1986) emphasize the strong relation between unemployment and poverty.

The majority of the unemployed, according to Korale (1989) are first time job seekers, less than 20 years of age and located in the most densely populated wet zone. This points to unemployed youth waiting to find employment after completing their education. Richards and Gooneratne (1980) argue that the males have high and unemployment rates and have great difficulty in finding employment, whatever their level of education. Alailima (1988) concludes that poverty in urban and rural areas is closely related to increasing unemployment. She finds that unemployment rates are high and have increased for the poor in urban

and rural areas, while decreasing for the non-poor between 1960/70 and 1980/81.

The employment generating capacity of the AMP has been rated as poor (Karuntilleke, 1987). Construction activity has utilised only 12000 persons at times of peak activity, as against 20000 estimated at Inception. Very little information again is available on the level of employment generated by agricultural activities in the newly settled areas. Norms of 4260 man days of employment per acre of paddy cultivated are commonly used. Assuming an average of 50 man days per acre and double cropping of paddy, this would imply that an average farm family with the holding of 2.5 acres (1 hectare) would utilise only 250 mandays as against an availability of a minimum of about 500 man days, given through labour from family. Labour utilisation would have been higher depending on the importance of other field crops such as chillies and onions mainly in the yala season. Nevertheless a high degree of under employment characteristic of much of dryland agriculture would appear in Mahaweli too.

The AMP envisaged the settlement of 140,000 families and generation of farm employment of about 300,000 persons. It was also envisaged that indirect employment to another 50000 persons would have been provided. No information is available in this regard in terms of actual numbers.

Capital Expenditure, Death Repayment and Inflation

Given the deteriorating economic situation, the policy of the government in the post 1977 period was to accelerate growth through an ambitious investment program, of which the AMP was the lead project. The required rates of investment go beyond the capacity of the countries domestic resources and much greater reliance had to be placed on external funding. This was associated with the liberalisation of the economy and the adoption of an open door policy. This was not without impact on the economy and this section documents the magnitude of the changes in macroeconomic aggregates such as savings and investment, and budgetary and trade deficit in relation to the investments on the AMP.

Relevant information is summarized in Table 13.4. Domestic savings remains relatively stable over the period in 1970 to 1990. Investment however doubled from about 15% of the gross domestic product GDP

during the period 1971 to about 30% in the early 1980s and falling back to about 20% by 1990. Investment in the AMP explains this pattern (see Table 13.1). External resources have to fill the gap between savings and investment. The government budget reflected these changes. Capital expenditures as proportion of total government expenditure increased from about 25% to nearly 50%. Government revenue did not increase as fast and consequently budget deficits increased. The government in its anxiety not to curb consumption relied increasingly on foreign funding. Foreign financing of the budgetary deficit increased from an average of above 45 present in the 70s to over 70% in 1984 and declining thereafter to under 50%. Again, the AMP would help explain the increased dependence on foreign financing in the early eighties. Dependence on foreign funding increased the debt service ratio. Debt service in terms of amortization and interest payments increased from a little over 10% of foreign earnings by way of exports of goods and services and private transfers to about 20% in 1988 but declined thereafter. These changes associated with increasing deficits in the balance of merchandise trade, were mitigated somewhat by large increases in the remittances of Sri Lankan workers from abroad (Kelegama, 1986). Trade liberalization and removal of restriction on consumer demand which characterized post 1977 period explain trade deficit in part. Undoubtedly, the heavy expenditures on the AMP also generated additional demand for imports, both capital and consumer goods. It is not possible to disagree given their effects. But a welcome trend is the change, though slow, in the structure of trade. As reflected in Table 13.5, there is a shift from imports of consumer goods, principally food items, to intermediate and investment goods. The AMP with its contribution to increased food production would have helped in this process.

Given the time lags in investment activity, an inflationary impact from the increased investment generated by the AMP is to be expected. Price increases occurred in the 80s compared to the period 1070-77, increasing from under 50% over 200%. However, all of this cannot be blamed on the AMP. Also to be taken into account are the liberalization of the economy and the release of pent up demand, oil price increases, exchange rate depreciation, and the worldwide inflation which is transmitted to the country through its open door policy. Again, it is near impossible to unravel the interrelationships.

Table 13.4: Some leading economic indicators, 1970-1990 (Rs.'000 million)

year	GDP	domestic savings (market prices)	invest. Ratio (%)	Govt. revenue value	govt. expend. As % of deficit	budget deficit	foreign finance	capital exp.	debt service ratio (%)	total%
1970-77	24.9	12.8	15.7	4.9		7.2	2.3	1.0	43.5	
1978	42.7	15.3	20.1	11.7		18.9	7.1	4.5	63.4	
1979	52.4	13.8	25.8	12.7	21.5	8.8	4.2	47.7	41.9	
1980	66.5	11.2	33.8	14.1	30.3	16.3	6.7	41.1	45.9	11.2
1981	85.0	11.7	27.8	16.2	31.1	14.9	8.2	55.0	43.1	14.4
1982	99.2	11.9	31.3	17.8	37.9	20.1	8.8	43.8	49.2	15.3
1983	121.6	13.8	28.7	25.2	46.5	21.3	11.0	51.6	46.4	17.8
1984	153.7	19.9	26.0	37.7	53.6	15.9	11.3	71.0	40.7	14.7
1985	162.4	11.9	24.1	39.0	64.7	25.7	12.2	47.5	47.9	17.8
1986	179.5	12.0	24.0	41.6	69.7	28.1	15.8	56.2	50.4	21.7
1987	196.7	12.8	23.5	44.9	72.2	27.3	15.0	54.9	47.9	23.0
1988	221.9	12.0	22.9	45.7	88.9	43.2	18.9	43.8	44.5	24.1
1989	251.9	12.2	21.8	56.7	94.5	37.7	18.0	47.7	39.2	20.5
1990	321.7	14.3	22.4	70.8	114.9	44.1	23.2	52.6	35.5	15.4

Table 13.5: Sectorial distribution of imports, by value (Percent)

Sector	**1971**	**1972**	**1973**	**1974**	**1975**	**1989**	**1990**	**1991**
Consumer Goods	56.0	51.8	52.5	47.0	50.5	26.1	26.4	25.6
Of which food	45.0	44.8	45.9	42.8	48.0	16.4	14.5	13.2
Intermediate goods	20.7	24.3	30.0	42.1	36.0	56.4	51.8	50.7
Investment goods	21.1	21.2	16.6	12.4	12.4	15.0	21.7	23.5

source: Central bank of Sri Lanka, annual reports(various issues)

The significance of the AMP lies in the fact that it made heavy demands on the limited resources available to the government and exacerbated the problems outlined above. In a resource poor situation, it is to be expected that such heavy expenditures would have resulted in less emphasis on other sectors. Table 13.6 presents information on the sectoral distribution of government capital expenditure. The increased emphasis on agriculture and irrigation, brought about primary by the AMP, and its consequences for other sectors is clearly brought out. Particularly to be noted are the shortfalls in the social services sector.

Table 13.6 Sectoral Distribution of Capital Expenditure (Percent)

Sector	1972-76	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
(Average) Economic services	6.47	79.7	83.8	82.6	87.0	84.0	83.4	65.7	75.0	72.0	70.2
Of which agriculture and irrigation	27.0	41.5	55.3	49.4	45.2	41.8	31.7	28.3	30.5	27.5	27.0
Mahaweli	n.a	32.2	45.3	38.3	34.1	32.0	23.2	17.0	16.1	13.2	9.5
Social services	11.3	15.2	9.9	12.1	6.7	8.0	6.9	9.3	10.4	13.0	10.3
Other	24.0	5.1	6.3	5.3	6.3	8.0	9.7	25.0	14.6	15.0	19.5

Source: Central bank of Sri Lanka, annual reports (various issues)

On the positive side, one must take cognizance of the linkage effects of the AMP Investments. Earlier, in passing, mention was made of the possibilities for the generation of indirect employment. There is no way on which even some form of informed guesses could be arrived at. However, the linkages appear to be weak. As reflected in the various consumer finance surveys conducted by the central bank of Sri Lanka, by far the greater proportion of consumer expenditure by low income groups is on agricultural commodities.

Concluding Remarks

Investment in major irrigation projects especially in developing countries have rarely lived up to their expectations. The realized economic rate of return have been lower than at appraisal stages. The reasons include a combination of design flaws, cost overruns, time over runs, over ambitious target and unrealistic cost estimates. The AMP is no exception.

In terms of the direct costs and benefits the cost have more than doubled to that estimated at inception. Worldwide inflation and a depreciating currency is partly responsible. Inefficiencies waste and corruption together with design problems are also a part of the explanation. Achievements of benefit in terms of physical targets fall closer to expectations. The construction work on the head works were completed more or less on time and power generation target achieved. Downstream development however lagged behind but agricultural benefits are capable of achievement though delayed. Agricultural diversification is however moving only slowly. Benefits in value terms are a different story. The unanticipated fall in fuel prices meant that the

value of power generated was slower than projected but also the import substitution potential was less than expected at the same time, the long-term drop in agricultural prices reduced the value of total benefits. Given the increase in cost and decrease in value of benefits the ex-post economic rate of return could be expected to be much slower than projected at the appraisal stage.

Assessment becomes much more difficult when secondary or indirect costs and benefits have to be taken into account. Significant proportion of the country's resources in terms of investment were channelled to the Mahaweli. Since domestic consumption was not significantly affected this meant reliance on foreign funding as well as high rate of inflation. It also meant a cutback on social overheads. Environmental costs never entered into cost calculation but such costs are difficult to quantify. The initial stages of any investment program will be associated with increased inflation till such time that the increased benefits starts flowing. The data suggest that inflation is falling but then the picture is clouded with increased defence spending etc. Similarly with debt repayment, the debt ratio initially rose but has been falling of late and no doubt power generation and increase the agricultural production from the AMP have contributed to this reduction.

The massive investments helped increase the rate of growth of the economy from an average of about 2.0 % per annum prior to 1977 to between 4 to 5% in the 80s. But apparently this has not helped the country in securing long-term improvement in social welfare. Income inequalities poverty and malnutrition appear to have increased. The physical quality of life index places Sri Lanka closer to the developed countries. But low rate of economic growth and increasing inequalities and social discontent present Sri Lanka with a development conundrum. AMP could have brought a temporary respite but its benefits appear to be more than overtaken by the social tensions that long years of economic neglect generated. It is still too early to assess whether the AMP laid firm foundations for long term accelerated economic growth and development. In terms of current thinking the massive infrastructure in terms of power and irrigation that has been delayed is a necessary condition for development. It remains to be seen whether the country can put this to good use. The telescoping of a 30 year development program into about 10 years has saved time though at some sacrifice. But much great effort is required to extract the optimal use from the increased power and irrigation facilities. Given a lifespan of 50 years or more it is still too early at the end of about 10 years to say whether the

AMP is a success or failure. Lessons may be learnt from post-mortems. But may be Sri Lanka, for that matter the rest of the developing world, may not have the opportunity to put the lessons to good use. All that can be done is to limit the damage and increase the benefits which require forward-thinking rather than looking back over one's shoulders.

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Agricultural Research

CHAPTER 14

Planning, Monitoring and Evaluation of Agricultural Research[1]

Introduction

The Department of Agriculture (DOA) has as its major objective increased in productivity of a wide range of crops that go to make the food basket of the average Sri Lankan. The role of research in securing such increases in now widely recognised. Resources are however scarce and there are competing demands. Agriculture must compete with other sectors such as industry, services, infrastructure and the like, within agriculture itself a wide range of activities compete for whatever resources are allocated to agriculture. The decision criteria will then have to be to allocate resources to those activities that have a higher pay-off. However, such decisions cannot be based on signals provided by the market. Research is regarded as a public good where the benefits of research cannot be captured solely by those who undertake the research. Thus administrative decisions determine allocations to research and the danger of resources being misallocated arises. This points to the need to plan, monitor and evaluate research.

The objective of planning research is to optimise returns to investment. It has been defined as a deliberate concerted attempt to work out the best ways of achieving chosen goals. The planning process in research management consists of assessing needs, setting goals, developing plans, formulating programmes and projects and identifying monitoring and evaluation indicators (Horton et al, 1993). The needs and goals of agricultural research must be in conformity with national objectives which, in overall terms, can be specified in terms of growth, equity, security and sustainability. Research and technology must also be in conformity with the farm production environment, taking into account the physical, biological, socio-economic and institutional factors influencing farm production. Once plans are developed, which essentially is an exercise in priority setting, close monitoring and periodic evaluations ensure the achievement of objectives. While monitoring ensures timeliness, evaluation identifies drawbacks and weaknesses. External

[1] Reproduction from an unpublished article.

reviews are focussed on research management and research capacity. They highlight the appropriateness and relevance of research and thereby seek to enhance the contribution of agricultural research to agricultural development.

The Production Environment

Farmers operate under varying types and levels of limitations and the effectiveness of research and technology must be assessed in relation to these limitations. More importantly, production and land use patterns are influenced by consumption characteristics which show considerable dynamism over time. The relative importance of various food groups are shown in Table 14.1. The dominance of rice is brought out, as also the relative importance of many of the commodities identified as other food crops (OFC). But what is important to note is that is product mix will change with changes in incomes. If the examples of South Korea and Taiwan are of any relevance, per capita rice consumption may actually decline, once a certain level is reached. Meat, fish, dairy products, fruits and vegetables assume greater importance. Rapid urbanization and the convenience of bakery products may accelerate this trend, as also changes in relative prices.

Table 14.1. Percentage contribution to total energy and protein availabilities, annual average 1991-95

Food Group	Energy	Protein
Cereals	57.2	53.0
Rice	(41.0)	(32.9)
Wheat	(15.2)	(19.8)
Other	(1.0)	(0.3)
Roots and Tubers	3.2	-
Sugar	12.8	-
Pulses	2.6	7.8
Fruits and Vegetables	4.5	5.0
Milk, Meat, Fish and Eggs	6.4	27.9
Nuts, Fats and Oils	13.6	5.2

Source: Dept. of Census and Statistics, Food Balance Sheet (Various years)

Land use patterns and value of production in respect of food crops are shown in Table 14.2. While rice again emerges as by far the most

important crop cultivated, the OFCs in total also occupy a sizeable extent. Congruency or parity in terms of value of production or even extents cultivated is often used in resource allocation, and some idea of the respective weightages to be given to crops can be gauged from this table.

Table 14.2. Major Food Crops: Average Annual Extents Cultivated, Production, and Gross Value of Production, 1990-94

Crop	Cultivated Extent (1000 ha)	Production (1000 mt)	Gross Value (Rs. mn)
Paddy	848.4	2504.2	19432
Chillies	37.3	33.6	3015
Red Onions	7.9	82.2	2102
Big Onions	3.6	37.5	-
Potatoes	6.5	63.7	2059
Green Gram	38.3	27.8	622
Black Gram	11.8	10.4	172
Soyabeans	2.9	3.8	57
Cowpea	25.0	19.8	310
Gingelly	12.4	7.9	139
Groundnuts	11.1	11.9	220
Maize	46.7	59.2	392

Source: Dept. of Census and Statistics, Statistical Abstract, 1997 Gross Value computed using producer prices.

The structure of the agricultural sector is shown in Tables 14.3, 14.4 and 14.5. The predominance of smallholdings under 2 acres (0.8 ha) is evident. This has implications for the introduction and adoption of modern technology. Poverty in Sri Lanka is a rural phenomenon and it affects mainly the landless and operators of holdings under one hectare. While rural incomes could be expanded through increases in agricultural productivity, the ability of poor farmers to adopt costly innovations need to be addressed. Also to be noted is that most smallholdings have a rice component.

Table 14.3. Percentage Distribution of number and area under agricultural smallholdings, by size groups, 1982

Size Class	Number (%)	Area (%)
Under 1/2 acre	25.6	2.0
1/2 to 1 acre	17.0	3.8
1 to 2 acres	21.5	10.4
2 to 5 acres	26.6	28.3
5 to 10 acres	7.0	16.3
10 to 20 acres	1.4	7.6

Source: Dept. of Census and Statistics, Census of Agriculture 1982.

Table 14.4. Percentage distribution of agricultural smallholdings by crops, 1982

Crop	Number	Area	Av. Size (Acres)
Paddy	41.0	35.0	1.66
OFC	42.6	21.8	0.99

Source: As for Table 3.

Table 14.5: Percentage distribution of number of paddy smallholdings, by size groups, 1982

Size Class	Percent Number
Under 2 acres	67.4
2 to 5 acres	7.0
5 to 10 acres	4.3
Over 10 acres	1.3

Source: As for Table 14.3

Resource allocations also need to take into consideration the anticipated future demand for the commodity in question, import and export prospects, and demand and price elasticities. The prospects for self-sufficiency in rice, low income and price elasticities, competition from wheat, trade prospects, including trade liberalization, and the size of the domestic market for other food crops are important considerations influencing returns to research. The availability of resources, by way of

land, labour and capital and their future prices and price elasticities, as well as the yield and production limiting factors also need to be considered (Per-Pinstrup Andersen, 1982).

Resource Allocation to Research

The resources allocated to research represent the cost of research. While in general the costs of research can be specified in terms of labour inputs including scientists, the physical inputs such as land and buildings, the capital and agricultural inputs used in the production process, difficulties arise in disaggregation. Several projects may be going on at the same time and decomposition by particular projects may not be easy. Moreover, the value placed on labour time may not reflect its opportunity cost as labour markets are far from perfect. Another problem arises in valuing the existing stock of knowledge relevant to a particular research activity. Bearing these problems in mind, it appears appropriate to accept budgeted expenditures as proxy values of cost.

The resource allocation to research is influenced by a host of factors, many of which are external to the research process and determined by the health of the economy at large. Allocations to research in general in Sri Lanka shows a declining trend from 0.3 percent of the gross domestic product (GDP) in 1966 to 0.18 percent in 1996, in real terms (Fernando and Amaradasa, 1998). The allocation compares unfavourably with a world average of 1.8 percent, India's allocation of 0.8 percent and the 1.3 percent of the newly industrialized countries (NIC) (Fernando and Amaradasa, 1998).

The overall allocation to agriculture in 1996 amounted to Rs. 669.2 million, of which nearly 80 percent was for recurrent expenditure. The annual budgeted research expenditure for DOA is estimated at Rs. 150 million over the years 1994-96. The distribution of budgeted expenditures, by disciplines and research centres is shown in Table 14.6. Breeding and agronomy together account for over 50 percent of total research expenditure, followed by soils, entomology and pathology, with 10 percent or less than 10 percent, each. The research centres too reflect this pattern, though given over to different crops. Bandarawela, and Aralaganwila buck the pattern by spending considerably more on Entomology, while Angunakolapelessa spent more on soils.

The commodity classification of research expenditures is given in Table 14.7. Rice account for less than a quarter of total research

expenditure in 1993. Fruits and vegetables as a group account for 28 percent.

Trends in Productivity

The output of research can be measured in different ways. Knowledge as the output of research is measured in terms of publications of a scientific and technical nature. It can also be measured in terms of innovations resulting from research such as a hybrid seed or insecticide. But for operational purposes, the principal purpose of agricultural research is to secure increases in agricultural output and it is this concept that is used here. But benefits must be related to costs in some way and this is why cost-benefit analysis is the favoured methodological tool in evaluating research. No such exercise is attempted here. The approach is, given the level of the costs of research, to give some broad indication of the level of output in terms of productivity increases. Subject to the availability of data, this simple approach could be extended to include quality changes, savings in inputs and the like. The point to note is that evaluation must take into consideration both inputs and outputs.

The achievements in respect of rice are well known. Rice yields more than doubled, from about 1.5 mt/ha in the mid-fifties to about 3.6 mt/ha in the mid-nineties and applied to both Maha and Yala seasons. Much of this increase is attributed to the high-yielding varieties of rice. The new varieties appear to have been both economically profitable and socially acceptable, as evidenced by the rapid rates of diffusion of the improved seeds. However, role must be taken of the fact that the irrigable extent and fertilizer application also increased.

Yield increases however have not been uniform. As shown in Table 14.8, yield variations occur between seasons and by mode of water availability. It is known that the new varieties are capital intensive and specific in their requirements of water, in addition to demanding higher levels of management. They would thus seem to favour the high response areas with assured supplies of water, that is the areas serviced by major irrigation systems and be discriminatory to the rainfed areas.

Table 14.6. Percentage Distribution of Estimated Research Expenditure, by Discipline and Research Centres, 1993

Discipline	DOA	PGRC	Gannoruwa	Makandura	MI	Batalagoda	Bomubwela	Bandarawela	Angunakol apalessa	Aralagan wila
Breeding/ Genetics	31	49	20	35	38	44	46	35	19	32
Agronomy	23	4	18	29	31	8	25	26	36	26
Entomology	7	-	9	5	3	8	5	27	23	3
Pathology	6	-	6	2	4	1	6	15	8	8
Soils	10	-	5	9	11	2	17	11	9	23
Weed Science	2	-	4	2	7	-	-	3	-	2
Food Science	5	-	31	-	-	3	-	-	-	-
Eng/ Technology	9	-								
Biotechnology	2	29	3	-	-	-	-	3	-	-
Support Services	5	19	4	17	-	34	1	-	-	-
Total Budget Rs. M	148.94	6.97	22.43	16.93	22.31	7.04	14.40	14.74	17.04	17.03

Source: Dept. of Agric. M&E Unit

Table 14.7. Percentage Distribution of Estimated Research Expenditure, by Commodities and Research Centres 1993

Discipline	DOA	PGRC	Gannoruwa	Makandura	MI	FMRC	Batalagoda	Bomubwela	Bandarawela	Angunakol apalessa	Aralagan wila
Rice	23	18	11	6	8	58	100	60	2	41	15
Gr. Legumes	11	7	26	7	25	13	-	-	3	4	6
Oil Seeds	4	1	-	2	2	-	-	-	-	20	6
Fruits	18	23	30	39	6	-	-	6	29	9	25
Vegetables	10	13	14	10	10	-	-	11	30	4	6
Roots/Tubers	7	5	6	10	-	-	-	8	32	1	7
Condiments	5	3	-	5	17	-	-	-	2	4	13
ZZZ	13	19	11	5	18	29	-	3	-	3	16
XXX	5	4	2	17	3	-	-	8	3	8	4
Coarse Grains	3	4	-	-	11	-	-	-	-	7	2
Other	1	2	-	-	-	-	-	4	-	1	-
Total Budget Rs. M.	148.94	6.97	22.43	16.93	22.31	4.94	7.04	14.4	14.74	17.03	17.04

Source: Dept. of Agric. M&E Unit

Note: XXX represents multiple crops

ZZZ no crop involved

Attention must also be drawn to the growth rates in rice yields shown in Table 14.9. The sharpest increases have occurred in the seventies and early eighties, when the impact of the new improved varieties were beginning to be felt. Since then the rate of increase in yields has declined markedly. There has been concern at what has been referred to as a yield plateau. Similar developments appear to have occurred in Asia as a whole (Rosegrant and Pingali, 1994). Declining world rice prices, declining growth in research expenditure and output, declining irrigation investment, degradation of irrigated area, intensification-induced decline in productivity growth and a stagnant or declining technological yield frontier, declining efficiency of fertilizer use, and increasing losses due to pests are some of the reasons adduced (Rosegrant and Pingali, 1994). Breakthroughs in yield potential are expected in the next 5-10 years through changes in plant architecture and the exploitation of hybrid vigour. We in Sri Lanka need to investigate the causes of relatively stagnant yields and the potentials for shifting the yield frontier. In the final analysis, this means more investment on rice research and more trained personnel. It also means new directions and new strategies.

Table 14.8. Annual average rice yields, by seasons and water availability, 1991-95

Water availability	**Yields in mt/ha**	
	Maha	**Yala**
Major schemes	4.03	3.75
Minor schemes	3.28	2.88
Rainfed areas	2.90	2.47

Source: Dept. of Census and Statistics, Statistical Abstract 1997.

Table 14.9. Annual average yield of paddy, by seasons, for specified years (kg/ha)

Period	**Maha**	**Yala**	**Growth Rates (%)**	
			Maha	**Yala**
1952-54	1501.3	1522.0	-	-
1962-64	1967.0	1970.3	3.8	2.9
1972-74	2429.3	2218.0	2.3	1.3
1982-84	3435.7	3360.7	4.1	5.2
1992-94	3457.3	3376.7	0.1	0.1
1995-97	3602.3	3476.7	1.4	1.0

The OFCs present a study in contrast. Table 14.10 shows yield trends over the last 25 years. There has been little or no change in yields over this period for the wide range of crops represented in this group. This is not to imply a lack of success attendant on research. A few high yielding varieties have been introduced. But for a variety of reasons not clearly understood, the investment on research has not yielded any commensurate return. Perhaps in not being able to identify the reasons for such a situation, research has failed. Reasons may lie in inadequate funding, poor staffing, shortage of trained personnel, poor organisation, amongst others.

Prices and markets may be another problem. A recent study sees only limited growth prospects. To quote "price analyses show a general trend of declining prices for most of the OFCs despite wide variation within districts. This suggests that there is little prospect for expanding cultivation of these crops for local consumption" (Wijayaratne et al, 1996).

Table 14.10: Annual average yield of selected Field Crops other than paddy, for specified years (mt/ha)

Crop	1970-74	1975-79	1980-84	1985-89	1992-96
Chillies	0.5	0.8	0.9	1.1	0.8
Red Onions	10.8	9.6	9.9	9.3	9.1
Big Onions	8.4	9.5	10.1	10.2	9.5
Potatoes	14.3	14.9	12.9	12.9	10.9
Green Gram	0.6	0.7	0.8	0.7	0.8
Black Gram	0.5	0.7	0.6	0.7	0.8
Maize	0.7	1.1	1.1	1.1	1.2
Soyabeans	1.1	1.2	0.8	1.1	1.2
Cowpea	0.8	0.7	0.9	0.7	0.9
Gingelly	0.4	0.6	0.5	0.6	0.6
Groundnuts	1.2	1.0	1.1	1.2	0.9

Fruits and vegetables constitute the other major food group. Information on production, productivity and growth trends is not available. Price data however suggests that, unlike in the other food groups already considered, real prices have shown a tendency to rise. This suggests that supply has not kept pace with demand. Income elasticities tend to be high for this group so that supply will have to

increase at a rate higher than the population growth rate of about 1.0 percent per annum. The implication is that productivity growth has not been high, given that there must have been some area expansion also. The impact of research on production appears negligible.

Food Processing and Value Addition

It was seen earlier that rising incomes and urbanization creates a growing demand for processed foods. A variety of processed foods were on display in a small unit at DOA, but there was no evidence of commercialization or linkages with the private sector. It appears to be mainly experimental in character.

Monitoring and Evaluation

Monitoring is to be thought of as a support service, assisting researchers in constantly refining research goals and processors. As a routine accountability procedure, it ensures the timelines of operations. This necessitates proper databases being maintained.

The monitoring unit is understaffed and ill-equipped. It is not clear whether it is providing any feedback to researchers or being used primarily as a management tool by the directorate. The unit has not got into any research evaluation.

Recommendations

The following recommendations are made in the context of a perception, borne out by available empirical data that returns to research have not been commensurate with expenditure incurred by DOA on research.

Rice Research

1. Yield potentials in rice appear exhausted. New directions will have to be charted in line with developments in other countries. These emphasize plant architecture, biotechnology and the exploitation of hybrid vigour.

2. As a first step, an all-island integrated rice research plan should be developed and extensively discussed by peer groups.
3. Given a climate of globalization and trade liberalization, emphasis must be placed on cost reducing technologies.
4. Technology specifically addressed to less favourable areas is conspicuous by its absence. Even if the production impact is small, it would help increase farmer incomes in rainfed areas and covered by minor tanks.
5. Problems associated with rice yield variability and rice quality should be addressed.

OFCs

1. Years of research have not resulted in any breakthroughs at farm level, implying poor farmer response to whatever new varieties have been released. New directions have to be charted out, with emphasis on cost reducing technologies. Demand constraints will however have to be taken into account.

Furits and Vegetables

1. The lack of reliable data precludes any attempt to evaluate research in this field. There appears to be a singular lack of co-ordination with other divisions to focus attention on preservation, packaging, transport and market demand. Research appears to be focussed primarily on varietal screening.

Floriculture

1. This is best left to the private sector, with research by DOA addressing pest and disease management.

Food Technology

1. A small unit existing in comparative isolation. It should liaise with the private sector and other agencies involved in similar research and become market oriented.

Socio-Economics

1. The centre appears to operate in isolation and is bedevilled with a high staff turnover. It should integrate itself with on-going research programmes to evaluate economic feasibility and support such programmes with demand studies.
2. If technical research has been carried out and new technologies developed but not accepted by farmers, then the socio-economics centre must at a minimum come up with explorative studies.

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CHAPTER 15

Factors Related to the Success of Agricultural Research Centres in Sri Lanka [1]

Kurt Finsterbusch [2] and T. Jogaratnam [3],

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

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[1] Reproduction from a Sri Lanka Journal of Agrarian Studies 4 (2), 1983 65-79.

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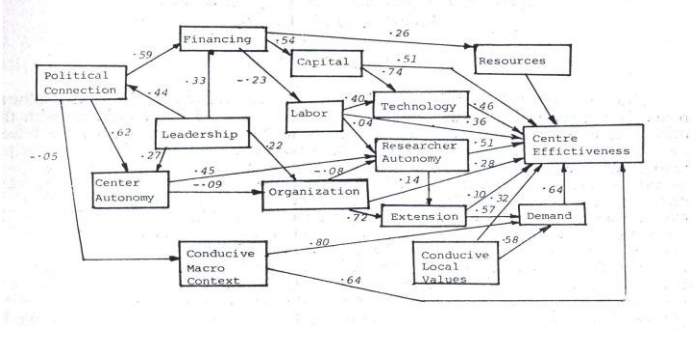
organizational structure, effective management and good leadership. Unique to agricultural research centres is their dependence on effective extension work for their success. They serve the agricultural sector of the economy by providing new varieties, new methods, and information on farmers' problems 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 15.1 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 15.1. 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 predominantly 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 15.1 and 15.2). 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.

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.

Table 15.1. 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 Res.		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 15.2. 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 and 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	-.01	.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

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 15.1 presents the correlations of this and three other measures of overall effectiveness with 23 measures of centre outputs or success. According to Table 15.1, 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 15.1 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 specific for specific sub-dimensions. The differences between the last two columns reflect these differential emphases.

I. 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 15.2. 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 15.2 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 embarrass 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 15.2 supports the theoretical model presented in Figure 15.1 but not perfectly. It provides support for 22 out of 30 hypotheses (arrows in figure 15.11) 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 15.1 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 15.1.

We have pointed out that 22 out of 30 hypotheses in Figure 15.1 are supported at the not very demanding level of significance of .2. What

about the eight hypotheses in Figure 15.1 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 15.1 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 corelated or not correlated with beneficiary motivation to use 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 15.3 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 15.3 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 15.3 – 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
Consequence 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 if 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 Distance from Colombo to Kandy	-.53 -.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 15.2 (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 15.1 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 normally 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 1 2 3 4 5 6 7 high	11 _____
A. What are its major problems?		
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			av.		high			20	
		1	2		3	4	5	6	7		
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

CHAPTER 16

The Effects of Trade Policies on Returns to Rice Research in Sri Lanka: An Analysis[1]

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Abstract

The objective of this paper is to examine the returns to rice research under different trade regimes. A partial equilibrium, static simulation model was used for the analysis. National data on price, quantities demanded and supplied, and research data in 1999 and elasticities of supply and demand were used to calibrate the base equilibrium model. Impacts of three different policy scenarios were assessed using the base equilibrium model. In the first scenario, the impact of research with trade protection was discussed. In this scenario, the Net Annual Research Benefits (NARB), gross return net of expenditure on rice research, was Rs. 58,220 million. In the second scenario, the impact of research impact under free trade was discussed. In this scenario, NARB was Rs. 46,010 million. In the third scenario, the impact of research was discussed under self-sufficiency with free trade. In this scenario, NARB was Rs. 54,393 million. Self -sufficiency in rice could have been achieved by increasing rice research investment up to Rs.46.56 million (on increase of 37% from Rs.29.5 million). These results indicate that the impact of rice research was positive and substantial in Sri Lanka despite that trade regime. Similar results were obtained for rice research investment in other countries. It is concluded that the Sri Lankan government had under-invested on rice research and further increase in investment would have resulted in higher benefits.

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Introduction

Returns to research investment

Investments in research and technology development (R and D) have contributed to modern agricultural development through productivity improvements. Beginning with Schultz in 1953 and Griliches in 1958, a large number of research evaluation studies have examined the rate of return to agricultural research investments. Summaries of these studies, which carry rates of return to agricultural research, are reviewed by Norton and Davis (1981), Ruttan (1982), Echeverria (1990) and Alston et al. (2000). Rates of return to agricultural R and D in developing countries range from -100 to 1,490 and in developed countries range from -14.9 to 5,645. Rates of return to rice research in different parts of the world range from 11.4 to 466.0. Return to research has shown different results depending on the policy regime, measurement of research benefits, author, commodity, and geographical region of the study. Alston et al. (2000) carried out a meta-analysis of the return to agricultural R and D and explained reasons for variations in research results. The focus of this paper is on returns to rice research investment in Sri Lanka.

Research and development in rice sector in Sri Lanka

Rice varieties suitable to different environments were developed through natural selection in the past. In 1902, over 300 rice varieties were being cultivated in the country. However, yields of these varieties were relatively low. This situation led to the initiation of a rice research and development program focusing on increasing productivity through variety improvement. In this program, three main phases can be identified. In phase I, four different age classes were identified among traditional varieties. In these age classes, pure-line selections were made in 1940s and of them, five varieties (Podiwee, a-8, M-302, VP-28724, PP-2462/I l) with a yield potential of 2.0-2.5 mt per ha were released to farmers. In phase II, a hybridization program was initiated in 1952 at the Central Rice Breeding Station (CRBS), Batalagoda. In 1957, four new varieties known as 'H series' (H-9, H-4, H-7, and H-10) were released and these were adopted by farmers in a wide range of rice growing environments. This group of rice varieties was identified as the Old Improved Varieties (OIVs). In phase III with the influence of the International Rice Research Institute (IRRI), 'Bg' rice varieties were released in 1970s. These varieties, called the New Improved Varieties (NIVs), have intermediate plant height, erect leaves

and adequate resistance to bacterial leaf blight. Several 4-4.5 month varieties (Bg 90-2, Bg 400-1, Bg 379-2 and Bg 380) and 3.5 month varieties (Bg 94-1, Bg 94-2 and Bg 350) with a yield potential of 10 mt per ha were released to farmers. In the early 1980s, a high yielding short-aged variety, Bg 750 was released. Varieties of Bg 407 and Bg 745 with the better quality and higher yielding potential were released in the late 1980s. However, some of these Bg varieties gave relatively lower yields than even some of the traditional varieties under some soil conditions (e.g., in saline soils). After recognizing this limitation, rice improvements program was initiated at the Bombuwela Research Station and in the other satellite stations situated in stressed environment during the 1970s. New varieties performing well in saline soils were released from Bombuwela. They were referred to as the Bw series. Improved cultivation practices have also been introduced from time to time. Altogether about 21 High Yielding Varieties (HYVs) are being cultivated by about 85% of the farmers in the country Weerasinghe, 1994; Dhanapala, 2000). A hybrid rice program is the next major introduction to the Sri Lankan rice sector. This program was initiated for the first time in the early 1980s and then carried further in 1994 by scientist at the Rice Research Development institute (RRDI), Batalagoda in collaboration with a team of Chinese scientist from the University of Sichuan (Jayaratne, 2000). Niranjan et al. (2000) evaluated the impact of rice research investment on rice production in Sri Lanka. It was found that a 1% increase in investment has increased rice production by 0.3%.

Trade liberation in Sri Lanka

Sri Lanka along with the rest of the world is moving towards the gradual removal of restriction on trade. Developing countries are expected to reduce their tariffs by 26% over the period 1995-2005 under the Uruguay Round of General Agreement on Tariffs and Trade (GATT) negotiations (Sandaratne, 1995; Meemeduma, 1995). The South Asian Preferential Trading Agreement (SAPTA) came into force in December 1995 and it was proposed to convert SAPTA into SAFTA (South Asian Free Trade Area) by the year 2001 promoting free trade (Perera, 2000; Somaratne, 2000). The Indo-Lanka Free Trade Agreement, would further liberalize trade between Sri Lanka and India (Alwis, 2000; Samarappuli, 2000). Currently rice is in Sri Lanka's negative list, in the trade agreements written so far, and hence the rice market is not presently affected by trade agreements. Tariff rate on rice imports during 1999 was around

35% which was raised to 49% after imposing an additional 14% surcharge in the year 2001.

Objective of the study

As indicated earlier the type of trade regime is one of the factors determining returns to research investment. The objective of this study is to simulate changes in returns to rice research under different trade regimes in Sri Lanka.

Methods

The conceptual model

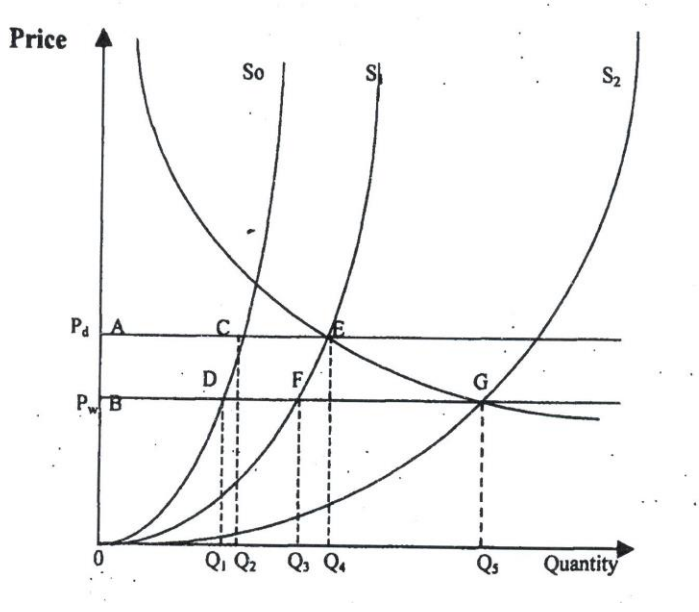
A partial-equilibrium static simulation model of an open economy is used in the analysis. The conventional commodity market model is assumed, with adjustments for market distortions arising from government interventions in the rice market. It is recognized that other factors such as environmental externalities of supply and the nature of the research induced supply shift also affect research benefits. Not all of these are taken into account in this exercise. A log-log supply function is selected and adjustments made for market distortions by way of trade protection. Graphical representation of the model employed to estimate social returns to research investments in a small importing country with protection is depicted in Fig. 1 (Alston et al., 1995).

In Figure 16.1. S_0 represents the supply curve in the absence of research investments. When this situation is considered under free trade, supply is Q_1. In the absence of research investments but with the enforcement of a protection on imports, supply increase to Q_2. S_1 represents the research induced shift in the supply function. When this situation is considered under free trade, supply increases to Q_3. In the presence of research investments and a protection on imports, then supply increases to Q_4. S_2 represents the supply curve given a self-sufficiency situation in free trade, then supply increases to Q_5. The net annual research benefits (NARB) which is the change in producer surplus net of research investment expenditure, to rice research investments are discussed under three different trade policy scenarios. In the first scenario, the actual position, as of 1999 where a Nominal Protection Rate (NPR) of 16% is estimated, is calculated. In the second scenario, the potential NARB under a free trade regime is simulated. In the third

scenario, NARB to research investments to achieve self-sufficiency under free trade is simulated. The basic assumption in the third scenario is that the objective of research investments is to achieve self-sufficiency in rice and estimate the level of investments required to achieve such self-sufficiency.

Producer surplus is measured by the area above the supply curve and below the price line. Gross Annual Research Benefits (GARB) is measured and discussed under three scenarios. In the first scenario, GARB equal to the area AEO minus area ACO (area OCE) in Figure 16.1. In the second scenario, GARB equal to the area BFO minus area BDO (area ODF). In the third scenario, GARB equal to the area BGO minus area BDO (area ODG). NARB is equal to the GARB minus research investments in each scenario. Benefits Cost Ratio (BCR) is equal to the GARB divided by research investment.

Figure 16.1: Partial equilibrium model of estimating benefits to rice research in a small importing country with a trade protection



The algebraic model used in this study based on this conceptual model is shown below.

$S = e^{\alpha} P_d^{\beta} R^{\delta}$ 1

$P_d = P_w (1+NPR)$ 2

$PS = e^{\alpha} R^{\delta} \frac{P\,d}{\beta+1\,3}$ 3

NARB = PS - R 4

Endogenous variables = S, P_d, PS, NARB
Exogenous variables = R, P_w, NPR
S = Supply
R = Research investment expenditure
P_d = Domestic price of rice
P_s = Producer surplus
NPR = Normal Protection Rate
NARB = Net Annual Research Benefit
e = Natural log
α = Intercept term of the supply function
β = Price elasticity of supply
δ = Research elasticity of supply

The empirical model and data

In previous research benefit evolution studies in the world, supply and demand functions are assumed to be either linear or non-linear. The supply shift is assumed to be either parallel or non-parallel. Research benefits occurring with linear parallel and linear non-parallel shifts have been compared by Lindner and Jarrett (1978), Rose (1980), Wise and Fell (1980) and, Norton and Davis (1981). The linear pivotal supply shift framework can be found in Lindner and Jarrett (1978) and Rose (1980). The GARB in linear-parallel supply shift is higher than that of a linear non-parallel pivotal in proportional supply shifts, but lower than that of linear convergent supply shift. Peterson (1967), Ayer and Schuh (1972) Akino and Hayami (1975), Flores-Moya et al. (1978) and Nagy and Furtan (1978) have adopted the non-linear constant elasticity pivotal supply shift framework among, others (Table 16.1). A Comparison of research benefits from linear and non-linear specifications of the demand and supply curves was evaluated by Voon and Edwards (1991). The key point described by Voon end Edwards is that if a particular model specification is a better description of reality, then use of the alternative model

specification can cause overestimation (or underestimation) of returns to research. Niranjan et al. (2000) in their analysis estimated and explained that the non-linear specification of the supply function describes data better than the other form for the Sri Lankan rice sector. In order to simulate the benefits, price elasticity of rice supply (0.59) and research elasticity of rice supply (0.37) are taken from Niranjan et al. (2000).

Table 16.1. Type of supply curve shifts, functional form and their measurements.

Type	Supply curve shift	Type of supply curve	Reference
Parallel	-	Linear	Grillicious (1958)
Proportional	Proportional change	General specification	Peterson (1967)
Parallel	Horizontal shifter	Linear	Hertford and Schmitz (1977)
Pivotal	Production function	Constant elasticity	Akino and Hayami (1975)
Four shifts	Vertical shifter	Linear	Lindner and Jarrett (1978)
-	Vertical shifter	Linear kinked supply curve	Rose (1980)

Source: Norton and Davis. 1981.

In the supply function, price of seed paddy (Rs. per bushel) and proxy for weather (the ratio of rice area harvested to total rice area cultivated) also shown as significant variables. However, their effects were added into the intercept term in the simulation exercise. The supply function used for policy simulation is given below.

$$IQs_t = 7.67 + 0.59IP_{t-1} + 0.37\ IRES$$

Where, at time t, IQs is the log of the quantity of paddy supplied (mt), IP_{t-1} is the log of the average nominal retail price of rice lagged by one year (Rs. Per kg) end IRES is the log of weighted average research

investment (Rs.) on rice (nominal) lagged over 8 years and distributed as a polynomial for 5 years.

The research investment on rice was considered as a lag variable. Hence, nominal research investments from 1987 -1991 (five years) were weighted by using the annual result elasticities calculated for that period and then compounded each using a 12% rate (rate which is used by the World Bank for publicly funded research). The total compounded weighted research investment (nominal) calculated using the procedure above was Rs. 29.5 million and it was considered as the base-year (1999) value in the analysis. Price of rice was also considered as a one-year lag variable in the estimation. Hence, world price of rice in 1998 was compounded using the same rate (12%) and then adjusted to suit the base-year 1999. The compounded world market price of rice was considered as the nominal retail price and it was Rs. 27.9 3 per kg in 1999. Demand for rice to be achieved at the self-sufficiency level under free trade scenario is calculated at -0.1 price elasticity of rice demand (Appendix 1).

Table 16.2. Base-year, 1999 data set

Variable	Value
Compounded with price (retail) of rice (Rs. per kg) (P_w)	27.93
Domestic rice supply (million kg) (S)	2,855
Compounded weighted total rice research investment (million Rs.)	29.5
NPR	16%
Compound rate	12%
Price elasticity of rice demand	- 0.1

The NPC on traded output is estimated using the following formula (Monke and Pearson, 1994).

$$\text{NPC} = \frac{\text{Private (market) price}}{\text{social (world) price}}$$

The calculation of NPC for rice in 1999 is done taking the rice wholesale market is the point of reference. Then;

$$\text{NPC for rice} = \frac{\text{Average wholesale price for domestic rice (Rs/ kg)}}{\text{Average wholesale price for imported price (Rs/ kg)}}$$

$$\text{NPC for rice during } 1999 = \frac{25.78}{22.31} = 1.16$$

NPR = 100 (NPC-1) = 16%

NPC of 1.16 shows that due to government policies market price of rice was maintained at a level 16 % higher than the world price.

Base year data set is presented in Table 16.2. The TSP (Time Series Package) was used to simulate NARB in this analysis

Results and discussion

The equilibrium values of the simulation exercise are shown in Table 16.3. Rice research impact under three different trade regimes is shown in Table 16.4.

Scenario 1: Research impact with trade protection

The Sri Lankan rice sector with research investments as of 1987- 1991 and current protection level is considered as the basis for the analysis. Which rice research investments of Rs. 29.5 million and NPR of 16%, retail price of rice was Rs. 32.40 per kg and domestic supply was 2.855 million mt GARB was Rs. 58,249 million. GARB is calculated by subtracting the equilibrium Producer Surplus (PS) in the absence of research with protection from the PS in the presence of research under protection. NARB was Rs. 58,220 million, and BCR was 1975.

Table 16.3. Equilibrium values of the simulation exercise

Item	With research under protection	No research under protection	No research under free trade	With research under free trade	Self-sufficiency under free trade
Price (Rs. /kg)	32.40	32.40	27.93	27.93	27.93
S (mn mt)	2.86	0.005	0.004	2.62	3.09
R (Rs. mn)	29.50	0.00	0.00	29.50	46.56
PS (Rs.mn)	58,356	106.7	84.4	46,123	54,524

Scenario 2: Research impact in free trade

Given the existing amount of rice investments (Rs 29.50 million) in the context of free trade, the analysis indicates that retail price would fall by 16% from Rs. 32.40 - 27.93 per kg. Supply would decrease by 9% from 2. 855 – 2.616 million mt GARB would decrease by 27% from Rs. 58,249 – 46,039 million. In this scenario, GARB is calculated by subtracting the equilibrium PS in the absence of research under free trade, from PS in the presence of research under free trade. NARB would also decrease by 27% from Rs. 58,222 – 46,010 million. BCR would also decrease by 27% from 1,975 – 1,561.

Table 16.4. Rice research impact under three different trade regimes in Sri Lanka

Item	Scenario 1 Trade protection	Senario 2 Free trade	Scenario 3 Self-sufficiency under free trade
Price (Rs. / kg)	32.40	27.93 (-16)	27.93 (-16)
S (mn mt)	2.855	2.616 (-9)	3.086 (8)
R (Rs. mn)	29.50	29.50 (0)	46.56 (37)
GARB (Rs. mn)	58,249	46,039 (-27)	54,440 (-7)
NARB (Rs. mn)	58,220	46,010 (-27)	54,393 (-7)
BCR	1,975	1,561 (-27)	1,169 (-69)

Figures in parenthesis are percentage change from scenario 1.

Scenario 3: Research impact when achieving self-sufficiency in free trade

Research investment in rice is this supply shifter considered in this analysis and it is employed here to show how the self-sufficiency conditions are to be met. The compounded weighted total rice research investment in 1999 was Rs. 29.5 million and, increasing that amount by 37% to reach Rs. 46.56 million, would enable Sri Lanka to achieve self-sufficiency in rice production under free trade. In such a situation, domestic price of rice would have been equal to the world market price of Rs. 27.93 per kg (decrease by 16% from Rs.32.40 kg). Then, the total rice quantity demanded in 1999 that is 3.086 million (considered as the demand to achieve self-sufficiency level under free trade with research investment), would have been met by domestic supply resulting in zero net imports of rice. As a whole, GARB would have been Rs. 54,440 million (decreased by 7% from Rs. 50, 8249), which would have been distributed among ric producers is their share. In this scenario, GARB is calculated by subtracting the equilibrium PS in the absence of research under free trade, from PS at the self-sufficiency level under free trade. The NARB would have been Rs. 54,393 million (decreased also by 7% from Rs. 58,220 million). BCR would have been 1,169 (decrease by 69% from 1,975).

Conclusions

The effects of trade policies on returns to rice research Investments are discussed under three different scenarios. In the first scenario, the actual position as of 1999, where a NPR of 16% was imposed, is considered. The Sri Lanka government, invested about Rs. 12,210 million on rice research in 1999 to improve the production of rice farmers. The results of this study show that return to this investment is very high. The result of this study can be compared with early studies, where extraordinarily high returns to rice research were observed and it indicates too little investment in rice research in the past. This situation has been explained as a very serious degree of resource misallocation by both national and international policy makers. It can therefore be concluded that the Sri Lankan government had also under invested on rice research and further increase would have resulted in higher benefits. Research investments under a free trade regime (scenario 2), and increased research investment to achieve self-sufficiency (scenario 3) bring in leaser benefits.

Acknowledgements

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Appendices

Appendix 1. Results of the linear - log demand estimation.

Explanatory variable	coefficient	t - statistics
Constant in the demand function	0.24***	4.25
Love of retail price of rice	-0.02*	-1.82
Log of retail price of wheat flour	0.02***	2.67
Log of income proxy	0.004	1.40
Log of one-year leg - per capita	0.06***	
2.74 demand for rice R^2= 0.54		
Adjusted R = 0.50		
Durban Watson = 2.1		
Auto Correlation Coefficient = -0.29		
Method of estimation: ARI (Maximum Likelihood Iterative Technique)		
Sample period: 1951 = 1999		
Number of observation = 49		

* Significant at 10% ** Significant at 5% ***Significant at 1%

CHAPTER 17

Impact of Rice Research on Rice Production in Sri Lanka[1]

S.K.D.F.F. Niranjan, T. Jogaratnam[2] and J. Weerahewa [2]

Abstract

This paper examines the impact of rice research investments on rice production in Sri Lanka. A supply function was estimated using time series data (1959-1999). Lagged research expenditure was included as one of the explanatory variables in the supply function. Results reveals that research investments have taken 8 years to show any positive change in rice production. This impact continued until the 12th year. Elasticity of supply with respect to rice research expenditure was 0.37. Elasticity of supply with respect to own price and price of seed paddy were 0.59 and -0.69 respectively. If research investment was increased by 10% over the period 1959-1999, domestic supply would have been increased by 3.56%.

Introduction

Numerous studies document high returns to investment in agricultural research. Rice is a sector of major importance in the economy of Sri Lanka and with the goal of self-sufficiency, successive governments have given priority to increasing production. Amongst other things, rice research and development has been actively promoted. Rice research is still a public activity and the Department of Agriculture (DOA) has established research stations in the different agro-climatic zones where rice research is a principal activity. Investment in rice research increased in real terms from about Rs. 2,400 in the early 1960s to about 17,000 in the late 1990s. However, they declined as a per cent of the gross domestic product (GDP), from 0.30% in 1966 to 0.18% in 1996 (Fernando and Amaradasa, 1999). The research impact is in part reflected in the increase in yields, from about 1.5 mt ha^{-1} in the early fifties to over 3.5 mt ha^{-1} in the late nineties (Department of Census and Statistics, 1998 and

[1] Reproduction from a Tropical Agricultural Research (2000), Vol 12: 249-254.

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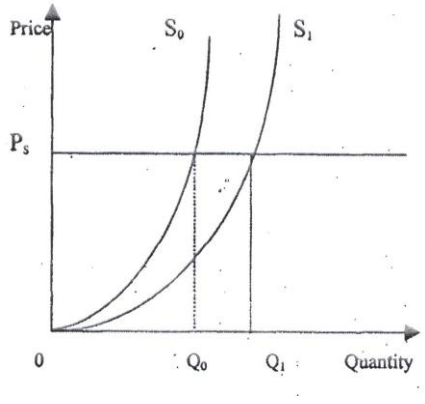
2000). There is increasing concern however that the rate of increase in yields appears to be slowing down. Questions arise as to how much should be spent on rice research and how it should be spent. Answers to such questions depend in part on an evaluation of the impact of rice research. *Ex-post* studies of this nature are also of importance in *ex-ante* research prioritisation exercises. The objective of this study is to estimate the impact of research investment on rice production in Sri Lanka.

Methodology

The conceptual model

Economic theory suggests that product supply depends on the price of the commodity, the prices of other commodities which could be produced, the prices of inputs, and technology. The relationship can be expressed in the form of a supply function. Successful investment leads to increases in product supply and as such can be incorporated into the supply function. Research investment that results in a yield increasing or cost reduction technology leads to a shift in the supply curve as depicted in Figure 17.1. The supply curve shifts from S_0 to S_1 and the quantity supplied increases from Q_0 to Q_1. The single equation supply response model has been widely used to estimate the returns to research (Alston *et al*.1995). It is well known that lags occur in research and its adoption. Assumptions have to be made about lag lengths and their duration, which then can be incorporated into the supply response model. Equally, price lags can also be taken into account.

Fig. 17.1. Supply function shift



A supply function of the form given below is used in this exercise:

$$Qs_t = g\,(Ps_{t-1}, Pi_t, R_{t-k}, \ldots, R_{t-k-r}, T_t)$$

Where, at time *t*, *Qs* is quantity supplied, Ps_{t-1} is producer price at time *t-1*, Pi_t is price of inputs (i= 1,2,…,n) such as fertilizer, seeds and labour etc., R_{t-k} is investment in research at time $t\text{-}k_r$ R_{t-k-r} is investment in research at time *t-k-r* and *T* is a proxy for other types of technology. Parameter *k* represents the time after which benefits occur (duration of the research lag) and parameter *r* represents the duration over which benefits are retained.

Many reasons can be adduced to explain the research lag. There are intervals between the time that research activity commences and knowledge is generated, new technology innovated and the adoption of the new technology. In estimating a supply function as represented above, 4 important decisions have to be made. These relate to (a) the type of research expenditure that should be used, (b) the type of lag distribution that should be imposed (c) the duration of the research lag, and (d) the duration over which benefits are retained (Alston *et al*.1995).

(a) Research expenditure

The research expenditures utilized in research evaluation are of 2 types; one relates to expenditures in the location or country in which the research is carried out. The second takes into consideration research carried out in other locations or other countries, in short the spill-over benefits.

(b) The lag distribution

The impact of research expenditures have been studied using different lag models, such as polynomial lags, trapezoidal lags, geometric lags etc. These refer to the type of relationship after investment in research, the adoption of the new technology, and its obsolescence. This has been identified as consisting of a research lag, a development lag and an adoption lag (Alston *et al*.1995). Polynomial lag models with different degrees and end-point restrictions are used in this study.

(c) The duration of the research lag (parameter k)

The occurrence of research lags was referred to above. Parameter k refers to the time after which benefits begin to occur.

(d) The duration of benefits (parameter r)

The parameter r refers to the duration over which benefits are retained.

The supply equation can be used to estimate the shift in supply to calculate the change in economics surplus and the rates of return to research. This study focuses only on the impact on production.

The empirical model

The following supply function was estimated:

$$lQ_s = s_0 + s_1 lP_{t-l} + s_2 lRES + s_3 lS + s_4 W$$

where, lQ_s is the log of the quantity of paddy supplied $(mt)_r$ lP_{t-l} is the log of the average real producer price of paddy lagged by one year (Rs kg^{-1}), *lRES* is the log of real research expenditure on rice lagged over different periods and distributed as a polynomial (Rs), *lS* is the log of real price seed paddy (Rs bu^{-1}), *W* is the proxy for weather, (the ratio of rice area harvested to total rice area cultivated), and s_0, s_1, s_2, s_3, and s_4 are parameters to be estimated.

Different durations of the research lag (k) and duration of the research benefits (r) were tried out and a research lag of 8 years and a benefit lag of 5 years, that is from 8^{th} year to 12^{th} year were the most appropriate according to the statistical estimation and used in the empirical model. Benefits before the 8^{th} year and after the 12^{th} year were found to be insignificant.

Data

The secondary data used in the analysis were gathered from several sources. Annual recurrent research expenditure data on rice from 1959-1999 were initially obtained from the vote ledgers of the Rice Research and Development Institute (RRDI). Recurrent expenditure includes personal emolument of permanent researchers and other support staff members, and permanent and casual labourers; travelling expenses (domestic and foreign); supplies (stationary and office requisites, fuel and lubricants, uniforms, mechanical and electrical goods and other supplies); contractual services and research grants (local and foreign). Rice research is being carried out not only at RRDI but also at several research institutes/centres that belong to DOA. Hence, the following procedure is

followed to calculate the total annual rice research expenditure for the whole country. The percentage budget allocations for each research institute/centre for the last 5 years for rice research were calculated using the INFORM (Information for Research Managers) database maintained at the Council for Agricultural Research Policy (CARP). The 5 year average as a percentage for rice research by each research institute/centre[2] was used to adjust the actual rice research expenditure at RRDI in order to obtain the total Sri Lankan rice research expenditure for each year. Farm gate price of paddy was obtained from the Statistical Abstracts of the Department of Census and Statistics (DCS). Seed paddy price was derived from the Guaranteed Price Scheme (GPS) obtained from the DOA. Proxy for weather (the ratio of rice area harvested to total rice area cultivated) was based on the data obtained from the DCS. All price and cost data were deflated by the Colombo Consumer Price Index (CCPI) for food to convert into real terms.

Results

The supply function was estimated using the Ordinary Least Squares (OLSQ) and the Auto-regression (ARI) methods. The polynomial Distributed Lag (PDL) research variable is considered as the most appropriate form as shown in the final model below. Several computations were checked for significance under both OLSQ and ARI procedures. The best fit model was chosen after omitting non-significant variables. The best-fit model is given below.

$$lQ_s = 4.45 + 0.59\ lP_{t-1} + 0.37\ lRES - 0.69\ lS + 2.20\ W$$

The detailed results of the estimation are shown in Table 17.1.

Goodness of fit values for the supply function for rice was 0.97. As explained earlier, the research benefits are assumed to flow from the 8th year after commencement of research and are sustained till the 12th year. Results indicate that in each year from the 8th year to the 12th year, a 1% change in research expenditures results in 0.053, 0.080, 0.087, 0.080 and 0.065% changes in rice production respectively. Over the 5 year period from the 8th-12th year, the research impact on rice production is estimated at 0.37%. The price elasticity of supply is estimated at 0.59 while the price elasticity of seed paddy is estimated at -0.69. These elasticity coefficients are in line with results reported in other studies (Mangahas *et al*., 1967; Bogahawatte, 1978; Bogahawatte, 1984; Tsakok, 1990). This study was not extended to estimate the rate of return to

research. However, the sensitivity of domestic rice supply to changes in research investment over the entire period was examined. Increase in research investments by 10% and 20% for the period of simulation (1959-99) respectively would have had a 3.56% and 6.91% increase in the domestic supply of rice. Reduction in research investments by 10% and 20% respectively would have had a 3.79% and 7.85% decrease in the domestic supply of rice.

Table 17.1. Results of the estimation

Explanatory variables	Coefficient	t-Statistics	Elasticity
Constant in the supply function	4.45***	5.73	0.59
One year lag producer price	0.59***	2.71	0.05
Research expenditure (t - 8)	0.05*	1.80	0.08
(t - 9)	0.08***	3.18	0.09
(t -10)	0.09***	3.49	0.08
(t - 11)	0.08***	2.91	0.07
(t - 12)	0.07*	1.72	0.37
Sum of lag research	0.37***	5.33	-0.69
Seed paddy	-0.69**	2.37	
Weather proxy	2.20**	4.88	
R^2 = 0.97 Durbin – Watson = 1.97			

*Significant at 10% level ** Significant at 5% level *** Significant at 1% level

Conclusions

Research investment in Sri Lanka has shown a statistically significant positive impact on rice production. Rice research impact was realized after 8th year of the investment. Production of rice increases gradually after 8th year up to 12th year and then decreases gradually. The research elasticity is estimated at 0.3.

Certain caveats are in order in interpreting the results. Problems arise in terms of the data available, the assumptions made in terms of the functional form, the variables used, the lag periods and the lag structure imposed. Results of different formulations however, were very similar. It is felt that the results indicate general orders of magnitude. The general conclusion is that research investment had a positive impact on supply and that procedures would have stood to benefit from rice research.

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CHAPTER 18

The Role of the Economist in Agricultural Research[1]

Abstract

The question of a research agenda in Agricultural Economics can be approached in different ways. One is to develop a framework broad enough to encompass the goals and ethical and value premises within which the evaluation criteria and priorities can be developed. Another is just to follow Jacob Viner's dictum that "Economics is what Economists do". In this paper some of the perceived problems and areas of work involved are set out. Given the changing perspectives, the emerging issues, the changing directions of research, and the multi-faceted problems that developing countries and the Economists working in such environments are grappling with, the challenge facing Economists is not to be bound by rigid rules and archaic procedures, but be alive to the problems that, in the final analysis, impinge on the quality of life of the millions living in these countries. One must also be alive to the criticism levelled at Social Scientists of the third world, namely that they work within a framework of reference imposed by developed country concepts and models, leading to agendas imposed by outside agencies and thus very often irrelevant to the needs and requirements of the third world.

Introduction

It has been observed that Agricultural Economists, as well as other Social Scientists, are not adequately involved in most agricultural research programmes. While it is almost trite to say that research and innovations resulting from it must be economically profitable and socially acceptable, Economists become involved mostly, if at all, in ex-post evaluations and have little say in the planning and design of research. Much emphasis is given nowadays to interdisciplinary research on problems crucial to agricultural growth and development. However, the coordination and integration may be due in part to an inadequate understanding of the role of the Agricultural Economist and in part to the absence of strong

[1] Re-production from a Sri Lankan Journal of Agricultural Economics, Vol. 2, No. 1, 1994.

disciplinary programmes in Economics which could contribute effectively to interdisciplinary dialogue. The later development of the Social Sciences, the fact that the Social Sciences concerned themselves with human behaviour and human institutions whereas the Natural Sciences in agriculture dealt with plants and animals perhaps accentuated the division. It has also meant, especially in Sri Lanka, poor representation in the higher levels of research management. Consequently, Agricultural Economics has been treated as a junior partner or as an appendage to established research divisions, poorly staffed and inadequately trained. This paper addresses the problem of developing Agricultural Economics research in the country, so that it assumes its proper role and contributes to the goal of agricultural research, namely, improving the welfare of all those dependent on agriculture.

Agricultural Research, Technology and Development.

The goals of economic development can be spelt out in terms of growth, equity and security. In recent years, with increased interest in preservation of the environment, sustainability is also a major objective. Unfortunately however, we still lack a clear understanding of the process of development and as a consequence there is also a difficulty in enunciating a clear agenda of research. Development thought has progressed through several phases, with the early post-World War II emphasis on growth and trickle-drown effects giving way to concerns with distribution, basic needs, social parameters and sustainability. There, however, seems to be some consensus that the springs of development are in some way connected with technology and institutions. While most people would agree that both technological advances and institutional reform are necessary for development, there is considerable debate in assigning priorities. T. W. Schultz drew attention to the so called “non-conventional” inputs in securing increases in productivity. Those who have followed in his footsteps have authored numerous studies which document the importance of technology in promoting rapid increases in productivity. Technological change is no longer held to be exogenous to the process of economic development. It is now held that it is only through advances in technology, such as through new and better varieties of seeds and planting material, new husbandry techniques, more efficient sources of power, cheaper and better plant nutrients, and more effective control of pests and diseases, that significant increases in productivity could be achieved. This paper devotes attention to the role of Economists

in agricultural research institutes which are primarily commodity-oriented. In consequence, little or no attention is paid to the requirements of constitutional research. This should not be downplay the need for research in this area.

Empirical studies suggest that returns to research have in the past been high. Internal rates of return of the order of around 40 percent have been cited in the literature. Agricultural research can help secure increases in agricultural output, reduce the quantum of resources used, change product characteristics and reduce production risks. The contribution of agricultural research to economic development lies in bringing about changes in one or all of these elements and securing increases in agricultural productivity. The concept of productivity growth implies not just an increase in production but changes in the ratio of output to input. While the new technologies may be described as product- specific or resource-specific, they also take the form of improved production systems and improved crop rotation methods. The new technologies through their impact on agricultural production, resource use, distribution or equity, nutrition, as well as employment, incomes and the environment contribute to overall agricultural and economic development.

The Allocation of Resources to Research

While investment in research has a high pay-off, the problem is that resources are scarce and agricultural research has to compete with other demands for public spending. Thus decisions need to be made on research priorities. Numerous attempts have been made to formalize the research allocation criteria, but as Ruttan (1982) points out, no resource allocation system can avoid making judgments about two major questions. These relate firstly, to the possibilities of advancing knowledge or technology if resources are allocated to a particular commodity, problem or discipline, and secondly, to the value to the society of the new knowledge or the new technology if the research effort is successful. It is argued that answers to the first question are best left to research administration and planners and that answers to the second require analytical methods familiar to the Economists. In a different vein, Per Pinstrup-Andersen (1982) suggests that decisions regarding priorities within goal-oriented agricultural research be, generally speaking, focused

on a specification of the desired technology and choice of methods to be used in obtaining such methodology, with the latter best decided by the researchers themselves. In specifying the desired technology, decisions require to be made on (1) the commodity or resources for which the technology is being sought; (2) whether the technology should facilitate improved efficiency; changed commodity characteristics, reduced production risk or some combination of these; the production environment for which technology is being sought; the constraints that the technology should remove,; establishing the cost and time requirements; and estimating the probability of success of the various lines of research. Satisfactory answers to such questions require close collaboration between natural and Social Sciences.

The Role of the Agricultural Economist

Agricultural research has been viewed primarily as a means of promoting economic growth. Although this narrow view of production-oriented goal has been criticized, much of agricultural research continues to be directed at increasing productivity. Such increases are secured most often through breeding programmes resulting in improved seeds and planting materials. Complementary work in agronomy and related fields has served to enhance the potentials of the new varieties. Agricultural Economists at first were largely concerned with studying enterprise costs and returns with a view to determining optimal input use and enterprise combinations. The emphasis was thus at the micro-economic level. It was not long before economists realized that profitability would also be affected by wider issues affecting the economy as a whole, such as input and output prices, marketing and credit, and demand and supply conditions.

Where the improved technology was concerned, Economists were mainly concerned with investigating the economic feasibility of new technologies. The distributive implications of improved technologies also began to be studied. It was, however, not clear whether the results were being transferred to the Natural Scientists at the design stage of research. Economists however were concerned that much of the technical data generated by researchers did not lend themselves to economic analyses. This highlighted the need to associate economists at the design stages of research agendas. With increasing interest in farming systems research and crop diversification, multiple-cropping and the like, Economists began to work in interdisciplinary groups.

One should not ignore the significant work of Economists in the area of economic growth and development. The process of growth and development and of technical change and their implications were highlighted. The economic and social dimensions of increased agricultural production probably filtered into and provided a feedback to the Natural Scientists. In more recent years, economists have begun to address themselves to problems of the environment and adopting the tools of analysis to problems of environmental degradation and pollution.

Ruttan (1982), identifies three major roles, especially in relation to Economists working in agricultural research institutes. These relate to the evaluation and dissemination of the new knowledge and technology developed by the institute, the analysis of programmes and issues of research resource allocation with the Economist playing a key role at the management level, and, finally, research on issues of personnel and professional interest with little direct input into the institute's programmes. One could perhaps identify a fourth role, namely that of data collection and analysis to service other programmes with the Economist occupying a minor position and no independent recognition in the institute's hierarchy.

Raj Krishna (1971), in a different context, identified priorities for agricultural Economics research in general. These include the collection of farm level data on input-output relations on the supply side and demand and outlook studies on the demand side. Such information provides the basis for assessing rates of technical change and projecting output. It enables the evaluation of the process of growth and development and provides the framework for policy analysis, especially in terms of input and output prices. Also highlighted were the analysis of projects, issues of equity and development, and the interaction between the agricultural and non-agricultural sectors.

The increasing interest in interdisciplinary work is highlighted by work done in international research institutes. The yield constraints research program, first developed at IRRI and with which local researchers were also involved, is cited as one of the best examples of interdisciplinary research, exploiting the professional complementarities existing in research institutes (Ruttan 1982). Similar research programmes involving close collaboration and integration of different research disciplines have been undertaken at other international research institutes (Per Pinstrup-Andersen, 1982). Multidisciplinary research teams now work on cropping

and farming systems, including issues of farming intensity, agro-forestry, environment, low input farming and alternative agriculture.

A major concern to Agricultural Economists is the allocation of resources in research. Allocative decisions require information on projected future demands and their elasticities; projected resource availabilities and their price elasticities; constraints to increased production; the structure of the agricultural sector; cost and time requirements; and the probability of success of each of the research strategies (Per Pinstrup-Andersen, 1982).

A Research Agenda in Agricultural Economics

Research can be categorized in many different ways. One such classification would be to group research into (1) descriptive studies, (2) evaluation studies, (3) policy studies, (4) discipline-oriented studies, and (5) basic or theoretical studies. In agriculture, much of the research undertaken is of an applied nature, commodity-oriented and directed at "growing two blades of grass where there is now one". In agricultural Economics one could also distinguish between macro-level and micro-level research. At the macro-level, major attention is given to exploring the impact of growth and development on society. Micro-level studies operate largely within the framework of the "efficient but poor hypothesis" and are largely centred around the economics of production and resource use at the enterprise and farm level.

Agricultural Economics research in Sri Lanka is now firmly established at the Department of Agricultural Economics and Extension, University of Peradeniya; the Division of Agricultural Economics and Planning, recently renamed the Socio-Economic and Planning Centre, Government Department of Agriculture, and the Agrarian Research and Training Institute. The Economic Research Department of the Central Bank of Sri Lanka has also undertaken studies in this area. An evaluation of the relevant priorities and the impacts and benefits flowing from such research are still to be done and hopefully will form the subject of a follow-up study. The Agricultural Faculties of the University of Ruhuna and the Eastern University are still in their infancy. Small units are also attached to the Tea, Rubber, Coconut, Sugarcane and Veterinary Research Institutes. Given the limited staff and facilities, decisions need to be taken on the scope and breadth of research that should be

undertaken. It is suggested that the following areas be given attention, especially in the early stages of development.

(1) Descriptive Studies: Basic information relevant to a sector, industry or commodity, preferably by agro-ecological areas, must be collected. Sometimes also referred to as bench-mark studies, the studies on major colonization schemes and village tanks carried out by the Peradeniya University's Department of Agricultural Economics, the cost of production studies of the Government Department of Agriculture and Agrarian Situation Studies of the ARTI performed this function. These, however, were carried out at the micro-level, but provided information on resource availabilities and resource use and also generated input-output data. These should be supplemented by macro-information pertaining to the structural characteristics of production, consumption and trade and the role of the sector/commodity in the economy. Such information lays the foundation for analytical studies. Here the aim is to discover causal relationships between variables and to predict behavioural patterns. Both cross-sectional and longitudinal studies have a role to perform in such descriptive/evaluative studies.

(2) Evaluation studies: These address themselves mainly to the socio-economic impact of the new technologies and are thus ex-post in nature. But important in terms of setting research priorities are constraints studies and yield-gap analyses.

(3) Policy studies: These are an important area of research given the widespread nature of government intervention in agriculture. The impact of government policy measures on production as well as their distributional implications must be assessed. Estimations of income and price elasticities are a major component of such studies.

Other Areas

As can be inferred, Agricultural Economists have concerned themselves mainly with problems of productivity, efficiency of distribution, with a view to increasing the productive capacity of the resources used in agriculture. But as Ruttan (1982) and Dahlberg (1986) emphasize, the problem of externalities is assuming greater importance, especially given the current concerns with the environment. Thus a strong case is made for broadening the research agenda to include impacts on health, nutrition, environment etc., that is the externalities which are very often ignored or bypassed in economic analysis.

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Conclusion

… Of Years Gone By [1]

Forty five years have gone by and yet it seems the other day. Yes. A little over 45 years, August 1953 to be more exact. Sometime after the final examinations in Economics, I received a telegram from the late Professor H.A.ds.S. Gunasekera. I was marking time teaching at a small school in Nawalapitiya. The telegram was a summons to assume duties as temporary Assistant Lecturer in Agricultural Economics. It was promptly dispatched to the waste paper basket. I could not imagine appointments being given to someone awaiting results. I thought my leg was being pulled. The telegram was brought to me by a room- mate working at the post office. He was given to such jokes. I never knew there was such a position at the University. A second telegram followed. I made my way rather sheepishly to Peradeniya.

Where was the University Department of Agriculture ? No one whom I asked knew. I had to trudge all the way from Lower Hantane to Upper Hantane to Gannoruwa and back to the house by the river. I met the Head of the Department. I was curtly told to commence lectures in Agricultural Economics the next day and to keep away from the Arts Faculty. They were full of communists, so he said. That was the first time I came to know of a subject called Agricultural Economics. Certainly not an auspicious beginning. I did not have a table or a chair, much less a room, to deposit myself.

Much water has flowed under the bridges since then. Student enrolments increased to about 200 from about 10. Academic staff now number over 100 compared to less than 10 then. New and imposing buildings have cropped up all over. On a self- congratulatory note, there came into being a Department of Agricultural Economics with a staff of 14 and a building of its own. The Department was split up later to create a new Department of Agricultural Extension. I also take pride in the fact that the first calculators in the faculty, a Marchant and a Friden, were gifted to Agricultural Economics. So too was the first vehicle, a Toyota Hi-Ace Wagon. I also had the privilege of inviting the first three Visiting Professors in the Faculty and of setting up the Agricultural Economics

[1] Retirement Speech of Professor T. Jogaratnam made at the Felicitation Ceremony organized by the Faculty of Agriculture, University of Peradeniya, 1998.

Research Unit, which alas is now defunct. So many things have happened, so many things have changed. How does one squeeze 45 years into a page or two??

Walking down memory lane, there flash across my mind the heated arguments, over the time table arrangements, curriculum content, the chairs to create and occupy, the honours to be given or not. Ah yes; one cannot forget a former Vice-Chancellor's quip at an examiners' meeting: "pass them, pass them, only the grass will die" referring to some border line cases. At the end of the day, the acrimonious debates and heated arguments are forgiven and forgotten. They were all in the cause of giving a training to students that could compare with the best in the world. The satisfaction lies in the fact that not for a moment does one feel let down.

Just a few days ago, I was at a conference and sitting alongside me were some of my former students, now friends, and all of them occupying the commanding heights in various walks of life. My mind races back to others occupying similar positions across the world. It was a moment to savour. Could anything give greater pleasure or satisfaction to one who had given his life time to teaching! As I sat there, half listening to what was going on, my mind leaps back, of all things, to an incident a few years ago. While abroad, I received a call from a professor in a leading University. An introduction is made and I was asked whether I could place him. I scratch my head. Perhaps he sensed my discomfiture. Loud and clear came the reply. "Sir, do you remember bailing me out from the Police Station at Polonnaruwa". I was speechless, clueless. What had happened? A drunken brawl! How did I get into the act? Was I also involved? Cant' be! Memory fades. He then clarifies. I had taken a group to survey some farmers. After a hard and heavy day's work, relaxation in the evening came via the bottle. Where was I at that time? I cannot remember; perhaps turning a Nelsonian eye; not the worse for anything, I hope.

Another unconnected, unrelated incident flashes across my mind. On a field trip a few years ago in the North Central Province, accompanied by a colleague, we lost our way. I get nervous, the security situation being what it was. The driver stops the jeep in front of a small dilapidated building and not a soul in sight. Debating what to do, I was astounded to see someone leaping through the bushes shouting sir, sir, for all the world to hear, arms flying, face beaming, wreathed in smiles. Again the same question, again the same scratching of the head. But there was no

reproach in his voice as he said “sir, I was your student”. I felt so relieved and safe.

I feel impelled, to relate another incident, just to give another side to the story, just to show that it takes all manner of people to make this world. Another student, to whom I had given a couple of very favourable recommendations, and he very well deserved them, showed his annoyance in no uncertain terms when I reported on his progress. The sponsors of his scholarship and the University required a confidential report from me. He thought I had no right to do so, though the report in question was even more favourable. But he even went further and thought he had the right to advice me on selections to the staff. He said he was not happy with a then recent selection of mine. May be he forgot I selected him. Another incident comes to mind. An individual approached me for a place on the staff, the only individual to do so. He wanted to get married. He was holding a job which would not permit him to do so for some time. One can very well understand his impatience, but not the arrogance. They all sought greener pastures later on and hold very high positions now. As I said, all sorts of people make this world and I relate these more for their hilarity than anything else.

Equally hilarious, but in a different sort of way, is the case of former Research Assistant. He wanted to extend his stay beyond one to two years. His parents became suspicious. Discrete inquires were made. Did I have a marriageable daughter? Yes, I had a daughter but too young for me to indulge even in any long term planning. If she was old enough she would have revolted at the very thought of it. They have minds of their own, the young.

While there have been times to laugh, there have also been times, not to cry, but to feel despondent. I have literally mortgaged myself, signing bonds as surety. An individual or two have betrayed the trust and confidence. What can one do, except perhaps to say to myself “*et tu, Brute*”? But then, can I ever forget all those who came in numbers to camp themselves in my house in the aftermath of the events of 1977 and 1983. Or those who offered solace to me and my family in various other ways at that time. It would be invidious to mention names. But they would certainly find a place in any scroll of honour.

At the same time, I must be humble enough to admit that similar stories could be related about me. No one is perfect. If such stories are hilarious, let us all laugh. If I have erred, if I have done wrong, I seek forgiveness.

I can go on and on. But time and space forbid. These are all isolated incidents which could be duplicated times without number, and related by others too. But they are etched indelibly in my mind. Their very ordinariness is what makes them so valuable to me. Perhaps I should write a book. May be an autobiography! But who cares. Anyway I have always been too lazy to put pen to paper, unless compelled as now.

If I have any word of advice to our younger colleagues, it is to give our students the highest priority. We all learn from our students. We are what we are because of them. Let there be no excuses for cancelling lectures, cutting short on curricula, laxity in administering examinations and the like. This requires discipline of a high order. Developing this discipline is what the students taught me and for this I owe them a deep debt of gratitude. I should not forget those whom I call the support staff for want of a better word. Their smiles of welcome every morning set the day for me. They have willingly obliged me with all that I asked of them. Never a sour face. A special word to those numerous research assistants who helped me. I trusted them and they more than returned that trust. I sincerely hope they more than profited from their close association with me. To my colleagues in the Faculty, many of whom have been my students, I can only say that they have more than fulfilled expectations. To all of them, from students to staff, who made me what I am, I can only say a big “thank you” from the bottom of my heart.

There are regrets to be sure. Never an aspirant for any honours, much less the Nobel prize, I wish I could have left some imprints on the sands of time. The relevance, the significance, and the impact of whatever I have done keep cropping up in my mind. I may have gathered enough points, but despite numerous reports and some publications, I remain very skeptical and increasingly cynical. May be the only consolation is that the students in whose training I have had a hand will, to parody a well known economist now dead, contribute in better measure to an understanding of the problems of poverty, malnutrition, growth and development, problems which continue to haunt us.

It is time to say adieu, but’ not farewell. There have been farewells in the past and there may be some in the future, given my habit of coming back, and hopefully without demands on others’ purses. But when it is time for the last farewell which comes to everyone, I hope and pray that the end will be sudden and swift leaving no time..... to say farewell.

The volume is a result of contributions made by the following members of the Department of Agricultural Economics and Business Management

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