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## REPRODUCING OLD STRUCTURES THROUGH REFORMS: THE EXPERIENCE OF LAND REFORMS IN SRI LANKA

BY

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### ABSTRACT

*In this article I propose to sketch the structure and action of polity and peasantry in relation to land reforms in Sri Lanka. I am primarily concerned with the land reforms of the seventies, but as a prelude I shall also discuss in brief, the early land and agrarian reforms in the independent Sri Lanka in order to place the history of current land reforms in a sociological perspective. The scheme of interpretation is based upon the dialectical method which involves thesis, anti-thesis and synthesis. It is argued here that land reforms did not fundamentally alter the property relations (production relations) but rather indirectly served to perpetuate the existing structures. The objectives and policy framework behind the land reforms in particular, and the agrarian reforms in general are considered to be indicative of political ideologies of the state in relation to the peasantry as governed by economic factors, as well as by social and political factors.*

### Historical Background

There are two pieces of legislation that could be considered as of relevance to early land and agrarian reforms in Sri Lanka. They are the 1953 Paddy Lands Act and the 1958 Paddy Lands Act. The 1953 Paddy Lands Act, conceived as it was, relied upon the goodwill of the individual land owner to treat the tenant humanely; it accepted the high rent paid by the tenant to be unfair, but left it to the individual to resolve it. It also sought registration of tenancy arrangements and security of tenure for a five year period, but then all these were left for the individuals to come to agreeable terms with. The Act was implemented in two districts and was proved to be ineffective. The next attempt at land reform came about in 1958 which fixed the maximum rent paid by the tenant, sought security of tenure and created farmers' organizations called 'Cultivation Committees'. However, the area of authority was confined to paddy lands alone. On the other hand, the land owners reacted by evicting the tenants; by the end of 1959, there were nearly 15,000 reported cases of eviction; by 1971 it was 43,134 (Weerawardena, 1975:5, 21-25, Appendix 7B) and gaining control over the institutions created for the benefit of the tiller. In the seventies there was a spate of reforms: the 1973 Sale of State Lands Law made provision for the colonists to buy land they had received under the government-sponsored settlement schemes; the 1972 Agricultural Productivity Law created Agricultural Productivity Committees in each local government division with appointed members who had a wide range of responsibilities;<sup>1</sup> the 1973 Agricultural Lands

1. The objective of the law was to impose regulations on land use and management, cropping patterns, cultivation practices, irrigation water management, soil and water conservation, pest and disease control, etc., with a view to obtaining maximum productivity from crops and livestock. The Minister may serve a Dispossession Order on people failing to fulfil such obligations. The Committees were entrusted with the duty of promotion, coordination and development of agriculture, and of assisting in the formulation of implementation programmes and targets for the production of crops and livestock. The APCs have powers to acquire and dispose of any property, to order anybody to furnish information on land, to impose and collect tax, to utilise the money for the performance and exercise of their duties and responsibilities, to obtain loans from the government or any other approved credit institution.

Law replaced the Paddy Lands Act of 1958 and provided for appointed membership in Cultivation Committees; the 1972 Land Reform Law fixed a ceiling on private ownership of land to 50 acres (25 acres in the case of paddy land and 50 acres in all other lands) and provided for the take over of all private land in excess; the 1975 Land Reform Law provided for the take over of the Company-owned estates; the 1979 Agrarian Services Act limited the paddy land operations under tenancy arrangements to five acres and gave more powers to the land owner, including relinquishing tenancy arrangements.

### Analysis

First of all, the scheme of interpretation demands a clarification of the three stages, thesis, anti-thesis and synthesis. The system of land tenure as it existed before the reforms and the conventional politics are included in the thesis; the challenges to this order of affairs are considered as anti-thesis, the syncretism caused i.e., the reforms or the structures and actions brought about by the process, is treated as the synthesis.

Secondly, it also requires a clarification on what is meant by the land reforms and the agrarian reforms; following Peter Dorner (1972; 18-19) and Wolf Ladejinsky (1964:356) I have taken land reforms to include all structural changes introduced by the state resulting in changes with regard to land ownership, land ceilings, land control, land consolidation, land registration and land redistribution in favour of small peasants, while agrarian reforms are considered as concerning itself with a much larger arena covering the institutional framework relating to the control of rents, security of tenure, the provision of agricultural extension, credit and marketing facilities, and other services to help small farmers to cultivate their land effectively. In a sense land settlement in Sri Lanka or the settlement of people in new land brought under cultivation through state intervention is also a kind of land reform. But since it does not involve acquisition of developed land of private ownership by the state and subsequent redistribution or alienation of the same by the state in favour of peasants and/or creation of special organizations to manage these lands under specific instructions of the state, I do not consider land settlement as land reforms proper.

In the independent Sri Lanka there have been two major systems of farming with attendant forms of land tenure corresponding to the dual economic structure, the peasant sector and the plantation sector, which Sri Lanka inherited from British colonialism. The picture can be ascertained from the following quantitative data: of the 3.5 million acres cultivated in 1946, 2.3 million acres were under the plantation sector, whilst only a little over one million acres were under the food producing peasant sector (Oliver, 1957).

The plantation sector was characterised by a modern capitalistic system of management; large units of production with processing industries within the production base; contractual forms of work relations as the dominant form of relations, i.e., the existence of a wage earning class of labourers having no claim for ownership of the product and the capitalist landowners managing the properties either by themselves or through corporate bodies, and a dominant resident labour force consisting mainly of Indian Tamils. These features gave the plantations the character of a distinct social system. British capital and management controlled a bulk of the plantations and processing and distribution of the plantation produce. During the post-independent era, Sri Lankans bought most of the privately-owned British plantations, without introducing any changes in the system of management or in production relations. It could only be considered natural as it was part of the acculturation process of the former to adopt the same system (Singer, 1964:85).

The peasant sector which sustained the majority of the population.<sup>1</sup> was characterised by a complex system of land tenure. According to the Survey of Landlessness conducted in 1948, 26.3% of all families dependent on subsistence agriculture in the rural sector had no land at all; 42.3% owned less than half an acre; and 54.1% owned less than one acre. The complex system of land tenure included a system of joint ownership of land (*Havul*), share cropping (*Ande*) tenancy, and a rotational system (*Thattumaru*) and (*Kattimaru*) of land tenure. Furthermore, there were lease-systems (*Badu*) and mortgage-systems (*Ukas*) etc.<sup>2</sup> each having its own tenurial arrangements. In the Wet Zone where the bulk of the population was concentrated and pressure on land was greater, about 20% of the land was jointly owned while the extent of *Ande* tenancy was over 40% in the case of paddy land (Farmer, 1957: 58, 84). In the districts of *Matara*, *Kandy*, *Matale* and *Ratnapura* more than 40% of the holdings and more than 45% of the area were under share-cropping arrangements (Sanderatne, 1972:120). On an islandwide basis, share-tenancy accounted for approximately 25 to 30% of the total acreage devoted to paddy, a figure that remained more or less constant during the past few decades (Peiris: 1976). The overall incidence of rotational land tenure was low, but in some districts of the Wet Zone it was over 36% (Moore & Wickramasinghe, 1978; 12-13; Weerawardena & Kolonnage, 1972:6). In certain other districts such as *Hambantota*, a considerable extent of paddy land was under *de facto* systems of control and management (Dias & Wickramanayake, 1977: 143-54).

The complexities of land tenure in the peasant sector have been accompanied by varying degrees and forms of surplus labour appropriation. As a generalization, it may however be stated that the incidence of share tenancy has been increasing and that the majority of the tenants continued to pay half the share of the harvest to the land owner. The extent of land ownership concomitantly determined one's social status as well as social stratification in this agrarian society where the majority of the population belonged to the *Govigama* (Cultivator) caste, and where non-agricultural employment opportunities were lacking. Therefore, it may be emphasised that the conditions under which land is held have an important bearing not only on productivity and distribution of income but also on the nature of the polity and society at large.

The systems of land tenure elaborated briefly above manifested themselves in the conventional political system at large, in terms of its general attitude towards the class of direct producers on the one hand, and its approach to development on the other. This, I shall analyse in the light of competition for peasant allegiance. To begin with, the major political parties had recruited the overwhelming majority of their parliamentary membership from among the wealthiest sections of the population (Singer, 1964: 81-5; Wriggins, 1960; 115). This included representation of proprietary interests over the existing property relations and therefore the same production relations. Naturally, then, the political leadership of the day demonstrated no necessity to change the system (Silva, 1977: 131). Economically much of the resources and attention was channelled into export agriculture. For example, out of the total allocation of the Ministry of Agriculture, Irrigation

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1. The peasant sector is the food producing sector whose main crop is paddy which forms the staple food of the people of Sri Lanka. 80% of her population live in rural areas.
  2. In addition, there were the encroachers, permit-holders for food production, permit-holders under Land Development Ordinance, *chena* farmers or swidden agriculturalists and various types of service tenure.

and Fisheries, the investment allocation for non-export agriculture was 3.5% while for the export agriculture, it was 69%. (Ceylon Planning Secretariat, 1955). In fact, the country's development came to be identified with the development of export agriculture (Snodgrass, 1966:17). The traditional left, on the other hand, was concerned with the urban working class and the plantation workers, without recognising the revolutionary potential of the peasantry, in view of their classical ideological standing that the peasantry was not a proletariat, (that they have not been separated from the ownership of the means of production; they share land interests with the owners; and they could still own part of what they produce and that they could to a considerable degree, make their own decisions relating to the process of production). They gave relatively less value in their development strategy to agricultural development and advocated a policy of nationalization and industrialization (Silva & Samaraweera, 1974:21). Peasantization (better terms and conditions for the tenants and the peasants; land to the tiller; ceiling on land ownership; collectivization) would produce, according to Marxian ideology, historically regressive results. Because class is determinative of ideology, in the Marxist view, a society of peasants is a society dominated by petit bourgeois ideology. The belief that the plantation worker, by virtue of his position, as the proletariat of the most important economic activity of the island (the plantation sector accounts for about 93% of the total export earnings and nearly one third of the country's national income) could be revolutionized along with the urban proletariat who are engaged in the service activities connected to the export agriculture, led to the creation of social distance between the traditional left and the rural people. However, having realised the organizational power of the left, the power elite organized a twin strategy: the plantation workers of Indian origin were defranchised, thus leaving them out of the political arena and causing the loss of political strength of the traditional left to a considerable extent. Instead of abandoning parliamentary politics at this point altogether, the latter sought to play popular politics during the subsequent years (Obeysekera, 1973: 368-95). Henceforth, competition for peasant allegiance came to play a determinant role in the political and economic life of Sri Lanka. The power elite next demonstrated active participation in programmes of peasantization which included the expansion of the production base through family-farm based village expansion schemes and colonization schemes. According to the Land Commissioner's Department, 408,381 farm families have been settled by 1980 under various schemes of land alienation in an extent of 1,047,800 acres. The present Mahaweli River Diversion Scheme is expected to bring a further 900,000 acres under irrigation.<sup>1</sup> The ideology behind these actions was the concept of 'peasant proprietorship' which envisaged that individuals could conceive economic goals and freely act in pursuit of these. By creating a class of peasant proprietors, the power elite believed that it could establish, if not the identity of interests between the two conservative groups (governing elites and the peasantry), but at least a potentially harmonious working relationship between the two, and thus defeating the left's challenge (Silva, 1974: 2). The polity conceived society and social relations on the one hand, and the role of the state on the other, in terms of liberal ideology, and ruled out the crucial question in land reform, namely interference of the state with property relations (Herring, 1972). Resettlement of peasants on irrigated land in the Dry Zone continued to receive prime interest from the policy makers of the successive governments as solutions to the pressure on land in the Wet Zone and to increase production, among other objectives (Ellman, *et al.*, 1976: 1). In the 'Green Revolution' programme which commenced in the sixties, the state has been playing an

1. As a result of this, the extent under paddy cultivation, which stood at 856,000 acres in 1943 rose up to 1,614,012 acres in 1978. Acreages in the major colonization schemes and minor irrigation schemes which were 325,242 and 338,013 acres respectively in 1959 went up to 564,334 and 423,205 acres by 1978.



active role by subsidising inputs and supplying resources to achieve what has been described as an 'outstanding success', thus making the performance of the domestic agricultural sector 'crucial to the performance of the economy as a whole' (Corea, 1973: 296-297). This can be illustrated from the following statistics: the peasant sector increased its share in the GNP from 26% in 1950 to 69% in 1972; between 1952 and 1974, the output of the dominant crop of this sector, paddy, increased by 166%, while the area under paddy increased by 70% and the yield per acre by 45% (Wanigaratne, *et al.* 1980:2).

The contradictions involved in the process (between land, capital and labour on the one hand, and peasant culture, traditional loyalties and modern systems of management including norms relating to the parliamentary system on the other) brought forward challenges to the existing order. First of all, peasant politicization came by way of a millennialism towards the second half of the fifties. The political, social, cultural, administrative and economic domination by the alien structures (that is, the culturally alienated westernized elites who allowed Christian influence to determine the way in which the resources were distributed) aroused the primordial sentiments of the masses—the peasants—whose cultural identity was inseparably bound up in their religion, Buddhism. In this indigenous social structure, the religious leaders, the *Sangha*, controlled the symbols of identity and hope, and the other leaders such as the *Ayurvedic* physicians and *Sinhala* teachers were also well placed. Threatened by the alien values, ideas, practices and the ruling class' subservience to these, the peasants were now predisposed to reassert their identity in which their religion and language occupied a dominant position. The need for state intervention in economic affairs by way of planning (indirect control), direct involvement and regulation, was increasingly being felt and found expression in the acts of the new government that came to power in 1956 through mass politics (mobilization of the indigenous social structure and the charismatic authority of the power groups in this set up). However, land reforms were not attempted, although the terms and conditions of the tenants received attention. Yet, colonization of the Dry Zone was frequently given the character of a *Sinhala* Buddhist movement towards the reassertion of the past glory and the land lost following the Sinhalese retreat to the Wet Zone after the thirteenth century.

Although the expansion of the production base resulted in an increase in production output (average yield per acre of paddy which stood at 30 bushels in 1955 went up to 53 in 1978) in the new settlement schemes, the same old land tenure systems that prevailed in the villages emerged resulting in the concentration of land in the hands of a few and also rural indebtedness of the majority. The changes in cultivation practices caused by the '*Green Revolution*' package worked to the benefit of the capitalists and the majority found upward social mobility through farming unsuccessful. In the Rajangana Colonization Scheme, for example, for 84 percent of the settler households, the average monthly income from paddy farming was well below Rs. 200/- (Abeyratne, 1972). In 1969/70; 44 percent of non-estate and 59 percent of estate rural households received less than Rs. 200/- a month, which amounted to an average of less than Rs. 40/- per person per month (ILO, 1971:87). The experience resulted in a widespread negative attitude towards agricultural employment. The plantation sector's expansion and its adoption of new technology (especially cloning) exerted further pressure on land in adjoining villages and on employment opportunities within the plantation sector (Sarkar & Thambiah, 1957; xi; Report of the Kandyan Peasantry Commission, 1951). The peasants were now producing for the market and therefore were victims of market manipulation by the middlemen and the businessmen. The increasing prices

and sometimes the non-availability of new chemicals, fertilizers, and other necessary inputs also provided some of the necessary conditions for their being proletarianized (Amin, 1976).

The traditional left, having given up its revolutionary ideologies, came to terms with the power elites: the 'Father of Marxism in Sri Lanka', or the leader of the *Mahajana Eksath Peramuna* (People's United Front) crossed over to the United National Party, the party supporting the presence of foreign capital and its management in the economy; the rest, the Communist Party and the *Lanka Sama Samaja Party* (the Lanka Equal Society Party) formed an alliance with the national bourgeois, the Sri Lanka Freedom Party. The disgruntled groups broke away from the traditional left and formed independent organizations. The new left mainly headed by the JVP, took the revolutionary ideologies, along with criticisms of the traditional left and guidelines on a Sri Lankan revolution to the schools, universities and the rural proletariat, stressing the need to link the oppressed sections of the rural poor with the urban worker. As the government soon fell short of the electorate's expectations and failed to solve the country's problems, an armed struggle headed by the JVP attempted to overthrow the system. The state crushed the struggle. However, major land reforms came as a direct consequence of this armed struggle.<sup>1</sup> Land reform laws were passed in the legislature endorsed by all the parties in the Parliament. Under the Land Reform Law No. 1 of 1972 which imposed a ceiling on privately held land ownership to 50 acres, 563,411 arces (of which 386,895 acres were already cultivated) were to be vested in the Land Reform Commission; the Land Reform (Amendment) Law of 1975 resulted in bringing further 415,508 acres of company-owned estates under the Land Reform Commission (Abeysinghe, 1976).

However, lands belonging to temples, shrines, churches, mosques and trusts were exempted from the Land Reform Laws. *De facto* systems of land control such as *Gambara* system also did not come within the purview of these laws. On account of the small holdings in the paddy agriculture, hardly any paddy lands came within the reform laws, anyway. Nevertheless, it must be noted that about 60% of the acquired land was under export agriculture and 85% of these was within the densely populated Wet Zone where cultivable land has been nearly fully utilized (Peiris, 1975).

The synthesis can be explained in terms of alienation of land:

- (a) categories of land exempted from the land reform legislation, and
- (b) management of land which came to be vested in the Land Reform Commission under this legislation.

The lands that remained unaffected by the reform were those belonging to religious and charitable organizations. The organizations, in social relational terms, were social structures in more than one sense: firstly, they were cultural in the sense that they were part and parcel of peasant culture predicting particular ideational relations or normative behaviour; secondly, they were economic relations permitted to survive through the changes that were being introduced. Thus, both culturally and economically there were structures left 'unaffected' which were conforming to the conservative model of social relations. By leaving these 'structures' to survive, the

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1. A personal discussion the writer had with Mr. Mahinda Silva, the then Secretary to the Ministry of Agriculture and Lands, revealed that the idea of land reform was being seriously considered before the insurrection broke out. However, it is important to note that the insurrection and its process of development, would have quickened the legislative action in this connection.

state ensured the existence of a force of resistance within the peasant society, itself. Further, the nationalization of other lands also meant a reduction of economic support that these institutions had been receiving from the land-owning elite. In the circumstances, although these particular structures were not affected theoretically, that in itself did not mean that they were unopposed or indifferent to the reforms. This had important implications for the reforms despite the fact that the peasant sector as a whole did not lose its own land by virtue of its small fragmented holdings. The problems perceived primarily in economic terms were the result of the secularization of both religion and polity, and was a jealously watched phenomenon by the former. Thus, on the one hand, the exclusion of the traditional power structures left the peasants to be essentially peasants; on the other hand, on account of secularization these power structures were bitter about the state's demonstrated preference on circumscribing its area, leaving political and economic matters for the state's own concern. In essence, therefore the reforms did not correspond to progressive development in this area. *De facto* systems of land control having not come within the purview of the reforms continued to exploit the peasantry. In principle, it was successfully competing with the idea of nationalisation or 'socialization' of means of production. The peasant production relations thus being basically unaltered, reinforced resistance to change, and helped in the reproduction of the general power structure of rural society.

The other front is concerned with what was done to the land that came under the reforms. As a result of nationalization being interpreted by the state as 'people's property,' the peasantry was expecting that all acquired estates would be distributed among the people. However, the state decided upon a three-part management scheme: individual peasant holdings, collectivisation and large production units. To begin with, the land reforms came by as an abrupt response to the crisis situation: the insurgency. There was no intent of land reform in the government election manifesto; the programme of reforms was carried out within a short period of time, under emergency regulations; and the government did not have a specific plan of action as to the management of land that came to be held by the Land Reform Commission. A majority of the acquired estates being crucial to the country's foreign exchange earnings, the state could not give into the popular demand for redistribution. In the circumstances, the state had to rely upon its bureaucracy both in the drafting of the programme of land reforms and in the implementation of it. In this situation, the bureaucracy being in sharp contrast to the traditional patron-client type of social relations, it was confronted by rural social structures in general and rural power structures in particular. The sections of the peasant population that received land under redistributive schemes of the government, either on an individual or collective basis, were now caught up between their new masters (the bureaucracy) and new socio economic organisations, and their original social situation that is the wider village society in which they live as opposed to the situations where they work in the new organizations.

The new society that was being experimented within isolated pockets surrounded by villages that were under the sway of capitalism in terms of production for the market, rejuvenated certain traditional principles of social organization relating to labour mobilization and mutual trust and co-operation. They also received continued government support and services which were not so readily available to the wider peasant society. The contradictory elements that were inherent in this exercise were: (a) stress of tradition without respect to the variation of time and activity; (b) discrimination; (c) misconceived relationship between the micro and macro society and economic ideologies. In the first place, although the reassertion of traditional ideology and identity in terms of collectivisation was attractive to the

peasantry in general, it proved to be of no success in practice for the very meaning of traditional principles could not be conceived due to the historically different stages of the contemporary society. Secondly, government support to the collectives was perceived as a waste by the wider peasant society where the majority of the people lived and problems prevailed. This practice acted against the emergence of a sense of self-reliance that it tried to create because of dependency upon the government machinery; it also did not promote intergation with the villages; instead it created a rift. Thirdly, it was considered that although these schemes were smaller in scale and in number, it would create a demonstration effect, as in the extension methodology, upon the villages gradually transforming the wider society into one based on co-operative forms of social organizations. As time passed by, it proved otherwise. The economic ideology relating to collectivisation was attempted at a time when the macro economy was being increasingly organized on the principles and ideology of capitalism. Moreover, in the places where it was attempted, the very binding principles relating to co-operation worked to undermine its own success, for the observance of such principles as mutual trust and co-operation led to the denial of the general members' access to check the account books, etc., and surplus labour appropriation by outsiders. The surplus labour appropriated by the outsiders or the central administration was redistributed to some of the other similar organizations under the principle of mutual aid, but also in turn brought about undesirable results which demoralized and discouraged the ordinary members.

Collectives and their administrative framework were not the only institutional changes introduced. Concomitant to the reforms were some institutional changes which included the creation of Agricultural Productivity Committees and Cultivation Committees comprised of appointed membership. The District Political Authority created in 1972 had a Member of Parliament as its head and had wide powers regarding the allocation of funds. The state bureaucracy was thus brought into work in close collaboration with the peasantry, their representatives and their policy makers. But here again the problem mentioned before namely, that of secularization versus politicization in the context of an agrarian society, resulted in the ultimate collaboration between the bureaucracy and the polity. This left the ordinary peasant at the receiving end, rather than involving him in the decision-making process relating to production, distribution, management and construction. The rural power structure, the bureaucracy and the higher level political structure, mutually reinforced each other and accumulated facilities and benefits which otherwise would have accrued to the peasants. The bureaucratic redefinition of the concept of villages (co-operative, traditional) into various terms (*Janawasa*, *Samupakara Gammuna*, *Samuha Govipola*, *Samuha Nishpadana*, *Sanwardana Mandala* and so on) contributed more to the intensification of and the increase in the process of bureaucratization. Although these were conceived as being different to the ordinary villages in terms of their organizational structure and progressive stage of development, the paradox was the necessity for integration. The sons and daughters of the ordinary villagers were recruited, but they also brought along age-old village problems like family feuds etc., into these schemes. The bureaucratic structures of the new villages failed to unify the factions. They instead found it easier to manage them through a policy of divide and rule, which was contradictory to the attempted ideal of reconstructed village. By the end of the decade, the new villages had been dissolved and a process of villagization (decollectivisation) was set in motion, which gave individual allotments and removed the bureaucracy furthering the process of capitalization. However, even if half of the land controlled by the Land Reform Commission was redistributed as individual allotments, it would have meant only a marginal increase in the peasant sector (Peiris, 1975), while the problems of this sector would still remain as before (Goonaratne & Samad, 1979:277-91).

It was decided that the best productive estates were to be managed as before with the only change being in terms of service personnel. Although the extensive privileges that the managers and superintendents had enjoyed were reduced to some extent, they were restored before the decade elapsed. While some of the estates were returned to the former owners, the management of the majority of the rest was given to the former owners or their managers. The estates that were still under government control were managed by special bureaucratic organizations created for this purpose. All in all, in the case of the plantations, there have been no fundamental changes and the so-called peasant-workers alliance did not occur despite villagers receiving employment opportunities in these estates. A peasant, in such cases, may also be a plantation worker, and a plantation worker may also be hired by the peasant. These economic relations however did not permit a political consciousness to develop. Instead, a new form of patron-client relationship and factionalism emerged. The old problem of enmity between the up-country peasant and the Indian plantation worker was further intensified, with the latter getting his long time unclassified and uncertain legal position of being 'stateless' workers on the state-owned plantations now resolved. The subsequent developments witnessed the incorporation of the leader of the Indian Plantation Workers' Union into the ruling party's cabinet of ministers and granting of voting rights to these workers. Yet, it did not promote 'class consciousness'; on the contrary, politicization along popular politics led to further development of factionalism. This was the converse of institutionalization and consolidation of old structures through reforms.

In conclusion, land reforms represented a convergence of political opinions in the sense that all the major political parties endorsed the programme of land reforms. However, agreement on the policy level does not assure a synthesis of actual forces at work. In effect, it served to further the process of Sri Lankan mode of capitalistic development with its attendant forms of factionalism and patron-client bondages. This was important in an agrarian society where competition for peasant allegiance is crucial for the reproduction of the *status quo*. These reforms, contrary to popular belief, did not create conditions under which the peasants became revolutionary, but reproduced relations which were essentially old structures.

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## AGRICULTURAL INSURANCE IN SRI LANKA

By

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### ABSTRACT

*Successive Governments in Sri Lanka since Independence recognised the need for comprehensive measures to overcome the chronic problems endemic in peasant agriculture and took action in various ways to provide relief for small farmers who were subjected to severe hardships and impoverishment. Among the measures adopted were changes in tenurial conditions, guaranteed price schemes, subsidized agricultural input programmes, construction and improvement of irrigation systems and the expansion of institutional credit schemes.*

*Since one of the basic risks associated with peasant farming in Sri Lanka was the uncertainty of yields as a result of climatic and other factors, the possibility of protecting the capital laid out by the farmer and his efforts, and ensuring the stability of farmers' incomes also received special attention of the Government in the late 1950s. As a result of this special concern, the services of a FAO Adviser were obtained for the purpose of advising on a scheme of agricultural insurance that would protect farmers against damage or loss to their crops resulting from the vagaries of nature and other hazards. This FAO Adviser, after a careful study of local conditions and problems, presented his report to the Government which was published as Sessional Paper XIV-1957. This report advocated the adoption of crop insurance on an experimental basis. Thus, Sri Lanka became the first country in South East Asia to adopt crop insurance as a strategy for providing relief to farmers who suffered loss or damage to their crops as a result of inclement weather, floods, droughts, pestilence, disease or damage by wild animals. It was first introduced in 1958/59 on an experimental basis in respect of paddy lands in selected districts and thereafter extended to other areas on the basis of the Crop Insurance Act No. 13 of 1961. Eventually, in 1974 this Crop Insurance Scheme was replaced by a more comprehensive compulsory scheme under the Agricultural Insurance Law No. 27 of 1973. Some aspects of these two schemes and the difficulties encountered in their implementation are discussed below.*

### **The Crop Insurance Scheme**

The Crop Insurance Scheme was introduced into Sri Lanka with the 1958/59 *Maha* season as a pilot project and on an experimental basis. Its main objective was to carry out experimental schemes of crop insurance, commencing with paddy only, with a view to gaining experience in its working so that in course of time appropriate systems of such insurance could be evolved and established for the whole Island.

The insurance was to guarantee for producers of crops—paddy in the first instance—protection against average or normal physical losses from natural hazards beyond the control of the producers, in return for an annual contribution to be paid by them. Abnormal or extraordinary losses were, to the extent of their excess over the average or normal losses, still to be covered by insurance but the extra cost of such extraordinary losses was to be borne by the Government as part of its relief operations.

In fixing the aggregate area of experimentation as well as in allocating it to different parts of the Island the following three basic principles were observed:

- (a) the aggregate pilot area was of the smallest scale possible consistent with a reasonable spread of risks and with its usefulness as an experimental measure.
- (b) the aggregate area consisted of smaller areas typical of the whole Island as far as possible, leaving out excessively high risk districts or high risk divisions and tracts within districts, and
- (c) the different areas had reasonably workable data to start the insurance and a fairly dependable administration.

On this basis, the pilot project was limited to cover approximately 25,000 acres of paddy in 6 districts, namely, *Hambantota*, *Anuradhapura*, *Colombo*, *Kegalle*, *Amparai* and *Batticaloa*, for a period of four years. The principles governing the operation of the project were that

- (a) the insurance was an “all risk” insurance, in terms of which farmers were given protection against physical losses of crops resulting from all natural hazards, including pests and diseases, beyond their control.
- (b) the insurance applied only against large-scale losses in quantity, that is, when the losses exceeded 30 per cent of the estimated or appraised long-term average yield. All losses in excess of this percentage were to be indemnified to the extent and in proportion to the full insurance amounts.
- (c) the insurance was compulsory for all paddy growers, that is, all owner-cultivators, landlords, and tenants as defined in the Paddy Lands Act, in areas declared to be under insurance and were automatically brought within the scope and benefit of insurance.
- (d) the insurable acreage and interest of each paddy grower was determined separately from acreage reports which he was required to submit at the beginning of insurance and thereafter when a change had occurred in the insurable acreage and interest already established.
- (e) the actual amounts of insurance cover as well as the premium rates per acre were determined by districts, by revenue divisions and also, where necessary, by homogenous areas or tracts within a district.

The Crop Insurance Act No. 13 of 1961 provided the necessary legislative authority for the operation of the scheme and also provided for the possibility of extending the insurance cover to certain valuable cash crops like chillies, cotton and tobacco (Ray 1971:12).



From the 1962/63 *maha* season, the Government decided to gradually extend the Scheme to cover the entire paddy acreage in Sri Lanka and brought another 65,000 acres in the five districts of *Kalutara, Kurunegala, Matara, Ratnapura* and *Vavuniya* under insurance. The Scheme was further extended with the 1963/64 *maha* season to cover another 200,000 acres in the five additional districts of *Badulla, Galle, Kandy, Jaffna* and *Trincomalee*. The total number of districts covered by the Scheme was then 16.

The Department of Agrarian Services was entrusted with the operation of the Scheme and provision was made for an advisory board which included a representative of the farmers and a person experienced in insurance matters. Cultivation Committees established under the Paddy Lands Act, and where Cultivation Committees were not available, Multi-Purpose Co-operative Societies were appointed as Insurance Agents at the field level.

All persons having interest in paddy lands in the areas specified by the Minister were automatically brought under the Scheme, and both owners and cultivators were included. The premia as well as indemnities were based on the respective shares of the crop, and insurance protection was offered against lack of water, drought, floods, disease, and other hazards.

An uniform premium rate of Rs. 6/- per acre was payable by the farmer. Since it was considered that indigent farmers might not be able to pay the premium in advance of cultivation, as was the normal insurance practice, he was granted the concession of paying it after the harvest, in cash to the Cultivation Committee or in the form of paddy to the Multi-Purpose Co-operative Society when deliveries were made under the guaranteed price scheme. The premium was not required to be paid for any insurable land that was not cultivated during a season, provided the Cultivation Committee or the Multi-Purpose Co-operative Society concerned had been duly informed. Provision also existed for the grant of a rebate on premium if there was no loss over a period. In case of damage to the crop, such damage had to be notified to the Cultivation Committee or the Multi-Purpose Co-operative Society concerned within a specified period of the occurrence of the damage. Indemnity, however, was payable only if the loss was such that the yield from the insurance unit was less than 70% of the acreage yield for that unit—an insurance unit being all the paddy lands within a Cultivation Committee area in which a person may have an interest. Only 15% of the coverage was payable for any loss at the early stage, 70% for the loss occurring before flowering, and 100% of the insurance cover where the loss occurred after flowering.

The insurance experience of the first six years, 1958/59 to 1963/64 was quite favourable, as the total amount of indemnity payments was less than the total amount or premium collection even though such collection fell far short of premia due and amounted to only about 35%. Perhaps, in no other country has the experience in the initial years of the comprehensive crop insurance been as favourable as in Sri Lanka. This, however, was largely due to the inauguration of the scheme on a limited and experimental basis and also due to the favourable weather conditions during this period.

In 1964/65, the total indemnity payments for both *maha* and *yala* crops amounted to nearly Rs. 1.4 million as against total premia due of Rs. 1.61 million, of which Rs. 460,200 or 30.3% were actually collected. In 1965-66, however, for the first

time, indemnities paid out exceeded not only premia collected but even premia due. Even so, the total of premia collected almost doubled over the previous years for approximately the same gross insurable (*maha* and *yala*) area.

During the 1958/59 to 1965/66 period, the aggregate indemnity paid to farmers and the commissions paid out of premia receipts to the Insurance Agents amounted to Rs. 4.21 million as against the premia collection of nearly Rs. 2 million. If, however, all the premia payable had been collected (Rs. 5.12 million) not only could all the indemnity payments have been made without taxing Government funds, but there would also have been a surplus of Rs. 0.91 million for the reserve fund.

It is generally recognised that no insurance, much less an "All-Risk" crop insurance scheme, can be expected to balance itself each year through the equalization of premia collected and indemnities paid. It has essentially to balance itself over a longer period of 15 to 20 years. Till the 1965/66 financial year (i.e. in 8 years) the Government had incurred a total expenditure of Rs. 4.5 million (i.e. Rs. 3.31 million as grants and subsidies, and Rs. 1,186,030 as administrative costs), or an yearly average of Rs. 562,000/-. On the other hand, during the same period, farmers had paid a total of Rs. 2 million as premia, i.e. for every Rs. 1.00 paid by the farmers, Government had paid an additional Rs. 2.25. If however, all the premia due from the farmers had been collected, no premium subsidy would have been required and the only cost to Government would have been the administrative costs.

The failure to collect the appropriate premia was partly due to the reluctance on the part of the farmers to pay, because of the novelty of the scheme and the lack of appreciation of its real benefit and value. There were some farmers, particularly in the low risk areas who did not accept a uniform premium rate in both high and low risk areas. There were others who contrived to get an extra service out of Government without making any payment at all. There was also the inadequacy of both legislative and institutional arrangements for enforcing the repayment.

Among the other major problems that militated against the successful implementation of the scheme were:—

- (a) the absence of reliable and accurate data in relation to paddy lands and persons having interest in such lands,
- (b) the frequent fragmentation of the insurance unit by the distribution of several plots of land held by one person in a specified area among his relatives in order to qualify for claim on the loss occurring on one single plot,
- (c) false claims in respect of lands not cultivated and not reported to the Cultivation Committees, often with the connivance of the latter,
- (d) corruption among some of the Cultivation Committee members themselves,
- (e) undue delays in the making of indemnity payments,
- (f) lack of knowledge and awareness on the part of farmers and others concerned in regard to the real nature and importance of crop insurance, and
- (g) lack of adequate trained and competent staff both at the centre and at the field level to implement the Scheme properly.

Although all these, except the last one, could perhaps have been resolved through better institutional and administrative arrangements and proper progress control, no effective remedial measures were taken, and consequently, a valuable scheme for the benefit of the farmers failed to achieve the desired results.

Owing to the shortcomings of the Crop Insurance Scheme and its failure to achieve the desired results, a special committee was appointed in 1969 to review the situation and to recommend an effective and comprehensive scheme of crop insurance. This committee recommended the extension of the paddy insurance scheme on a compulsory basis throughout the Island in both seasons—*maha* and *yala*—with varying premia rates, depending on the risk factor and worked out on an actuarial basis. It also recommended that the premia rates should not exceed Rs. 30/- per acre and that the coverage of other crops and livestock should be made optional.

### The Agricultural Insurance Scheme - 1974

The Agricultural Insurance Law No. 27 of 1973 embodied these recommendations and came into operation in April 1974, on which date the Crop Insurance Act No. 13 of 1961 stood repealed. The Agricultural Insurance Board, consisting of a Chairman appointed by the Minister of Agriculture and Lands, a nominee from the Ministry of Agriculture and Lands, the Director of Agriculture or his nominee, the Commissioner of Cooperative Development or his nominee, an officer from the People's Bank, Bank of Ceylon, and an officer of the Paddy Marketing Board, was also established to implement the Law.

In March 1975, a compulsory insurance scheme for paddy cultivation in the Island (consisting of approximately 2.2 million acres cultivated in 2 seasons) was inaugurated. The newly constituted Agricultural Productivity Committees (APC) were entrusted with the task of implementing the scheme at the Village Committee level which included the collection of premia, providing necessary facilities for reporting damages, assessment of damages and payment of indemnities received from the Board. In this task the APCs were assisted by the Cultivation Committee which covered a smaller area under each APC.

Damage rates and coverages were determined for different areas of the country on the basis of available statistics. The rates were originally determined on acreage harvested as against acreage sown, and consequently partial damage to crops harvested was not taken into consideration even though indemnities were paid for partial damage. The rates were later revised on the basis of information available on partial damage and choice was given to the APC to select one premium and coverage level among several, before the commencement of *maha* 1976/77 season. Premia rates in all districts were kept between Rs. 5/- and Rs. 30/- per acre per season, and payment was made by a farmer in terms of the shares he held (Senanayake 1978:3).

Under the direction of the APC, premia collected in each Cultivation Committee area were handled by an officer of the Cultivation Committee or a nominee of the APC. Information in regard to the premium to be paid by each farmer for each season in respect of each parcel of land owned or cultivated by him had to be recorded in the premia register prepared on the basis of information contained in the

agricultural lands register which was to be maintained in terms of the Agricultural Lands Law No. 42 of 1973. The premia that were accordingly collected were credited to the bank account of the Agricultural Insurance Board, while the APC got a commission of 10% of the premia collected for itself and its collection agents.

A loss notification and indemnity computation register was maintained by all APCs for each Cultivation Committee area so that farmers could report damages to crops arising from the following seven insured causes, namely (a) excess of water, (b) lack of water, (c) floods, (d) drought, (e) pest, (f) diseases, and (g) wild animals and birds. The damage to crop was assessed on an eye estimate, about two weeks before harvest, by a committee comprising an APC representative, a CC representative and an experienced farmer of the area. A separate report on damage to crops in a tract or *yaya* was obtained from a committee headed by the Grama Sevaka and consisting of one representative each from the APC and CC. The report was on the basis of an eye estimate. It was originally intended that the total damage to crops indicated in the second report would be indemnified by sending the total amount of indemnity to the APC who would then indemnify the individual farmers in its area according to the first report. This procedure was however, abandoned in practice for two main reasons:—

- (1) Absence of total participation in the insurance scheme in spite of provision for the compulsory insurance of all paddy lands, and
- (2) Inability to make a fair assessment of both reports and the payment of indemnities thereafter.

Besides, there were many problems connected with the implementation of this agricultural insurance scheme, chief of which were the following:—

- (1) The computation of damage rates was based on the statistics collected seasonally by the Department of Census & Statistics from Cultivation Committees, which was not altogether satisfactory.
- (2) The districts and their subdivisions had been demarcated for general administrative purposes. As a result, information of damage and yield could not be related in a reasonable manner to areas which did not have uniform agro-climatic conditions.
- (3) The insurance unit for the purpose of computing premia and indemnities was the Cultivation Committee area which was not demarcated on the basis of uniform agro-climatic conditions. The tract or *yaya* was a geographically compact unit with a fair degree of uniformity in yield and risk potential and a better unit for insurance purposes. The existence of around 60,000 *yayas* in the Island, however, necessarily meant that such a scheme could not be properly implemented without computerization.
- (4) Eye estimation of damage to crop was not always firm and reasonable owing to the lack of recognized criteria for such estimation and the superficial nature of the exercise (an effort was being made to provide training for APC and CC representatives and farmers to improve their skills in this direction under the Sri Lanka-SIDA Technical Assistance Agreement).

- (5) Insurance as a form of co-operation and mutual self-help ran counter to the tradition of subsidies which farmers had got used to over the last three decades. Statutory provision for the payment of premia by one million farmers was therefore of little practical value without a sustained and effective programme to popularise the Scheme and educate them on its advantages and benefits.
- (6) The APC and the CC which were responsible for the implementation of the Scheme were themselves in their formative years and were unaccustomed to keeping proper office records, submitting reports, as required and on time, and adhering to acceptable systems and procedures.
- (7) The lack of proper training and orientation and commitment of the government officials serving the agricultural sector handling credit, distribution of inputs, extension, planning agricultural development and helping rural institutions was also a serious drawback.

The Agricultural Insurance Board recognized these problems, and made certain fundamental changes in the administrative set-up in 1978 so as to facilitate the achievement of the desired goals. The proposed changes had special regard to the hazards of the compulsory insurance of nearly 2.2 million acres of paddy lands cultivated in two seasons by nearly one million farmers and included the establishment of a Board of Management at executive level besides the Agricultural Insurance Board at the Head Office, establishment of seven regional offices, appointment of Assistant Directors in charge of districts and the launching of special projects for the insurance of sugar cane, tobacco, cashew, cotton and subsidiary food crops. The Board also decided to get actively involved in the special area development projects such as *Mahaweli*, *Kaluganga*, *Gin Ganga*, *Uda Walawe* and the proposed *Kelani Ganga* and *Deduru Oya* diversion schemes.

The Board also decided that where the Cultivation Committee Agents had proved unsatisfactory, it would appoint its own premia collecting agents on a commission basis, and also provide APCs with full-time Field Assistants to maintain their records and engage in field supervision. It also decided to establish regional offices, manned by professionally qualified Accounts Officers, to supervise the work of their respective regions so as to ensure that all returns were sent in time and indemnity payments were made without delay. 50 Loss Adjusters trained by Swedish Experts were also posted to the districts and action was being taken to replace the eye-estimation method with crop cutting surveys. Meanwhile, under an agreement between Sri Lanka and Sweden, facilities were obtained for training officers in statistics, actuarial and insurance methods, farmer education, livestock insurance etc., and the services of experts and essential equipment from abroad were also obtained to ensure the effective and comprehensive implementation of the Agricultural Insurance Scheme.

In spite of these measures, however, very little progress was made. Although insurance of all paddy lands was made compulsory by the Agricultural Insurance Law of 1973, the provisions of the law were never enforced because of practical difficulties. There were large numbers of farmers who did not accept the Scheme and the Board found it impossible to prosecute around 800,000 individual farmers

every season for non-payment of their premia. Moreover, it was politically suicidal for any Government to permit such a step against the overwhelming majority of the small farmers in the country. As a result, the choice of insurance was left to the individual farmers, and what in practice happened was that there was a high rate of insurance from the high risk areas and a low rate of insurance from the low risk areas. Although initially, higher rates of premia were proposed for all areas, Members of Parliament who represented low risk areas protested against this and the Cabinet of Ministers decided in 1975 that the maximum premium chargeable should not exceed Rs. 30/- per acre. Since the Scheme was based on the insurance of the entire extent of paddy lands in the high risk, medium risk and low risk areas and since it was envisaged that the heavy liabilities in the high risk areas could be offset by the income from premia from low risk areas, the balancing of losses became impossible and the viability of the scheme itself was seriously impaired.

In order to minimize the adverse effects of the non-enforcement of compulsory insurance and the limitation of the premium rate artificially, a system of pro-rationing (i.e. the calculation of the total indemnities payable in a given area on the basis of the premia collected in that area) was introduced by the Agricultural Insurance Board but, this system had to be abandoned in 1978 owing to political pressures. Unfortunately for the Board, soon after this abandonment, the paddy cultivation was disastrously affected by a cyclone, and the indemnity claimed by the eastern province alone for the 1978/79 *maha* season exceeded Rs. 4 million. The reserve fund of the Board which stood at Rs. 3.5 million was completely exhausted in meeting the indemnity claims for 1978/79 *maha* season and the position of the AIB became precarious. A request of the Minister of Agricultural Development and Research to the Cabinet for a 40% premium subsidy was referred to a sub-committee of development secretaries who were appointed to review the past operations of the Agricultural Insurance Scheme since the establishment of the AIB, to examine the premium rate structure, farmers' participation and indemnities paid, to examine the basis of revised premium rates and coverage for paddy, to explore the possibilities of providing agricultural insurance services to paddy farmers at a reasonable cost, to examine alternative measures for compensating paddy farmers against crop losses/failures, and to cover any other matters of relevance.

The study of the sub-committee in due course confirmed that

- (a) although insurance of all paddy lands was made compulsory by the Agricultural Insurance Law of 1973 the provisions of the law were never enforced.
- (b) there were practical difficulties in enforcing the law because large numbers of farmers did not accept the Scheme and it was not possible for the Board to prosecute almost 800,000 individual farmers every season for non-payment of premia.
- (c) it was politically unwise for the Government to take such action against such a large percentage of the farming community of the country.
- (d) since the Scheme was based on the insurance of the entire extent of paddy lands in the high risk areas and the off-setting of losses in high risk areas from income from premia from the low risk areas, the viability of the Scheme collapsed because farmers in the low risk areas did not join.

- (e) the removal of the system of pro-rationing (i.e. the calculation of the total indemnities payable in a given area on the basis of the premia collected in that area) also contributed to the collapse of the Scheme and considerable hardship to the Board, and
- (f) that the AIB's undertaking of the entire loss assessment through its own officials was impractical and involved both organizational and technical problems.

The sub-committee's recommendations to overcome these difficulties included the appointment of the Agricultural Service Centre as the implementation agency of agricultural insurance at village level which would collect the premia, assess the damage on an individual basis and make the payment from a block sum received from the AIB. It also recommended a rational system of incentives for village level officers and the ASC committee members participating in insurance work, and an incentive scheme for the non-claimant insured persons. In regard to technical matters, the sub-committee recommended among others, the maintenance of premium rates within Rs. 20/- in low risk areas and within Rs. 125/- in high risk areas, the limitation of coverage in a given area to the value of 75% of the standard yield, the relinking of bank loans and insurance coverage, and the linking of fertilizer subsidy with crop insurance.

The performance of the Agricultural Insurance Scheme was again reviewed in 1980, and the findings of the review team were again that the AIB was not geared to achieving its principal objectives, namely, (a) the promotion of agricultural production, (b) the stabilization of farm incomes, and (c) the undertaking of research necessary to promote agricultural insurance<sup>1</sup>. It was also found that the farmers had lost the confidence they had placed in the AIB and that their participation in the Scheme had consequently dropped drastically over the seasons. Moreover, the AIB had become a burden to the Government which directed that the AIB should implement a development plan to arrest this situation and make itself a financially viable institution.

This development plan which the AIB consequently introduced in 1981 *yala* season was evaluated two seasons later in 1982. It was found that the AIB had categorized all the ASCs into "permanent risk", "high risk", "medium risk", and "low risk" areas and that coverage levels and premia rates had been fixed on the basis of risk factors. None of the ASCs had however fallen into the "permanent risk" category because of the inability of the AIB to go down to the least possible unit, i.e., the *yaya*, for want of reliable agricultural insurance statistics below the ASC level. It was encouraging, however, that the AIB had since taken action to maintain data on coverage area-wise so that it would be possible in the future to exclude permanent risk coverage areas from insurance.

It was also revealed that the indemnification procedure adopted on the basis of the stage of loss had positively contributed to improve the finances of the Board and to keep the loss ratios at minimum levels. It was also recognised that it was in keeping with the principle that insurance covered only the cost of production up to the time of loss and not the expected income.

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<sup>1</sup> Evaluation Team: Report on the Development Plan of the Agricultural Insurance Board, Mimeo, 1982.

In the case of premia collection, the payment of a commission of 6% to COs, DOs and ASC clerks had encouraged them to spend more time on insurance work, while the stoppage of payment of a commission to lending agencies had not discouraged them in this work.

As regards loss assessment, the appointment of a committee, comprising representatives of the Board, the KVS and the CO of the area, to assess loss had not only increased the accuracy of the estimates but had also reduced bias and favouritism. At the same time, the decentralization of the payment of indemnities in the three districts of *Kandy*, *Kurunegala* and *Galle* had also been successful and had resulted in expeditious settlements.

Nevertheless, in order to be realistic, the success or failure of the insurance scheme should be evaluated in terms of the two most important factors, namely, (1) the percentages of farmer participation, and (2) the loss ratios. According to the district-wise percentages of participation in 1981 *yala* and 1981/82 *maha* seasons, along with the corresponding figures for 1980 *yala* and 1980/81 *maha* vide-Table I—it is seen that there is a sudden drop in farmer participation in 1981 *yala* season except in the districts of *Kalutara*, *Ratnapura*, *Trincomalee* and *Polonnaruwa*<sup>1</sup>. This drop in participation has, however, been attributed to four principal reasons:

- (i) The loss of farmers' confidence in the AIB when they did not receive the anticipated indemnities as a result of the re-introduction of the proration of indemnities based on district-wise premia collection in 1980/81 *maha* season, of which they had received no prior intimation.
- (ii) The reluctance of farmers to insure their crops because of the introduction of new coverage rules and premia rates which had resulted in the reduction of the coverage of certain ASCs while the corresponding premia rates had increased three to four times,
- (iii) Failure of the AIB to take action against defaulters, and
- (iv) Delays in the payment of indemnities.

Although farmer participation in 1981 *yala* had recorded a drop, 1981/82 *maha* season had recorded a relatively high percentage of participation in all the districts except *Galle*, *Matara* and *Kalutara*. Nevertheless, it must be conceded that the overall percentages of participation achieved for the whole Island in 1981 *yala* and 1981/82, *maha*, namely, 3.9% and 5.7% respectively are not satisfactory for a compulsory insurance scheme. Yet, it is hoped that this increasing trend in the percentages of participation would continue over the next few years and contribute to the stability and success of the Scheme.

As regards the loss ratios, the position district-wise since 1980 *yala* is presented in Table II. It will be noticed that there is a significant decrease in these ratios which is a desirable feature of an insurance scheme. While the decrease in the standard deviation of these ratios indicates that the differences between the districts are low, the decrease in the ratios themselves confirms that there has been a decrease in adverse selection during these two seasons. These trends are also encouraging, and it is hoped that, with appropriate attention and direction, the Insurance Scheme could be made a viable proposition and a real boon to farmers of this country.

<sup>1</sup> Evaluation Team: Report on the Development Plan of the Agricultural Insurance Board, Mimeo, 1982.



Table 1 Percentages of Farmer Participation

<i>District</i>			<i>YALA 80</i>	<i>MAHA 80/81</i>	<i>YALA 81</i>	<i>MAHA 81/82</i>
Colombo	...	...	1.80	1.20	0.60	1.00
Gampaha	...	...	1.80	1.70	0.42	2.00
Kalutara	...	...	3.00	1.10	1.38	0.50
Kandy	...	...	12.80	12.20	7.36	7.00
Matale	...	...	6.00	7.10	3.64	5.30
Nuwara Eliya	...	...	6.50	15.30	0.54	1.50
Galle	...	...	8.00	5.30	1.48	0.80
Matara	...	...	3.10	2.20	0.96	0.70
Hambantota	...	...	9.60	5.60	4.39	6.00
Jaffna	...	...	32.90	1.30	0.00	0.80
Mannar	...	...	0.00	25.40	0.00	16.30
Vavuniya	...	...	0.00	0.93	0.00	9.00
Mulativu	...	...	0.00	1.00	0.00	1.10
Batticaloa	...	...	4.50	3.00	1.43	2.00
Ampara	...	...	3.30	2.40	1.08	2.10
Trincomalee	...	...	4.30	3.30	3.37	3.60
Kurunegala	...	...	6.90	4.10	2.64	5.00
Puttalam	...	...	4.90	3.30	1.29	3.00
Anuradhapura	...	...	14.40	19.80	8.25	13.80
Polonnaruwa	...	...	8.00	10.00	12.15	17.00
Badulla	...	...	7.00	18.00	0.91	1.00
Moneragala	...	...	5.00	6.00	3.00	5.40
Ratnapura	...	...	5.30	3.50	3.91	5.00
Kegalle	...	...	27.70	8.70	7.48	3.20
Sri Lanka	...	...	7.10	6.00	3.81	5.74
Mean	...	...	7.36	6.76	2.76	4.71
Variance	...	...	61.05	43.58	9.57	22.40
Std, Deviation	...	...	7.98	6.74	3.16	4.83

Source: Evaluation Team Report 1982

**Table II**  
 Loss Ratios — Indemnities Payable  
 Premia Collected

<i>District</i>			<i>Yala 80</i>	<i>Maha 80/81</i>	<i>Yala 81</i>	<i>Maha 81/82</i>
Colombo	...	...	2.24	2.99	1.46	0.81
Gampaha	...	...	1.63	0.91	0.99	0.19
Kalutara	...	...	3.71	1.77	1.37	*
Kandy	...	...	1.68	1.81	0.50	0.55
Matale	...	...	4.87	1.07	2.13	0.81
Nuwara Eliya	...	...	3.22	1.72	0.54	0.71
Galle	...	...	2.08	2.18	1'04	—
Matara	...	...	2.22	1.16	0.26	0.34
Hambantota	...	...	2.37	0.06	0.01	0.28
Jaffna	...	...	0.05	3.24	—	0.85
Mannar	...	...	—	2.27	*	*
Vavuniya	...	...	—	4.66	—	0.30
Mullativu	...	...	—	0.42	—	0.09
Batticaloa	...	...	1.08	1.73	1.68	0.78
Ampara	...	...	2.29	1.70	1.35	1.30
Trincomalee	...	...	1.22	2.69	0.40	0.61
Kurunegala	...	...	2.21	0.54	0.86	1.53
Puttalam	...	...	3.18	1.15	2.40	2.10
Anuradhapura	...	...	1.52	1.64	0.70	1.69
Polonnaruwa	...	...	0.74	0.63	0.26	0.29
Badulla	...	...	3.12	2.07	0.08	0.30
Moneragala	...	...	0.93	0.73	0.03	0.26
Ratnapura	...	...	1.37	0.80	0.17	0.40
Kegalle	...	...	2.27	0.78	0.85	0.77
Sri Lanka	...	...	1.54	1.48	0.52	—
Mean	...	...	2.095	1.613	0.854	0.712
Variance	...	...	1.162	1.056	0.463	0.275
Std. Deviation	...	...	1.105	1.050	0.698	0.538

\* Not Available

Source: Evaluation Team Report 1982

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**PLANTATIONS AS THE DOMINANT MODE OF PRODUCTION  
IN SRI LANKA  
A HISTORICAL ANALYSIS**

By

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**ABSTRACT**

*The dual economy approach, based on the assumption of independently existing "modern sector" and "traditional sector", overlooks the dominant influence that the plantations (or the modern sector) has had on the whole economy and polity of Sri Lanka. This paper suggests a holistic approach in the context of plantations as the dominant mode of production. The latter brought in capitalistic characteristics in relation to capital, land, and labour in the traditional economy. These characteristics in turn have led to changes in the traditional social structure particularly to the formation of a capitalist oriented national elite. This has had implications for development policy and planning in the country.*

In the historical discussions of Sri Lankan political economy the general tendency has been to make a stark distinction between the plantation or the so called 'modern' sector and the 'peasant' or the 'traditional' sector – otherwise known as the 'dual economy' approach. This approach has led to much misperception historically of the economic, political and social reality of Sri Lanka. The latter is not without implications for policy and planning for the development of the nation.

It is misleading to speak of a separate and independently existing 'modern' sector and a 'traditional' sector in Sri Lanka firstly, because there are a great many overlaps and interactions between the two sectors and secondly, from a holistic point of view, the modern sector has had a 'total influence' on the whole political economy of the country. This paper attempts to explore specifically the second—the nature of the total influence of the plantations on the whole economy and society.

The total influence of the plantations is to be understood in the context of the plantations as the dominant 'mode of production' in the country. A mode of production may be considered following Cleaver, as consisting of

.....the material forces of production and the social relations which prevail among those involved with production. By forces of production is meant the combination of natural resources, man-made tools, skills, knowledge and labour which are co-ordinated by and through the worker in the process of production.....the relations of production refer to the structure of social relations among those connected to production (Cleaver 1974-pp21-22).

The plantations represented a form of capitalist mode of production in that they called for, in the productive process, a capitalist class who owned the means of production and proletariat who sold their labour for a living, not unlike in the development of capitalism in the Western Europe which took shape from the 'putting-out system' (Dobb 1946). The plantations, as a mode of production, differed

from the traditional modes in Sri Lanka in that the latter did not have a clearly defined form of private ownership nor a wage earning class.

The plantations, towards the end of the 19th century had become the dominant phenomenon in the economy of Sri Lanka. There was a physical infrastructure consisting of roads, railways, ports, and developed lands which was structured around the needs of the plantations; there was an institutional infrastructure, consisting of agency houses, banks, a commercial community and a marketing network, which was geared primarily to the plantations; there was the colonial government and the bureaucracy which were attuned to and had interests in a plantation economy. Further, the plantations had come to be the major earners of foreign exchange, and the largest source of local revenue to the government; the plantation crops occupied the greatest area of land under cultivation, and formed the major avenue of employment. Hence, the plantations the 'dominant mode of production'.

When the plantations came to be the dominant mode of production, many of its characteristics pervaded through the 'traditional' modes, as well. This pervasive influence was felt in the whole of the nation taken as a "system" or a total 'social formation' in Maxian terminology (Marx 1961). Some of these characteristics are singled out for the discussion below. The characteristics are: the spread of a money economy, changes in the concepts relating to land and labour, and certain changes in the traditional social structure, particularly the formation of a new national elite.

### 1. Monetization of the Economy

The plantations led to a general monetization and commercialization of the whole economy through direct involvement of Sri Lankans in the estate sector and in small holder production of the export crops as well as through other monetary flows into the economy that the plantations opened up. The Sri Lankan ownership in the plantation crops, discussed below, would provide an indication of this monetary flow:

From the coffee times (1820-1890), the Sri Lankan villagers had gradually moved into the cultivation of cash crops. This involvement was relatively smaller in coffee and tea but was greater in rubber and coconut. In 1880-81, at the height of the coffee era, the share of Sri Lankan ownership was over 20,000 acres which amounted to about 8% of the total as shown in table below:

Table I—Non-European and European Ownership in Coffee, 1880-81

	<i>Extent in Acres</i>	<i>Percentage</i>
Non-European	20,352	7.9
European	236,148	92.1
Total	256,148	100.0

Source: M. Roberts, "Export Agriculture in the Nineteenth Century" in *History of Ceylon* Vol. 3, ed. by K. M. de Silva, p. 97.

Coconut occupies the other end of the scale in terms of Sri Lanka ownership. Its regional spread was wider, extending from the northern extreme in Jaffna to the southern extreme in Matara along the coast. Writing in the early 1890s Ferguson estimates that there were about 500,000 acres under coconut of which all but 30,000 acres were owned by Sri Lankans (Ferguson p.54).

Tea and rubber small-holdings classified as those under 20 acres were largely owned by Sri Lankans. Table 2 shows the small-holders' share in relation to the estates in tea and rubber.

Table 2—Area Under Estates and Small-Holdings  
(000 acres)

	1901		1946	
	<i>Estates</i>	<i>Smallholdings</i>	<i>Estates</i>	<i>Smallholdings</i>
Tea	366	41	490	63
Rubber	2	—	507	152
Total	368	41	997	215

Source: Snodgrass (1966), *Ceylon: An Economy in Transition*, Homewood: Richard D. Irving, p. 49

The production of these export crops by the villagers means a basic change in their earlier largely subsistence oriented production. A cash nexus is introduced and the costs and benefits are calculated in terms of rupees and cents. Table 3, showing the receipts from the export of major plantation crops distributed between the 'modern sector' and the "traditional sector", would provide an indication of the monetary flow into the villages.

Table 3—Breakdown of Receipts from Domestic Exports Between Modern and Traditional Sector, 1929 (Rs. Million)

	<i>Modern Sector</i>	<i>Traditional Sector</i>
Tea	202.1	32.7
Rubber	73.4	13.2
Coconut Products	25.0	35.6
Total	300.6	81.5
% of total	78.7	21.3

Source: Snodgrass (1966), *Ceylon: An Economy in Transition*, Homewood: Richard D. Irving, p. 60

The production of export crops was not the only source which brought in a cash flow into the villages. There was a host of other avenues which opened up with the increasing commercialization and the spread of monetization. The more lucrative servicing and trading functions connected to the plantations in which the Ceylonese were involved, according to Roberts were:

forest clearing contracts; contracts to supply food and labour; the operation of general merchant stores and boutiques in service centres—the "bazaar towns" and villages; trade in coffee; transport contracts; building contracts and allied trades; the supply of furniture; the supply of barrels and timber and the supply of arrack and toddy—both wholesale and retail (Roberts: p.268)

Such commercial activities and monetary flow, though more obvious in the plantation regions, were by no means limited to these areas. The improvements in communication, particularly roads and railways, that took place with the

development of plantations facilitated the spread of commercialization and the monetization in all regions of the country. Further the plantation crops opened up certain opportunities which were not necessarily limited to any region. For example, in the case of coconut, it provided for several small industries, such as the production of copra and coconut oil and the coir industry which were widespread in the rural areas (Roberts: p. 105).

It might be expected that the result of such diversification of activities and the commercialization of agriculture was that the traditional factors of production underwent certain changes and acquired new meanings. Those relating to labour and land are particularly relevant.

## 2. Labour as Commodity

Labour in the modern sense of wage labour was almost non-existent in the traditional economic and social organization of Sri Lanka. The only system of rendering labour, other than the mutual labour exchanges known as *attam* and help rendered on a gratuitous basis known as *kaiya*, was *rajakariya* whereby the subjects performed certain public services in the name of the Crown (Obeysekera 1967; p8; Knox 1911: p17). But the large capitalist plantations required an army of resident labour which was free from other economic ties. The requirement was met by mass importations of labour from South India. Thus, a class of landless agricultural labourers was created.

This landless labour class augmented gradually, by more and more Sri Lankans entering the ranks. Although the Sri Lankans were reluctant at the initial period the

.....less onerous conditions experienced in the cultivation of rubber and other crops and with the entry of Ceylonese capital into the plantation industry, local labour was gradually weaned from its initial unwillingness to work the plantations.....(Census of Agriculture 1952).

A contributory factor in the augmentation of the wage earning class was the landlessness resulting from the expansion of the plantations. The land consolidation that took place in the *Kandyian* highlands, during the rise of the plantations has been compared to the "enclosure" movement of the 15th and 16th century England—a movement which created a large labour force without land, without any tools or instruments of production, and with only labour power to sell (Hunt 1972: p. 23; Report of the Kandyian Peasantry Commission, p. 73; Pieris 1956 pp.82–86).

In the rush for land that accompanied plantation expansion, it is alleged, that not only government forest land but also vast extents of communal village lands, particularly the *chena* lands, were bought by planters (Vanden Drieson 1957; pp. 36–52). In other words there was direct appropriation of peasant land. In addition to such appropriation it has been alleged that the government land policy led to sale of land by villagers themselves. The Kandyian Peasantry Commission reports,

The presumption in favour of the Crown created by the Ordinance (of 1849) led to a great degree of uncertainty among the peasantry as to the title of their peasant land. As a result the peasantry sold what they regarded as doubtful titles.....(Kandyian Peasantry Commission p.91).

The outcome of all these was a severe limitation of land available for peasant cultivation.

A survey on landlessness in the Wet Zone districts reports the following rates, for the year 1946:

Table 4—Estimated Percentage of Wet Zone Agricultural Families who were Landless, 1946

<i>District</i>		<i>Percentage</i>
Colombo	...	14.2
Kalutara	...	22.0
Galle	...	20.0
Matara	...	20.2
Chilaw	...	34.9
Kurunegala	...	12.1
Kandy	...	19.4
Matale	...	38.3
Nuwara Eliya	...	41.8
Badulla	...	8.8
Ratnapura	...	32.2
Kegalle	...	20.5

*Source: Report on Survey of Landless, Sessional Paper 13 of 1952. Quoted in B. H. Farmer, Pioneer Peasant Colonization in Ceylon (London: Oxford University Press, 1957), p.89.*

Such landlessness and unemployment conditions have provided the impetus for more Sri Lankans to join the wage labour force in the estates. At the Agricultural Census of 1952 a total of 613,294 labourers were employed in the estates, of whom 153,063 were of Sri Lankan nationality.

Although wage labour began with the cultivation of plantation crops, it did not end there. Gradually, it has become a widespread phenomenon in the peasant sector as well. This trend was less pronounced in the non plantation areas i.e., the Dry Zone and the spread effect was generally slow up to the early decades of this century. But there had been a marked acceleration of capitalization of peasant agriculture from the 1930s. This coincides with the trend of increasing national attention to the development of peasant agriculture. The latter, as is well known, was brought in by a series of circumstances, the important among them were: the world depression of the 1930s which brought to the fore the basic weaknesses of a primary export economy and the need for diversification along more self-reliant lines through the development of domestic agriculture; the implementation of the Donoughmore constitution in 1931 which, with its universal franchise and the State Council with elected representatives, called for a government more responsive to the larger segment of the population; and the need to relieve the growing population pressure in the Wet Zone by absorbing more people in to the Dry Zone peasant agriculture.

The trend towards capital intensification, including the use of hired labour in peasant agriculture has been stepped up during the post-independence period. Particularly noteworthy are the changes in cultural practices associated with the 'Green Revolution' of the 1960s, which call for increased use of hired labour. According to a survey in *Maha* 1972/73 the percentage of hired labour in the total labour input in the production of paddy ranged from 56 to 78 in selected districts. (Vanden Drieson 1960: pp1-17; Snodgrass 1966: pp 59-71).

### 3. Land as Private Property

Land is probably the most important of the means of production that felt most, the impact of the plantation enterprise. Plantations, the form in which they were established by the British, were but a capitalist mode of production and therefore it

was imperative that land, as a means of production, be private property, for there could be no capitalism without the private ownership of the means of production. Private property means,

.....an exclusive, alienable, 'absolute' individual or corporate right in things .....it is a right to dispose of, or alienate, as to use; and it is a right which is not conditional on the owner's performance of any social function (Macpherson 1978: p. 10).

But such was not the concept of land in the traditional Sri Lanka. It is true that land constituted an important form of wealth in the traditional economic and social structure and that there was a higher strata of royal officials known as the *radala* who controlled vast extents of land, such land did not constitute 'private property'— as a commodity to be purchased and disposed of at free will because, the basic principle relating to land was that it belonged to the Crown and the right for the use of which was given to people in return for certain specified services (Pieris 1956: pp 169–179).

Hence, it was necessary to define the ownership over land in terms of private property and Crown property. The Colonial Government did just this through various land ordinances, such as Crown Lands Ordinance No. 12 of 1840, Crown Lands Ordinance No. 9, of 1841, Temple Lands Ordinance No. 10 of 1856, and Waste Lands Ordinance No. 1 of 1890. This made possible the sale of land as a commodity both by the government and by private individuals.

These measures were by no means, confined to the plantation regions, rather the government's legal and administrative measures applied to the whole of the country. These measures fostered by the plantation mode of production brought the concept of private property as the predominant concept relating to land. Thus, not only in the plantation regions but also in the other areas land has come to be bought and sold as a commodity.

## II

The plantations brought in certain capitalistic characteristics to the economy of Sri Lanka. Important among these are the increased monetization and commercialization of agriculture, and changes in the concepts relating to labour and land. The impact of these changes on the traditional economy were direct and more pronounced in the Wet Zone because the plantations were largely a phenomenon of this region. However, in the long run, due to increased communication, interregional flows of people and resources, and unifying administrative measures of the Government one may find a greater uniformity in such impact in the whole country (ARTI 1975: p. 18). This impact on the economy was not without implications for the traditional social structure. Some salient changes in the social structure accentuated by the plantation mode of production are discussed below.

### 4. Changes in the Social Structure

The Sinhalese social structure of the pre-British period has been compared to the feudal structure of the pre-capitalist Britain on the basis of some similarities, such as a rigidly stratified society, a decentralized political organization, a higher strata of royal officials with military functions and more important, an interconnected system of land tenure, social status and service obligations (Ryan 1953: pp 45–50). Similarly the impact of the capitalist plantation mode of production on the Sinhalese



social structure may be compared to the impact of industrial capitalism on the British feudal social structure. Particularly noteworthy in this respect are the creation of a class of owners of the means of production and another class of wage labourers, and the extension of a cash nexus into human relations involved in the process of production and distribution.

The changes associated with the plantation mode of production, such as the spread of a market economy, the metamorphosis in the concepts of land and labour, or the general administrative measures of the colonial government did not destroy completely the older social structure. The British often pursued a policy of ruling through the traditional power hierarchy and this buttressed the older social structure, except on those, not too rare, occasions where the evaluation of the British of a Sri Lankan's wealth, family and social status differed markedly from that of the locals. Similarly, the new opportunities associated with the plantation mode of production were not exclusive to any particular local group and therefore it may be expected that the new opportunity structure was not entirely inconsistent with the old one. Yet, it cannot be denied that the new changes introduced a certain fluidity in the traditional social structure whereby it was possible for individuals or whole groups to move up or down the social hierarchy. This was the result of the breaking down of certain exclusive privileges in the old system and the creation of new opportunities to wealth, status and power. Those related to land are a case in point.

Peebles, in a study of elite formation in the 19th century Ceylon, suggests that as a consequence of British land administration in the 19th century, firstly, a local market was created that brought a great deal of land under cultivation by Ceylonese land owners: secondly, the distribution of the extent of cultivated land tended towards a greater inequality of land ownership; and thirdly, the acquisition of land became a channel of upward social mobility for the Ceylonese elite (Peebles 1973; pp. 26–38). These changes, as to be expected, were more pronounced in the plantation lands and in plantation regions, but by no means confined to them. One finds today even in the most remote villages, such as those in the dry zone, some families which had better access to land purchasing channels, controlling disproportionately large extents of land (Leach 1961; Robinson, 1975, ARTI 1977). Such land acquisitions by hitherto underprivileged families in the villages gave rise to certain changes in the village power structure. It also paved the way for certain individuals to rise up to the level of elites of a regional nature. However, those lands related directly to the plantation enterprise are of more consequence, in that they gave rise to a new elite of national stature.

During the "coffee mania" of the 1840's over 250,000 acres of lands were alienated most of which were bought by the British. Only a few Ceylonese entrepreneurs bought land during this period. But Crown land alienation continued throughout the century and much of these lands were bought by the Ceylonese during the latter period. The new national elite acquired ten or more times the amount of land held by any Ceylonese before 1840 (Peebles 1973: p. 230).

Landed property related to the plantation economy provided the most important avenue to national elite status, but it was, by no means, the only one. There was a host of other entrepreneurial avenues to wealth and elite status that opened up in the new capitalist economy. Some of these, such as transport, timber contracting, and arrack and toll renting, were directly related to the plantation enterprise. Some, such as gemming and graphite mining were not. Quite apart from the entrepreneurial avenues there were others related to access of education, particularly through the medium of English, which also provided for upward social mobility.

Thus, there was a significant portion of the national elite who had made their way up through the administrative service and through the 'liberal' professions.

However, although there were different avenues to elite status they were eventually intertwined. As Roberts points out,

Once achieved; the national elite consolidated their positions by various means. A great many of these successful families took care to spread their "investments". The principal Ceylonese cash crop planters had mixed investments in a number of cash crops as well as urban property. Successful merchants and businessmen as well as those administrator-professional occupations generally purchased plantation property; Marriages linked and buttressed such investments (Roberts: p 274).

It was mostly from among this new national elite that the political leaders of Independent Sri Lanka were recruited (Singer 1973: pp 361-383). Consequently, the large majority of the political leaders of independent Sri Lanka had a shared background that was steeped in the capitalist liberal tradition of the West. This shared background of the leaders provided for a certain common orientation towards governing the country. This is in spite of the different political and ideological commitments declared by the different political parties. As Obeyesekera points out,

One could view the major political parties sociologically as factions of a ruling elite. Take the major political parties moving from right to left: the United National Party, the Sri Lanka Freedom Party, the Lanka Sama Samaja Party (Trotskyites) and the Communist Party. Party manifestos and ideologies might be radically different from one end of the spectrum to the other but the leadership of all these parties came from elite ranks almost without exception. They came from the same schools, went to the same clubs, spoke English and marriage alliance cut across political differences (Obeyesekera 1974: p 380).

Such an elite background among the political leaders was not without implications for government policy. In the formulation of policy relating to the development of land and agriculture, the leaders tended to operate within certain parameters set by their capitalist liberal background. In setting these parameters a dominant plantation mode of production has contributed in no small measure.

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## SOFTWARE OR HARDWARE? AN ECONOMIC APPRAISAL OF A WATER MANAGEMENT PROJECT

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### ABSTRACT

*The need for economic efficiency in the development and utilization of water resources has become an increasingly important issue as the cost of new irrigation has risen relatively to the amount of water supplied. As there are alternative ways in water control and management, this paper examines potential substitution of management for capital, studying alternatives such as canal lining pipe lines, cleaning channels using direct labour, soil compaction in beds and banks using direct labour and appointment of a Project Manager. The results show that pipeline which is more appropriate than canal lining would be only chosen if the opportunity cost of capital is judged to be less than 8.5 per cent and a combined programme of cleaning channels and Project Manager, if above this.*

### Introduction

The development of irrigation in the Dry Zone has evolved permitting land productivity to increase steadily. Supplemental irrigation during the wet season is followed by the construction of storage facilities to permit cultivate more land in the dry season. The cost of new irrigation has risen relative to the amount of water supplied and therefore the need for economic efficiency in the development and utilization of water resources has become an increasingly important policy issue. Therefore emphasis is being shifted towards the better use of rainfall and irrigation water and a reduction of water losses with a view to raising cropping intensity and to achieve the high yield potential of modern inputs. As there are alternative ways in water control and management, this paper examines potential substitution of management for capital.

Comparison of alternative projects even when based on good estimates may still lead to faulty project selection if an inappropriate technique is used. The Economic Cost Benefit Analysis has been used in this paper to compare alternatives and the purpose of economic appraisal is to provide a framework within which all aspect of a proposed project can be evaluated in a coordinated and systematic manner showing whether society as a whole will be better off by undertaking rather than not undertaking it or by undertaking instead of an alternative project to obtain similar ends. The way to ensure the most efficient use of public capital and other scarce resources is, in the margin, to finance no project whose benefits measured with references to the national development objectives are lower than that of the next alternative project relative to investment costs.

### The Setting

The alternatives considered are the provision of (a) canal lining, (b) pipe lines, (c) the cleaning and maintenance of gravel canal by direct labour, (d) compaction of soil in beds and banks of canals by direct labour and (e) the appointment of a Project Manager for integrated rural development. The last three alternatives are mutually compatible and can be studied as one combined alternative or as three separate alternatives. In this paper thus six alternatives are examined.

*Mahavillachchiya* colonisation scheme (MvCS), the first tank that has been modernized under the Five Irrigation Rehabilitation Scheme, was selected as the study location. MvCS is located 18 miles north-west of *Anuradhapura* and covers an area of 4200 acres of which 2,600 acres are irrigable. A farm-business survey using a stratified random sample was carried out in May 1980 in the scheme. *Dewahuwa*, a scheme modernized by the Japanese Government, has also been selected to illustrate the likely consequences of some possible alternatives as a positive approach. A field survey was carried out in May 1980 in the *Dewahuwa* scheme.

### Lining the Canals

This alternative involves the lining of the conveyance scheme with concrete or similar materials to reduce excessive seepage or erosion, to provide the necessary degree of water control, to reduce the labour required for measuring or dividing the water and to facilitate maintenance. The standard new design formula of 1 cu. sec. field channels each serving about 40 acres has been adopted in the MvCS. Compare with a conventional gravel field channel which feeds more than 40 acres, this involves a reduction of the area served by individual field channel. Since, it is not possible to re-align distributary channels and field channels due to the need for the involvement of a massive operation for the re-allocation of land, the solution seems to be the construction of two or three parallel channels each serving part of the area commanded by the original field channel. The construction of regulators in the main, distributary and field channels to increase water control in the conveyance system and the installation of parshal flumes to measure releases from the tank and water flows at various points in the system are also included in the canal lining programme.

Lined canals have a transmission efficiency of 90 per cent compared with 70 per cent of gravel canals. Assuming that farmers continue with mud sowing and a 44 per cent on-farm water use efficiency instead of the 65 per cent attainable with a strictly rotational delivery system, canal lining alone would save 3700 ac. ft. of water per year and cropping intensities would be raised to 196 per cent from 127 (Table 1 and 3).

The actual construction cost of lining canals at MvCS at 1980 price levels was 17,115 rupees per acre with an annual expenditure of 205 rupees per acre. The capital costs incurred in 1977-80 were estimated using records on actual expenditure converted to 1980 prices by using the All Sri Lanka Wholesale Price Index Numbers. Labour costs involved in 1977-80 are brought to the level of 1980 with the help of the wage rate index for government employees. Use of constant prices does not imply that the economy will not be affected by inflation in the coming years and it may be argued that different inflation ratios for the various components of input and output in the first few years could significantly affect the results of the economic appraisal. However, as it is impossible to project accurate prices for various commodities, use of a common deflator is justified as providing a standard basis for comparing the real costs and benefits accruing in different years.

The following procedures were used in estimating the future values of on-farm costs and benefits. The crop areas are based on the linear programming solutions, assuming 23.1 acre feet of water per farm available for *yala* cultivation in the case of canal lining (Vithanage 1982 b). With increasing efficiency of water use it should be possible by 1986 to cultivate a total of 4430 acres of paddy and 770 acres of pulses. Although a higher yield might be expected in *yala* in major irrigation schemes

than *maha* due to the greater number of sunshine hours, there are in fact no consistent differences in yields between *maha* and *yala* seasons in the recorded data for major irrigation schemes. It is, therefore, assumed that *maha* and *yala* yields for the possible alternatives are the same. Paddy yields are derived from historic trends for all island *maha* yields from 1951/52 to 1978/79. Out of a number of functions fitted, a semi-log function  $\text{Log } Y = a + bt$  gave the best fit.

Where  $Y$  is yield in bushels per acre,  $a$  is a constant value,  $b$  is a regression coefficient and  $t$  is years from 1951/52<sup>p</sup>.

$$\text{Log } Y = 28.14 + 1.0246 t \quad (\text{coefficient of determination } (R^2 = 0.87) \quad (0.032) \quad (0.0008))$$

Note: standard errors are in parentheses.

To check if there had been any change in the relationship in more recent years, *Anuradhapura* district yields were examined for the 12 year period 1967/68 to 1978/79<sup>53</sup> but the regression values were similar. The results were

$$\text{Log } Y = 47.93 + 1.0222 t \quad (R^2 = 0.40) \\ (0.08) \quad (0.0068)$$

Note: standard errors are in parentheses.

Due to lack of yield data on pulses it is assumed that the growth rate of yield of pulses will be the same as for paddy. Yields between 1990 and 2009 for which projects are estimated using 2.46 per cent growth rate per annum, as it is assumed that maximum benefits will be reached by 1990 (Table 2). It may seem that the yields are being raised without any additional project inputs. However, future all island policies and measures such as the introduction of new varieties and new extension activities could have an effect on MvCS also. The incremental economic cost of herbicides and pesticides would be small as 92 and 100 per cent farmers already used herbicides and pesticides respectively in 1979/80 and the amount of herbicides necessary with mud sowing is lesser when compared with dry sowing. But, additional cost per bushel for herbicides, pesticides, sacks, transport etc. is calculated and will be discussed later. A similar regression function is used to estimate the intermediate with the project yields for 1980 to 1990 period assuming given yields of 49.1 and 78.8 bushels per acre in 1980 and 1990 respectively. (Vithanage, 1982<sup>a</sup>).

As it is not possible to project prices for project outputs and farm inputs (in this case paddy, pulses and fertilizer) for each separate year, due to the inherent volatility of markets in agricultural products and the unpredictable nature of government intervention in these markets, projected 1990 prices, given by the Commodities and Export Division of IBRD are used throughout (Table 4). Full agricultural development with each alternative is reached in 1990 and use of 1990 prices can thus be justified. Since pulses are not traded internationally in any appreciable quantity, the Bank Group does not give a price for them. Historical comparisons of rice prices with those for pulses in Sri Lanka indicate that the price ratio remains fairly stable with pulses commanding a 50–70 per cent premium over paddy. A 60 per cent premium over paddy price is thus used to obtain the pulses price. Although there is a benefit with the salvage value of canal lining system, its present value will be very small and it is therefore ignored.

p. The Durbin Watson test  $d = \frac{\sum_{t=2}^n (e_t - e_{t-1})^2}{\sum_{t=1}^n e_t^2}$  calculation for the ratio gave 1.62. As this value is greater than the upper bound,  $d_u$ , at both 5 and 1% probability levels, the evidence does not support the hypothesis for positive auto correlation in the residuals. On the other hand,  $4-d$  is also greater than  $d$  so that negative auto correlation of the residuals cannot be expected, i.e. the remaining variation is a result of random effects.

Table 6 shows the annual incremental on farm crop production costs with each proposed alternative in 1990. The prevailing market price ratio of paddy and seed paddy was used to calculate the economic price of seeds (paddy and pulses). Fertilizer costs were extracted from tables 4 and 5. The linear programming analysis shows that the marginal value product of labour is approximately 10 rupees per day during peak labour periods at 1980 price levels and this value has been used as the economic wage rate. It is assumed that the economic cost of animal power for land preparation and threshing is equal to the financial cost as the manual labour cost composed a large part of the animal cost and as the market wage rate of labour is in fact similar to the economic wage rate. As the financial costs of labour and tractor are equal to the economic costs and the ratio of the financial cost of fuel to the economic cost is 0.93 (Tables 4, 5), it is assumed that the economic cost of tractor power for land preparation and threshing is equal to the financial cost. It is assumed that 75 and 25 per cent of land preparation and threshing will be done with the use of buffaloes and tractors respectively as buffaloes were used for 66 per cent of primary land preparation, 100 per cent of secondary land preparation and 68 per cent of threshing in *maha* 1979/80. The survey data shows that the average incremental other costs (pesticides, herbicides, sacks, transport etc.) are about 5 rupees per bushel and this value was used to calculate the miscellaneous costs.

The net effect of lining canals on public health and on the environment seems on balance to be positive. When the storage water is held in the tanks and run in the canals for a more extended period as would be possible with lined canals, mosquitoes increase. But the opening of the natural drains would remove the tail water which stagnates in low areas from the fields and so lessen the problem. The extension of the irrigation season would improve the recharge of village wells and so improve the domestic water supply.

A problem that could arise in future with lined canals is that these can be fairly easily damaged by farmers who are dissatisfied with the amount of water they are receiving and the costs of repair might be quite substantial. Such costs are not included in the projections.

### Pipelines and Re-use of Drainage Water

Provision of pipelines and re-use of drainage water is another alternative considered. It involves the introduction of a 'limited demand' schedule. Water is not supplied to farmers according to the decisions of the management, but is made freely available to them at a limited flow rate. According to this concept, all other practices are based on trying to prevent the farmer from using water but no one is in a better position than the farmer to know how much water he needs. With this system, water is only actually lost from a project by evapotranspiration. All other water is translocated and should be reclaimable to facilitate the farm application process. The water losses such as those from canal seepage are reduced by the use of pipelines and losses in farm application are tolerated and reused through use of pumps.

The physical core of this system is: the replacement of field channels by pipes; and the operation of the main and distributary canals at constant water levels maintained by float operated gates. Farmers are able to draw as much water as they require from the system, each farm having an individual outlet. Excess water is pumped back up from the drains to the canals.



This system eliminates water losses in field channels, picks up drainage water for reuse and supplies water equitably to all farms (tail enders are in fact better placed than top enders as water flows to lower lying pipes, ) reduces maintenance costs and releases for cultivation the areas now occupied by the field channels. This system of continuous irrigation retains the fertilizer in the fields and fish culture could be developed in main and distributary canals when operated at constant water levels. It is compatible with the present water management and farm procedures. The current on-farm programme of water division can be continued but at a much higher level of efficiency. Each farm turnout with its screw regulating valve and weir measuring device can provide a high level of water control, unattainable with the gravel canals or lined canals with ditch turnouts. The present problem of non-uniform planting dates combined with the rotational schedule can be alleviated by more flexibly controlled water deliveries.

Existing pipeline systems in Sri Lanka are relatively new and experimental. Pilot projects on channel D-1 of Block 404 of the *Mahaweli* area H project and channel D-3 of Left Bank track 3 of the *Mahakanadarawa* scheme are currently underway to evaluate costs and limitations of a specific pipeline system.

Estimates in Table 7 for Block 404 of *Mahaweli* scheme H area indicate that civil engineering work alone would cost 5020 rupees per acre at 1980 price levels while total civil engineering work costs were originally estimated at 2938 rupees per acre for the pilot pipeline system at *Mahakanadarawa* at 1979 price levels. However, the actual cost was about 21332 rupees per acre at 1980 price levels and this figure is used to arrive at the costs in Table 9. However, these figures contrast with the estimate provided by Professor Merriam. His progress report of February 1979 states,

‘The most intensive study was made of distributary channel 3 in block 302 and field channel 4 (*Mahaweli* scheme H area). This (investment cost) is estimated to cost about 1300 rupees per acre.’

According to the Irrigation Department officials, operational and maintenance costs would be similar to that with the canal lining programme, 205 rupees per acre at 1980 price levels (Table 8).

Transmission losses in field channels per mile are higher than in the main and distributary canals due to the greater surface area of the field channels. It is assumed that 50 per cent of transmission losses occur in field channels at MvCS and consequently installation of pipelines will reduce transmission losses by 50 per cent (Table 1).

It will be possible with pipelines to irrigate and cultivate the total lowland area under paddy in the *yala* season. It is assumed that paddy will be the sole crop cultivated in both seasons as farmers prefer to cultivate paddy when there is adequate availability of water (Vithanage 1982b). As in the canal lining programme, it is assumed that the additional area cultivated in *yala* will be brought in by equal instalments up to 1986. Estimation of annual benefits and costs is on a similar-basis to that used for the canal lining programme and estimates are given in Table 9. The salvage value of the pipelines is not included as a benefit as its present value would be very small. However, along with certain practical problems with installation of pipelines during the construction period some more problems could arise with operation and maintenance programmes. These will increase the costs and extend the period needed for full development.

### Cleaning and Maintenance of Gravel Field Channels Using Direct Labour

The existing method of delivery to individual farms at MvCS as in other schemes consists of a ditch running at right angles to the contours on a ridge with farms located on both sides of the field channel. Control structures are located where necessary to regulate the water surface elevation in the ditch and usually drop the water surface less than 4 feet (1.2 metres) at each location. Farm water deliveries are made through turnouts in the ditch banks.

The advantages of conventional systems are their simplicity, low cost to construct and lack of special maintenance equipment requirements. Water is always visible to farmers and with experience, they will gain confidence and knowledge of proper flows in the ditches. These conventional systems have flexibility and can be converted later to more sophisticated systems. Disadvantages include losses to seepage, consumption by vegetation and easy access for unauthorised issues. Earthen ditches tend to deteriorate and are subjected to changes in flow characteristics and water manageability. Therefore, a continuing programme of maintenance is needed. Johnson *et. al.* (1978) report that improved cleaning and maintenance of the field channels is the best means for obtaining increased water supplies for farmers' fields in most countries.

Kemper (1979) estimates that the losses in the field channels of some colonization schemes in Sri Lanka could have been reduced by about 75 per cent if the channels had been properly cleaned and maintained, Direct employment of labourers is preferred to farmer maintenance in this study to achieve the goal of adequate cleaning and maintenance of field channels.<sup>a</sup>

Assuming that proper cleaning and maintenance cut the losses in field channels only by 33 per cent, so that transmission efficiency is increased to 80 per cent from 70, and the on-farm efficiency is up to 35 per cent from 28, cultivable area of low land would be increased to 1122 acres (Table 1). The increase in on-farm efficiency can be expected as reduced possibility of water shortages with a cleaning programme will reduce the necessity to maintain a continually replenished stock of water as a buffer against possible shortages later or drying out. This alternative is compatible with the linear programming analysis's optimal plan of 7.0 acre feet of water availability in the tank in *yala* with 2767 acres of paddy and 1788 acres of pulses.

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a At present the Irrigation Department officials control water allocation at the main and distributary canals and attend to the repair and maintenance of the channel system and irrigation structures. Farmers have to clean their own field channels. However, Kemper (1979) reports that 'about half of the control structures and drop structures observed on field channels, are already out of commission, having been by-passed deliberately by farmers to obtain a little more water on having been washed out as a result of lack of maintenance which the farmers were supposed to provide'. The farmers using the field channels, finally inform the Irrigation Department that the channel is not able to carry water which is rightfully theirs. Instead of insisting that the farmers do a good job of cleaning and bringing back to its designed condition, the Irrigation Department apparently accedes to their wishes and provides the rather expensive additional offtake. If specific officials insist on standing by the rules and regulations, they may be transferred on grounds of 'uncooperative attitudes towards farmers.' As a result of such cases, the morale of the Irrigation Department appears to be low and maintenance standards have fallen in consequence.

Local field channel level farmer groups were organised in late 1980 on an experimental basis at the *Mahaweli* scheme and the *Gal-Oya* scheme to motivate farmers to control water allocation and to clean and maintain field channels for themselves. It is too early to evaluate them.

Costs in employing casual labourers to the Irrigation Department for the cleaning programme are estimated as described below. The total length of the field channels is 210,000 feet at MvCS. The channels are about 1000 to 1500 feet long and a man wielding a mamoty (hoe) should be able to shave about one inch of the soil plus all the grass crown from the bottom and sides of these channels at a rate of about 50 feet per hour and also to rebuild banks where they have been damaged by animals. Such work when done by the Irrigation Department now requires 20 hours of labour on 1000 feet canal. Assuming 50 per cent more hours as advised by the field officers at MvCS, 4200 labour hours are needed per time. This cleaning would have to be repeated about four times per year to keep the channel in good, high delivery condition. The Irrigation Department hired labour in 1980 for construction at the rate of 15 rupees per day. Consequently, the annual variable cost of cleaning and maintenance for the project would be 59466<sup>a</sup> rupees per annum. The total annual operational extension service cost and irrigation water management cost for the alternative are shown in Table 8. Annual estimates of benefits and costs with cleaning and maintenance of field channels, which is assumed to be undertaken by the government are shown in Table 10. Estimates have been prepared for 30 years as with other possible alternatives.

### Compaction of Soil in Beds and Banks of Field Channels Using Direct Labour

This is a further possible alternative and will be studied separately from cleaning and maintenance of field channels. High rates of infiltration in the gravelly red brown earth soils and in the red yellow latosols which are wide spread in the Dry Zone of Sri Lanka are problems in many parts of the irrigation distribution system. Recent studies at Colorado State University show that permeabilities of soils of similar textures can be reduced to one per cent of normal values by compaction at the proper moisture content (Kempar 1979). Data indicate that the effect should last through at least one season. Organization of such work could be handled as discussed in relation to the cleaning and maintenance of channels.

According to the Irrigation Department field officers at MvCS, a man wielding a wooden log with a handle could pound 100 lineal feet per day of a channel that will carry up to 1.0 cu. sec of water with a scheme total of 3400 labour days required for both seasons. The annual variable cost would be about 178038<sup>b</sup> rupees per annum at 1980 price levels. The annual operational cost for compaction of soil was added to the costs of the extension service and of additional fertilizer to estimate the gross incremental costs (Table 8 and 11), assuming that government would undertake the work on field channels. However, this could also be done with the help of farmers as discussed in the earlier section.

Although the studies show that permeabilities of soils can be reduced to one per cent, 85 per cent transmission efficiency is assumed, as compared with the existing 70 per cent, with compaction of soil in field channels. This programme would increase the cultivable area in *yala* to 1165 from 693 acres per year and it is assumed that the cropping pattern will be similar to the cleaning programme. Estimation of costs and benefits was similar to the pattern used in other possible alternatives (Table 11).

a  $(210,000 \text{ ft.} / 50 \text{ ft. per hr.} \times 8 \text{ hrs.}) \times 15 \text{ Rs./hr. for unskilled labour plus } (1/10\text{th of unskilled labour hours}) \times 32 \text{ Rs. /hr. for supervisors plus } 20\% \text{ of supervisors' cost as leave/} \times 4 \text{ times/year } 1.50 = 59466 \text{ Rupees/year.}$

b  $(210,00 \text{ ft./}100 \text{ ft./day}) \times 15 \text{ Rs./hr. for unskilled labour plus } (1/10\text{th of unskilled labour hours}) \times 32 \text{ Rs. /hr. for supervisors plus } 20\% \text{ of supervisor's cost as leave/} \times 3 \text{ times/year } 1.50 = 178038 \text{ Rs./year.}$

### Project Manager for Integrated Rural Development

It is generally accepted in Sri Lanka, that lack of coordination of services has resulted in production from major irrigation schemes falling far below their potential. The lack of attention to the management aspect may well be the most limiting factor but it should also be the quickest and cheapest to remedy. Even with the existing infrastructure and services, cropping intensities could be greatly increased, the latent management abilities of farmers utilised, underemployment reduced and inputs more satisfactorily co-ordinated if more emphasis was to be placed on effective management.

The unavailability of fertilizers in the cooperative stores at the required time, difficulties in obtaining credit on time and inadequate institutional marketing arrangements are common complaints among farmers at both MvCS and *Dewahuwa*. About 60 per cent of the surveyed farmers at MvCS sold paddy to private traders at prices about 10 to 15 per cent lower than the guaranteed price in *maha* 1978/79 and 1979/80. All farmers interviewed complained regarding the low prices and lack of ready marketing outlets for other crops. The Irrigation Department officials are more concerned with civil engineering works than water management and there are many occasions at present when farmers do not get as much water as they require. An integrated rural development programme could remedy most of these problems through the co-ordination of all departments on the scheme.

Increased availability of fertilizer will raise the profitability of the modernization scheme. Ishikawa (1967) states that the introduction of new seed-fertilizer technology has set the stage for increased emphasis on irrigation investment. The complementarity between irrigation and fertilizer is illustrated for four Asian countries in the work of Kikuchi (1975). In all four cases the introduction of modern varieties and fertilizers approximately doubled the internal rate of return on irrigation investment and cut the cost-benefit rates in half. The water issues from the bank sluices in terms of equivalent acre feet per acre are lower when there is close coordination between the farmers and the Irrigation Department as compared with those when there is no coordination. There was an integrated rural development programme in the *Dewahuwa* Scheme up to 1975 and average paddy yields were then 74 and 72 bushels per acre in *maha* 1971/72 and 1972/73 respectively when compared with 56, 62, 65, 40 and 68 bushels in *maha* seasons from 1975/76 to 1979/80.

This need to emphasise management was identified by the FAO/IBRD Cooperative Programme in 1966, and as a result the Special Projects Programme started in Sri Lanka in 1968. Although no thorough investigation has been carried out to measure its success, it appears that the results achieved were quite variable. Discussions with personnel involved lend to suggest, as a broad generalisation, that the following problems arose: (i) little long term cooperation developed between the Project Manager and the various departments involved; (ii) often a weak chain of control and communication existed between the Land Commissioner's Department (which has overall responsibility for the special projects) and the Project Managers of individual schemes, since the latter were frequently under the Agricultural Department; (iii) no detailed plans for the overall management and development of individual schemes were drawn up, nor were Project Managers trained to cope with the management problems that arose. These points tend to suggest that the need for effective scheme management cannot be met merely by the appointment of a Project Manager. It seems necessary to outline requirements additional to the appointment of a Project Manager.

A future Project Manager, employed by a parent organization, should be responsible for the integrated rural development programme. The parent organization could be the Land Commissioner's Department or the Central Bank or the Agricultural Development Authority or Mahaweli Development Board and should be responsible for the management of all major irrigation schemes in the Dry Zone, outside the areas controlled by the statutory bodies. The parent organization would (i) be accountable to the government for the management and productivity of all major irrigation schemes at government level, (iii) appoint a Project Manager to each scheme, (iv) monitor programmes and set seasonal targets, (v) operate a disciplined organization making managers accountable for progress on the schemes, (vi) liaise with heads of departments regarding agreed targets and the methods of operation of their departments on major schemes and (vii) establish a support unit to service the managers on each scheme. The project manager should be accountable to the Government Agent and the parent body. He would have the responsibility of drawing up a programme for the development of the scheme in conjunction with the district heads of departments, for the coordination of all departments on the scheme, for operating a monitoring system and identifying all constraints to development and for representing the interests of the whole scheme to the relevant authorities. As the Project Manager reporting directly to the Government Agent, he should be able to enforce his powers on other departments.

In these circumstances, a manager of average ability should be able to increase on-farm efficiency of water use at least up to 35 per cent from the present 28 per cent, (the pessimistic on-farm efficiency rate of the tank modernization appraisal report is 44 per cent) with the new extension service and close co-ordination between farmers and the Irrigation Department. On-farm efficiency was 35 per cent in some previous years. As happened in the *Dewahuwa* scheme, it is assumed that the task of attaining this improvement should not take more than four to five seasons. This will increase the *yala* cropping acreage up to 1035 acres of paddy from 693 acres (Table 2). This possible alternative is compatible with the linear programming analysis's optimal plan of 4.4 acre feet water availability in the tank in *yala*, and 2600 acres of paddy in *maha* and 1422 acres of pulses in *yala* will be cultivated under this plan.

Increased availability of fertilizer at the correct time will increase yields. The present price ratios of paddy and fertilizer are very favourable to farmers (fertilizer prices are subsidised by 75 per cent.) Favourable price ratios are very effective in getting the farmers to apply large amounts of fertilizer if available and to reach a high production. Izumi (1972) writes in his report on 'Economic of Nitrogen Fertilizer Application of High Yielding Varieties of Paddy in Sri Lanka' that,

'even if the price of fertilizer goes up 50 percent from the present level, both the yields and the income of the paddy per acre do not make any significant changes. Under the present situation, the most important matter for paddy farmers is not the price of fertilizer but to prepare a better credit and distribution system for fertilizer.'

The Project Manager would be concerned with the availability of fertilizer for farmers at the correct time.

The relationship between fertilizer use and paddy yields can be established for the data collected in 1980 at MvCS with the aid of regression analysis. Four regression functions were tested, linear and quadratic types, based on these data as shown in Table 12. Although the coefficients of determination are relatively low for all equations as might be expected in that the level of fertilizer use is not totally responsible for yield, the best fitted function was a quadratic function ( $y = a + bx - cx^2$ ) see Table 12). which explains that the yield responses for fertilizer follow the principle of diminishing returns when observations are in a sufficiently wide range. Given the MvCS level of use, the expected yield with this function is 49.38 bushels per acre in *maha* 1979/80, which is very close to the actual average yield of 49.1 bushels per acre. It is assumed that the yield with 66 per cent of the recommended fertilizer application will be 78.8 bushels per acre in 1990 (Vithanage, 1982 a). When the availability of fertilizer is increased, applications could be expected to rise to the recommended levels as was the case in 1973 and 1974 at the *Dewahuwa* Scheme. Even with only 90 per cent of the recommended fertilizer application, the yields would be raised up to 83.01 bushels per acre with this programme (Table 13), when compared with other possible alternatives, discussed earlier.

Other possible benefits might be obtained from an integrated rural development programme, although these are not quantified in this study. The manager would be concerned with the organization of the cleaning and maintenance of field channels, the supply of irrigation water to farm at the correct time and the provision of institutional credit for farmers to hire draught power on time. Once the manager arranges marketing outlets for crops other than paddy, the gross margin per acre for these crops will be increased and a shift to these crops in *yala* in lowland might be expected sooner than otherwise. The total area cultivated in *yala* would then be increased since these crops need less irrigation water per acre as compared with paddy. If he could arrange with the cooperative societies for more storage facilities, gunny bags and adequate cash to buy paddy during the harvesting periods, there could be more effective competition between these and the private traders.

Annual operational costs in Table 14 cover the salaries of the Project Manager, assistant, driver, maintenance and repairs of the vehicle, repairs to buildings, costs of extension service and irrigation water management. Estimation of annual benefits and costs is similar to the methods used in other possible alternatives.

#### **Project Manager for Integrated Rural Development, and Cleaning and Maintenance of Field Channels Using Direct Labour**

The incremental benefits which might be gained by combining the Project Manager option with the canal lining or pipe lines option will be very small as the total area will be cultivated in *yala* under either the canal lining or pipelines option alone. As the additional area which could be cultivated under soil compaction option over cleaning and maintenance option is only 43 acres of paddy (Table 2), it is more reasonable to combine the latter with the Project Manager option.

The combined effect of these two alternatives will increase the on-farm efficiency to 40 per cent due to the reasons discussed elsewhere. With an 85 and 40 per cent transmission and on-farm efficiencies respectively, acreage of paddy in *yala* will be increased to 1509 acres from 693 acres. This option is compatible with the linear programming analysis's optimal plan of 9.4 acre feet water availability in tank in *yala*, and 3497 acres of paddy and 1205 acres of pulses per annum will be cultivated under this plan.

Annual operational costs have been combined and estimation of annual benefits and costs are similar to the methods used earlier (Table 15).

### Results of the Economic Cost Benefit Analysis

There are several ways of appraising the results of a project. The discounted cash flow (DCF) technique and net present value (NPV), benefit cost ratio (BCR), internal rate of return (IRR) and present value of cost per additional acre parameters are all used in this study.

The present value of costs and benefits at the 12 per cent discount rate shown to be the appropriate accounting rate is shown in Table 16, and Table 17 shows the NPVs at the discount rates of 5, 12 and 20 per cent, the BCRs at the 12 per cent discount rate and the IRRs for six alternatives.

The alternative involving the appointment of a Project Manager has an IRR below 12 per cent and consequently a negative NPV when discounted at this rate. It, therefore, appears economically infeasible. The remaining alternatives all have a positive NPV with the largest values obtained by the combined programme.

It can be seen, however, that when the discount rate falls below 10 per cent, the pipelines alternative produces a larger NPV than the combined programme. The present values of this option and canal lining programme are very sensitive to the rate of discount used. This is because discounting emphasises the early costs of pipelines and canal lining, and diminishes the present value of incremental benefits which are spread over the project's life. This implies that the pipeline option would be chosen if the opportunity cost of capital was judged to be less than 8.5 per cent (the cross over discount rate), and the combined programme option if above this. Given the limited investment involved it is not surprising that the NPVs for cleaning channels, soil compaction and rural development are taken separately relatively small and do not fully utilise the economic potential of the MvCS. The evidence given earlier as to the appropriate discount rate leads to the choice of the combined programme.

Where the choice is between projects (mutually exclusive projects), the general rule is to select the project, offering the highest NPV. However, in the presence of capital rationing, it is necessary to 'normalise' projects so that they are comparable. There is a significant difference between the present value of costs of alternatives. Any available capital could be invested in other mutually compatible projects and it is assumed that the rate of return to this additional bit of investment is 12 per cent, shown to be the appropriate discount rate. Even with these estimations (column 8 of Table 17) the NPV of the combined programme is above the others, and the canal lining and pipeline options have the lowest NPVs with an incremental project.

### Conclusions

An investment in the hardware or physical works, such as canal lining and pipelines, is easier from the standpoint of the lending or funding agency than implementation of an investment strategy that emphasises software or management such as cleaning channels, appointment of a Project Manager for a rural development programme or a combined programme of cleaning channels and a Project Manager option. Further, hardware projects please industrial donor countries due to their high import content and please politicians and administrators as being highly visible and photogenic.

The appraisal shows that pipeline option is a more appropriate choice than the canal lining option when opportunity cost of capital is less than 15.5 per cent with given assumption. But the pipeline option would be only chosen if the opportunity cost of capital was judged to be less than 8.5 per cent (the cross over discount rate), and the combined programme option if above this. On the other hand, given the limited investment involved, cleaning channels, soil compaction and a Project Manager options taken separately do not fully utilize the economic potential.

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Table 1—Maximum Cultivable Area in Yala with Possible Alternatives <sup>a</sup>

	Without project	Gravel canals						With Combined programme
		With lined canals	With pipe lines	Cleaning & maintenance of field channels	Soil compaction in field channels	With a Project Manager		
1. Conveyance loss:								
(i) Main & Dist. channels evaporation (ac.ft.)	925	925	925	925	925	925	925	925
(ii) Main & Dist. channels seepage (ac.ft.)	1850	0	1850	1850	1850	1850	1850	1850
(iii) Field channels evaporation (ac.ft.)	...	925	0	925	925	925	925	925
(iv) Field channels seepage (ac.ft.)	1850	0	0	1233	925	1850	925	925
Total (ac.ft.)	5550	1850	2775	4933	4625	5550	4625	4625
2. Water re-use (20%) (ac.ft.)	3700	3700	3700	3700	3700	3700	3700	3700
3. Usable water in field (ac.ft.)	16650	20350	17267	17267	17575	16650	17575	17575
4. On-farm efficiency (%)	...	28	44	35	35	35	35	40
5. Maha field water requirement per acre (inches)	...	50.7	33.6	42.3	42.3	42.3	42.3	37.0
6. Maha field water requirement for the scheme (ac.ft.)	10833	7280	9273	9273	9273	9273	9273	8017
7. Water remaining for Yala (ac.ft.)	...	5817	13070	7994	8302	7377	9558	9558
8. Yala field water requirement per acre (inches)	...	100.7	70.2	85.5	85.5	85.5	85.5	76.0
9. Maximum Yala area cultivable (ac.)	...	693	2234	1122	1165	1035	1509	1509

Note: a. assuming 18500 ac.ft. of annual tank yield.

Table 2 Annual Estimates of Economic Benefits and Costs with Canal Lining

Year	without project				with project				Incremental		
	Paddy Yield/acre (bu.) (2)	Income ('000 Rs.) (3)	Incremental farm cost ('000 Rs.) (4)	Paddy Yield/acre (bu.) (5)	Pulses Yield/acre (lbs.) (6)	Income ('000 Rs.) (7)	Incremental farm cost ('000 Rs.) (8)	Gross benefits ('000 Rs.) (9)	Project costs ('000 Rs.) (10)	Gross costs ('000 Rs.) (11)	Net benefits ('000 Rs.) (12)
1	49.1	11722		49.1	500	11722	577	0	44500	44500	-44500
2	50.3	12009	20	52.90	527	14376	1158	2367	532	1089	1278
3	51.5	12295	40	55.75	555	16357	1722	4062	532	1650	2412
4	52.8	12606	60	58.63	585	18472	2318	5866	532	2194	3672
5	54.1	12916	81	61.18	617	20519	2942	7003	532	2769	4834
6	55.4	13226	102	64.39	650	21858	3125	8032	532	3372	5260
7	56.8	13561	124	67.27	685	22846	3366	9205	532	3533	5752
8	58.2	13895	147	70.16	722	23842	3533	9947	532	3751	6196
9	59.6	14229	168	73.04	760	24837	3734	10608	532	3897	6711
10	61.1	14587	194	75.92	800	25835	3915	11248	532	4072	7176
11	62.6	14945	218	78.80	820	26837	3989	11892	532	4229	7663
12	64.1	15303	243	80.7	840	27485	4041	12182	532	4278	7904
13	65.7	15685	268	82.7	861	28165	4095	12480	532	4305	8175
14	67.3	16067	294	84.8	882	28860	4147	12793	532	4333	8460
15	69.0	16473	322	86.8	903	29562	4204	13089	532	4357	8732
16	70.7	16879	349	89.0	926	30309	4272	13430	532	4387	9043
17	72.4	17285	377	91.2	948	31059	4327	13774	532	4427	9347
18	74.2	17715	406	93.4	972	31808	4379	14093	532	4453	9640
19	76.0	18144	435	95.7	996	32592	4441	14448	532	4476	9972
20	77.9	18598	461	98.1	1020	33409	4503	14811	532	4512	10299
21	79.8	19052	496	100.5	1045	34226	4566	15174	523	4539	10634
22	81.8	19529	529	102.9	1071	35045	4633	15516	532	4569	10947
23	83.8	20007	561	105.5	1097	35929	4701	15922	532	4604	11318
24	85.9	20508	595	108.1	1124	36814	4769	16306	532	4638	11768
25	88.0	21009	629	110.7	1152	37700	4841	16691	532	4672	12019
26	90.1	21511	663	113.5	1180	38653	4914	17142	532	4710	12432
27	92.4	22060	700	116.3	1209	39606	4987	17546	532	4746	12800
28	94.7	22609	737	119.1	1239	40561	5062	17952	532	4782	13170
29	97.0	23158	774	122.0	1269	41559	5140	18401	532	4820	13581
30	99.3	23707	811	125.0	1269	42570		18863	532	4861	14002

Note: a. Economic prices of inputs and outputs are based on Tables 4 and 5; b. Col. 4 - based on 5 Rs. per additional bushel over 49.1 bu./ac.; c. Col. 8 - see Table 6; Col. 10, 532000 Rs. = 533800 Rs. + 54156 Rs. (for annual operational costs of irrigation system and extension service respectively) - 35720 Rs. - 20000 Rs. (as previous annual operational costs of irrigation system respectively) see table 8; e. Col. 9 = Col. 7 - Col. 3; Col. 11 = Col. 8 + Col. 10 - Col. 4.

Table 3—Area Under Paddy and Pulses with Possible Alternatives

Year	Canal lining		Pipe lines		Cleaning Channels		Soil Compaction		Project Manager		Combined Programme	
	Paddy (ac.)	Pulse (ac.)	Paddy area (ac.)	Paddy (ac.)	Paddy (ac.)	Pulses (ac.)	Paddy (ac.)	Pulses (ac.)	Paddy (ac.)	Pulses (ac.)	Paddy (ac.)	Pulses (ac.)
1980	...	0	3293	3293	3293	0	3293	0	3293	0	3293	0
1981	...	150	3674	2767	2774	800	2600	900	3334	240	3334	240
1982	...	300	4056	2767	2774	1050	2600	1050	3375	480	3375	480
1983	...	450	4437	2767	2774	1300	2600	1200	3416	720	3416	720
1984	...	600	4819	2767	2774	1550	2600	1300	3457	960	3457	960
From 1985 up to 2009	...	770	5200	2767	2774	1788	2600	1422	3497	1205	3497	1205

Source: Vithanage (1982a).

Table 4—An Estimate of Accounting Ratios for Some Traded Goods

	Construction Stage			Operational Stage			Output
	Inputs			Inputs			
	Cement (cwt.)	Diesel (gallon)	Urea (tonne)	Triple Phos- phate (tonne)	Muriate of Potash (tonne)	Paddy (tonne)	
1. Import price, c.i.f. Colombo (US \$)	...	0.96	176.3	206.2	112.0	313.9	
2. Export price, f.o.b. Colombo (US \$)	4.55	15.40	2821	3299	1792	5022	
3. Foreign exchange in local currency (Rs.) <sup>a</sup>	-8.00	1.10	-75	75	75	75	
4. Store handling, labour dues (Rs.)	(-6.40)	(0.88)	(-60)	(60)	(60)	(60)	
5. Ex-factory price (Rs.) <sup>b</sup>	64.80		2746				
	(5832)		(2471)				
6. Road transport to MvCs <sup>c</sup> (Rs.)	2.00	0.45	422	422	422		
	(1.08)	(0.24)	(228)	(228)	(228)		
7. Rail transport to MvCS (Rs.)	...	0.20	...	...	...	...	
	...	(0.12)	...	...	...	...	
8. Trade margin (Rs.)	17.20	2.85	185	217	140		
	(12.04)	(2.00)	(129.3)	(149.1)	(98)		
9. Transport from retail outlets to farm (Rs.)	...	...	20	20	20		
	...	...	(16)	(16)	(16)		
10. Transport and marketing fees from Colombo to deficit area (Rs.)	...	...	...	...	...	640	
	...	...	...	...	...	(352)	
11. Transport and marketing fees from MvCS to deficit area (Rs.)	...	...	...	...	...	-400	
	...	...	...	...	...	(-220)	
12. Farm gate price (Rs.)	83.00	20.00	3373	4029	2449	5337 <sup>d</sup>	
13. Accounting price at MvCS	71.44	18.64	2845	3752	2194	5238	
14. Accounting Ratio	0.86	0.93					
15. Accounting price/economic price	...	...	0.84	0.93	0.90	0.98	

Note: a. 1 US \$—16 rupees in 1980; b. SCF of 0.9 is used as accounting ratio (Vithanage, 1982 a);

c. 240 Km to MvCS from Colombo; d. milling out ratio of paddy is taken as 65%; figures in parentheses are relevant accounting prices.

Sources: Import prices of fertilizer and paddy are based on data published by the Commodities and Export Projection Division, IBRD, April 1978; export prices were from Cement Corporation and Ceylon Petroleum Corporation.

Table 5—Economic Costs of Components of Possible Alternatives

	Operational stage annual costs ('000 Rs.)							Accounting ratio
	Canal lining construction ('000 Rs.)	Canal lining	Pipe lines	Cleaning channels	Soil compaction	Project Manager	Combined programme	
<b>A. Project cost</b>								
1. Cement ...	4150 (3569)							0.85
2. Diesel fuel	2400 (2232)	193.5 (180)	193.5 (180)	7.0 (6.5)	7.0 (6.5)	38.0 (35.3)	38.0 (35.3)	0.93
3. Unskilled labour	6400 (3712)	51 (30)	51 (30)	63 (36.5)	158 (91.6)	16 (9.3)	63 (36.5)	0.58
4. Skilled labour	4120 (4120)	94 (94)	94 (94)	47 (47)	71 (71)	67 (67)	79 (79)	1.0
5. Expatriate salaries	3520 (2816)							0.8
6. Equipment and vehicles	19380 (19380)	191.5 (191.5)	191.5 (191.5)	7.0 (7.0)	7.0 (7.0)	38.0 (38.0)	38.0 (38.0)	1.0
7. Buildings ...	2000 (1109)							0.55
8. Others	2530 (2277)	2 (1.8)	2 (1.8)	5 (4.5)	5 (4.5)	7 (6.3)	7 (6.3)	0.9
9. Total ...	44500 (38511)	532 (497)	532 (497)	129 (102)	248 (181)	166 (156)	225 (195)	
<b>B. Incremental Crop production cost</b>								
10. Seeds ...		172 (168.6)	173 (169.5)	103 (100.9)	120 (117.6)	65 (63.7)	127 (124.5)	0.98
11. Fertilizer		1262 (1173.7)	1295 (1204.4)	985 (916.1)	1007 (936.5)	1294 (1203.4)	1637 (1522.4)	0.93
12. Others		2263 (2036.7)	2332 (2098.8)	1475 (1327.5)	1549 (1394.1)	1016 (914.4)	1785 (1606.5)	0.9
13. Total ...		3697 (3379)	3800 (3473)	2563 (2345)	2676 (2448)	2375 (2182)	3549 (3253)	

Note: a. It is assumed that construction cost of pipelines has the same ratio of economic to social cost as canal lining.  
 b. Figures in parentheses are relevant accounting prices.

Table 6—Incremental Crop Production Cost with Possible Alternatives

	With canal lining (Rs.)	With pipe lines (Rs.)	With cleaning channels (Rs.)	With soil compaction (Rs.)	With project manager (Rs.)	With a combined programme (Rs.)
1. Land preparation and threshing						
(i) Buffaloes 240 Rs./ac.	343200	343200	227040	240720	131280	253680
(ii) Tractors 450 Rs./ac.	214650	214650	142200	150300	81900	158400
2. Seeds						
(i) Paddy 90.63 Rs./bu.	103046	172831	-47671	-47037	-62507	18489
(ii) Pulses 3.00 Rs./lb.	69300		150920	167040	127980	108450
3. Fertilizer						
(i) Paddy 166 Rs./cwt.	1017899	1294847	419763	422282	686981	1122519
(ii) Pulses 172.50 Rs./cwt.	243468		565352	584956	607105	514460
4. Farm labour						
(i) Paddy 64 man days/ac., 10 Rs./day	727680	1220480	-336640	-332160	-443520	130560
(ii) Pulses 55 man days/ac., 10 Rs./day	423500		983400	1020800	782100	662750
5. Miscellaneous 5 Rs./additional bushel	772200	772200	676418	687555	681930	797224
Total	3914943	4018200	2780782	2894456	2592949	3766522

Source: a. Buffalo and Tractor charges, Farm Survey, May 1980;  
 b. Seeds and Fertilizer prices are based on Table 4;  
 c. Labour requirements, (Vithanage, 1982a).

Table 7—Cost Estimates of Pipe Line Projects

		<i>Mahakandarawa Tract 3, Left Bank Distributary 10 (105.5 acres) (Rs.)</i>	<i>Mahaweli Scheme H area Block 404 (327.5 acres) (Rs.)</i>
1.	Earth Excavation ...	1800	147870
2.	Spun Pipe with laying ...	173368	984400
3.	Valves with fixing ...	1500	152843
4.	Flow meters with fixing ...	5000	19840
5.	Turnout Structures ...	22800	171289
6.	Spillway on the level of top canal ...	11600	30000
	Sub total ...	(232268)	(1506842)
	Cost per acre (Rs.) ...	2202	4601
7.	Regulating reservoir		
	i. Earthwork ...	n.g.	65250
	ii. Spillway ...	n.g.	4833
	iii. Nerypic Gate ...	n.g.	45167
	iv. Inlet and outlet ...	n.g.	21667
	v. Broad creased weir ...	n.g.	933
	vi. Pumps ...	30000	n.g.
	vii. Pumps House construction ...	5000	n.g.
8.	General		
	i. Temporary sheds for stores and watchers	1000	n.g.
	ii. Temporary sheds for overseers ...	3600	n.g.
	iii. Watchers ...	1800	n.g.
	iv. Transport and contingencies ...	36332	n.g.
	Total ...	310000	1621189
	Cost per acre (Rs.) ...	2938	5020

Note: n.g. not given.

Sources: Col.1—Estimates given by D. J. Bewan, Water Management Specialist, to the Anuradhapura Chief Engineer on 13th August, 1979; Col.2, estimates given by the Mahaweli Development Board on 6th June, 1980.

Table 8—Costs Involved other than Direct Investment with Possible Alternatives

	<i>Fixed Investment</i> (‘000 Rs.)	<i>Annual fixed and</i> <i>variable cost (Rs.)</i>
1. New extension programme—for all alternatives	3350	
(i) Skilled labour ... ..		43325
(ii) Vehicles and fuel ... ..		6500
(iii) Others ... ..		4331
Total ...		54156
2. Irrigation Department with gravel canals		
(i) Technical Asst. (1) 800 Rs./mth ...		9600
(ii) Labourers (4) 250 Rs./mth ...		12000
Leave and travel 20% ...		5320
(iii) Motor cycle (1) 500 hrs./yr. 14 Rs./hr ...		7000
(iv) Building repairs and renewals ...		1000
Contingencies 10% ...		800
Total ...		35720
3. Irrigation Department with lined channels and pipe lines		
(i) Skilled labour ... ..		64000
(ii) Unskilled labour ... ..		60000
Leave and travels 20% ...		24800
(iii) Equipment and vehicles contingencies 10%		350000
Contingencies 10% ...		35000
Total ...		533800

Note: a. Increased cost of fertilizer is given in Table 6.

Source: a. Cost on extension service, World Bank Appraisal Report (1976) op. cit. and Dept. of Agriculture.

b. Cost on water management, Dept. of Irrigation.



Table 9—Annual Estimates of Economic Benefits and Costs with Pipelines

Year	With Project		Incremental			
	Income (‘000 Rs.)	Incremental on farm Costs (‘000 Rs.)	Gross Benefits (‘000 Rs.)	Project costs (‘000 Rs.)	Gross costs (‘000 Rs.)	Net benefits (‘000 Rs.)
1	11722		0	55462	55462	—55462
2	14091	589	2082	532	1101	981
3	16394	1169	4099	532	1661	2438
4	18860	1760	6254	532	2232	4022
5	21375	2389	8459	532	2840	5619
6	24275	2996	11049	532	3426	7623
7	25361	3201	11800	532	3609	8191
8	26450	3405	12555	532	3790	8765
9	27536	3616	13307	532	3970	9337
10	28622	3814	14035	532	4152	9883
11	29708	4018	14763	532	4332	10431
12	30424	4068	15121	532	4357	10764
13	31178	4120	15493	532	4384	11109
14	31970	4174	15903	532	4412	11491
15	32724	4226	16251	532	4436	11815
16	33553	4284	16674	532	4467	12207
17	34382	4342	17079	532	4497	12582
18	35099	4406	17384	532	4532	12852
19	36079	4458	17935	532	4555	13380
20	36984	4520	18386	532	4591	13795
21	37889	4583	18837	532	4619	14218
22	38793	4645	19264	532	4648	14616
23	39774	4713	19767	532	4684	15083
24	40754	4780	20246	532	4717	15529
25	41734	4848	20725	532	4751	15974
26	42790	4921	21279	532	4790	16489
27	43445	4993	21785	532	4825	16960
28	44901	5046	22292	532	4841	17451
29	45994	5142	22836	532	4900	17936
30	47125	5220	23418	532	4941	18477

Note: a. without project income and on farm cost, and with project yields are given in table 2;  
 b. economic prices of inputs and outputs are based on tables 4 and 5; Col. 3—see table 6;  
 Col. 5, 532000 Rs. = 533800 Rs. + 54156 Rs. (as annual operational cost of irrigation system and extension service respectively) - 35720 Rs. - Rs. 20000 Rs. (as previous annual operational costs of irrigation system and extension service respectively), see table 8.

Table 10—Annual Estimates of Economic Benefits and Costs with Cleaning and Maintenance of Field Channels

Year	With Project		Incremental			
	Income (‘000 Rs.)	Incremental on farm costs (‘000 Rs.)	Gross Benefits (‘000 Rs.)	Project costs (‘000 Rs.)	Gross costs (‘000 Rs.)	Net benefits (‘000 Rs.)
1	11722		0	3350	3350	-3350
2	11604	375	-405	129	484	- 889
3	12556	628	261	129	717	- 456
4	13551	1176	945	129	1245	- 300
5	14521	1581	1605	129	1628	- 23
6	15653	2009	2427	129	2036	391
7	16377	2183	2816	129	2188	628
8	17112	2356	3217	129	2336	881
9	17854	2530	3625	129	2489	1136
10	18600	2703	4013	129	2638	1375
11	19355	2876	4410	129	2789	1621
12	19825	2926	4522	129	2814	1708
13	20315	2978	4630	129	2839	1791
14	20830	3032	4763	129	2867	1896
15	21324	3084	4851	129	2981	1960
16	21858	3142	4979	129	2922	2057
17	22401	3199	5116	129	2951	2165
18	22941	3264	5226	129	2987	2239
19	23508	3316	5364	129	3010	2354
20	24097	3378	5499	129	3046	2453
21	24684	3441	5632	129	3074	2556
22	25277	3503	5748	129	3103	2645
23	25913	3551	5906	129	3119	2787
24	26550	3638	6042	129	3172	2870
25	27191	3706	6182	129	3206	2976
26	27877	3779	6366	129	3245	3121
27	28563	3851	6503	129	3280	3223
28	29253	3924	6644	129	3336	3308
29	29968	4000	6810	129	3355	3455
30	30703	4078	6996	129	3396	3600

Note: a. Without project income and on-farm costs, and with project yields are given in table 2;  
b. Economic prices of inputs and outputs are based on tables 4 and 5; Col. 3, see table 6;  
Col. 5 129000 Rs. of annual operational cost = 59000 Rs. (for cleaning channel programme)  
+ 54156 Rs. (for extension service) + 35720 Rs. (for irrigation system) — 20000 Rs. (as  
previous extension service cost), see table. 8.

Table 11—Annual Estimates of Economic Benefits and Costs with Compaction of Soil in Beds and Banks of Field Channels

Year	With Project		Incremental			
	Income (‘000 Rs.)	Incremental on farm costs (‘000 Rs.)	Gross benefits (‘000 Rs.)	Project costs (‘000 Rs.)	Gross costs (‘000 Rs.)	Net benefits (‘000 Rs.)
1	11722	0	0	3350	3350	-3350
2	11631	385	-378	248	613	-981
3	12584	786	289	248	994	-705
4	13580	1194	974	248	1382	-408
5	14625	1650	1709	248	1817	-108
6	15790	2101	2564	248	2247	317
7	16521	2276	2960	248	2400	560
8	17263	2453	3368	248	2554	814
9	18012	2629	3783	248	2709	1074
10	18767	2804	4180	248	2858	1322
11	19530	2979	4585	248	3009	1576
12	20004	3029	4701	248	3034	1667
13	20499	3081	4814	248	3061	1753
14	21018	3135	4951	248	3089	1862
15	21517	3192	5044	248	3118	1926
16	22056	3244	5177	248	3143	2034
17	22604	3302	5319	248	3173	2146
18	23148	3367	5433	248	3209	2224
19	23721	3419	5577	248	3232	2345
20	24314	3481	5716	248	3267	2449
21	24907	3571	5855	248	3323	2532
22	25505	3606	5976	248	3325	2651
23	25948	3673	6141	248	3360	2781
24	26790	3741	6282	248	3394	2888
25	27437	3809	6428	248	3428	3000
26	28130	3881	6619	248	3466	3153
27	28822	3979	6762	248	3527	3235
28	29518	4027	6909	248	3538	3371
29	30239	4102	7081	248	3576	3505
30	30980	4180	7273	248	3617	3656

Note: a. Without project income and on farm costs, and with project yields are given in table 2; b. Economic prices of inputs and outputs are given in tables 4 and 5; c. Col. 3, see Table 6; Col. 5, 248000 Rs. of annual operational costs = 178000 Rs. (for soil compaction programme) + 54156 Rs. (for extension service) + 35720 Rs. (for irrigation system) - 20000 Rs. (as previous extension service cost), see table 8.

**Table 12 Regression Functions Applied to Fertilizer (cwt. per acre)—Paddy Yield (bu./acre) Responses, Survey Farms, Mahavillachchiya, Maha 1979/80**

	$R^2$	standard error of		
		<i>a</i>	<i>b</i>	<i>c</i>
<b>Left Bank</b>				
1. $y=40.1 + 8.39 x$	0.38	8.52	2.61	
2. $y=37.32 + 18.42 x - 4.57 x^2$	0.44	8.34	8.01	3.46
3. $\log y=38.9 + 0.15 x$	0.37	0.08	0.03	
4. $\log y=50.12 + 0.14 \log x$	0.34	0.08	0.03	
<b>Right Bank</b>				
1. $y=38.65 + 7.60 x$	0.32	12.11	2.22	
2. $y=35.50 + 13.89 x - 1.78 x^2$	0.35	12.12	6.75	1.81
3. $\log y=38.02 + 0.21 x$	0.31	0.11	0.02	
4. $\log y=47.86 + 1.32 \log x$	0.34	0.11	0.03	
<b>Whole Scheme</b>				
1. $y=39.56 + 7.59 x$	0.32	10.62	1.64	
2. $y=36.96 + 13.45 x - 1.83 x^2$	0.36	10.50	4.47	1.30
3. $\log y=38.90 + 0.20 x$	0.31	0.10	0.02	
4. $\log y=48.98 + 1.26 \log x$	0.32	0.10	0.02	

**Note:** *y*, yields per acre;  
*x*, fertilizer cwt. per acre;  
*a*, constant term;  
*b* and *c*, regression coefficients of *x* and  $x^2$ ;  
 $R^2$ , coefficient of determination.

Source: *Field Survey, May 1980.*

**Table 13 Paddy Yields with Different Levels of Fertilizer p for the Whole Scheme, Survey Farms, Mahavillachchiya, Maha 1979/80**

	Fertilizer Amount cwt/acre	per cent of fertilizer recommendation	Yield per acre (bushels)	With Fertilizer		
				Additional Cost (Rs.)	Additional income (Rs.)	Marginal increase in net income (Rs.)
(i)	0	0	35.96			
(ii)	1.083	33	49.39	60.65	497.20	436.55
(iii)	2.166	66	57.49	121.30	821.20	263.35
(iv)	2.925	90	60.61	163.80	946.00	82.30
(v)	3.250	100	61.30	182.00	973.60	9.40
(vi)	3,668q	113	61.60	205.41	985.60	-11.41
(vii)	$\frac{(iv)}{(iii)} \times 100$		105.43			
(viii)	3.285r		61.40			

Note: p. the function used is  $y = a + bx - cx^2$ ;

q. maximum yield,  $\frac{dy}{dx} = 0 = b - 2cx$ ;

r. optimum yield for farmers,  $\frac{dy}{dx} = \text{price of fertilizer/price of paddy} = b - 2cx$

Source: Field Survey, May 1980.

**Table 14 Annual Estimates of Benefits and Costs with a Project Manager for Intergrated Rural Development**

Year	With Project			Incremental				
	Paddy Yield/ ac. (bu.)	Pulses Yield/ ac. (lbs.)	Income ('000 Rs.)	Incremental on farm costs ('000 Rs.)	Gross benefits ('000 Rs.)	Project costs ('000 Rs.)	Gross costs ('000 Rs.)	Net benefits ('000 Rs.)
1	49.10		11722			3350	3350	-3350
2	53.68	500	11235	354	-774	166	500	-1274
3	56.89	529	12102	696	-193	166	722	- 915
4	60.16	559	13004	1008	398	166	1214	- 816
5	63.42	592	13947	1300	1031	166	1385	- 354
6	66.69	626	14779	1616	1553	166	1680	- 127
7	69.95	663	15524	1813	1963	166	1855	108
8	73.22	701	16274	2008	2379	166	2027	352
9	76.48	742	17033	2203	2804	166	2201	603
10	79.74	785	17799	2438	3212	166	2410	802
11	83.01	832	18581	2592	3636	166	2540	1096
12	85.05	852	19037	2633	3734	166	2556	1178
13	87.14	873	19505	2676	3820	166	2574	1246
14	89.29	895	19987	2717	3920	166	2589	1331
15	91.48	917	20478	2763	4005	166	2607	1398
16	93.74	939	20981	2808	4102	166	2625	1477
17	96.04	963	21500	2855	4215	166	2644	1571
18	98.40	986	22025	2902	4310	166	2662	1648
19	100.82	1011	22570	2954	4426	166	2685	1741
20	103.30	1035	23122	3001	4524	166	2706	1818
21	105.85	1061	23695	3052	4643	166	2722	1921
22	108.45	1087	24276	3105	4747	166	2752	1995
23	111.12	1114	24875	3178	4868	166	2783	2085
24	113.85	1141	25485	3211	4977	166	2782	2195
25	116.65	1169	26112	3269	5103	166	2806	2297
26	119.52	1198	26755	3327	5244	166	2830	2414
27	122.46	1227	27411	3384	5351	166	2850	2501
28	125.47	1258	28087	3447	5478	166	2876	2602
29	128.56	1289	28780	3509	5622	166	2901	2721
30	131.72	132	29484	3572	5777	166	2927	2850

**Note:** *a.* economic prices of inputs and outputs are based on tables 4 and 5; *b.* without project income and on-farm costs are given in table 2; *c.* Col. 5, see table 6; *d.* Col. 7 166000 Rs. of annual operational cost 96,000 Rs. (for the project manager's programme)+54156 Rs. (for extension service) + 35720 Rs. (for irrigation system) — 20000 Rs. (as previous extension service cost.), see table 8.

Table 15—Annual Estimates of Benefits and Costs with a Combined Programme

Year	With Project		Incremental			
	Income (‘000 Rs.)	Incremental on farm costs (‘000 Rs.)	Gross benefits (‘000 Rs.)	Project costs (‘000 Rs.)	Gross costs (‘000 Rs.)	Net benefits (‘000 Rs.)
1	11722		0	3350	3350	-3350
2	13274	524	1265	225	729	536
3	14550	935	2255	225	1120	1135
4	15897	1499	3291	225	1664	1627
5	17304	2064	4388	225	2208	2180
6	18779	2505	5553	225	2628	2925
7	19716	2734	6155	225	2835	3320
8	20659	2923	6764	225	3011	3753
9	21607	3193	7378	225	3250	4128
10	22663	3411	8076	225	3442	4634
11	23532	3650	8587	225	3657	4930
12	24109	3691	8806	225	3673	5133
13	24702	3714	9017	225	3691	5326
14	25312	3775	9245	225	3706	5539
15	25933	3821	9460	225	3724	5736
16	26572	3867	9693	225	3743	5050
17	27226	3913	9941	225	3761	6180
18	27894	3960	10179	225	3779	6400
19	28582	4013	10438	225	3803	6635
20	29283	4059	10685	225	3823	6852
21	30006	4110	10954	225	3839	7116
22	30744	4163	11215	225	3859	7356
23	31502	4236	11495	225	3880	7615
24	32275	4269	11767	225	3899	7868
25	33068	4327	12059	225	3923	8136
26	33882	4385	12371	225	3947	8424
27	34708	4442	12648	225	3967	8681
28	35571	4505	12962	225	3993	8969
29	36446	4567	13288	225	4018	9270
30	37340	4630	13633	225	4044	9589

**Note:** a. Without project income and on-farm costs are given in table 2; b. With project yields are given in table 14; c. Economic prices of inputs and outputs are based on tables 4 and 5; d. Col. 3, see table 6; Col. 5, 225000 Rs. of annual operation cost 96,000 Rs. (for the project manager programme) + 59,000 Rs. (for cleaning channel programme) + 54156 Rs. (for extension service) + 35720 Rs. (for irrigation system) - 20000 Rs. (as previous extension service cost), see table 8.

Table 16 Annual Present Value of Economic Benefits and Costs of Alternatives (at 12 per cent discount rate)

Year	Benefits ('000 Rs.)							Costs ('000 Rs.)						
	Canal Lining	Pipe lines	Cleaning Channels	Soil Compaction	Project Manager	Combined Programme	Canal Lining	Pipe lines	Cleaning Channels	Soil Compaction	Project Manager	Combined Programme		
1	0.0	0.0	0.0	0.0	0.0	0.0	39738.5	49527.6	2991.5	2991.5	2991.5	2991.5		
2	1886.5	1659.4	-322.8	-301.3	-318.8	1008.2	867.9	877.5	488.6	398.5	581.0	581.0		
3	2892.1	2918.5	185.8	205.8	2.1	1605.6	1174.8	1182.6	707.7	514.1	797.4	797.4		
4	3730.8	3977.5	601.0	619.5	448.4	2093.1	1395.4	1419.6	879.0	772.1	1058.3	1058.3		
5	4310.9	4796.2	910.0	969.0	639.0	2488.0	1570.0	1610.3	1030.2	785.3	1251.9	1251.9		
6	4376.4	5601.8	1230.5	1299.9	787.4	2815.4	1709.6	1737.0	1139.2	851.8	1332.4	1332.4		
7	4196.8	5333.6	1272.8	1337.9	887.3	2782.1	1596.9	1631.3	1084.8	838.5	1281.4	1281.4		
8	4018.6	5072.2	1299.7	1360.7	961.1	2732.7	1515.4	1531.2	1031.8	818.9	1216.4	1216.4		
9	3829.5	4803.8	1308.6	1365.7	1012.2	2663.5	1406.8	1433.2	977.9	794.6	1173.2	1173.2		
10	3621.9	4519.3	1292.2	1346.0	1034.3	2600.5	1311.2	1336.9	920.3	776.0	1108.3	1108.3		
11	3413.0	4237.0	1265.7	1315.9	1043.5	2464.5	1220.6	1243.3	863.6	729.0	1049.6	1049.6		
12	3130.8	3886.1	1162.2	1208.2	959.6	2263.1	1099.4	1119.7	779.7	656.9	944.0	944.0		
13	2857.9	3547.9	1060.3	1102.4	874.8	2064.9	985.8	1003.9	701.0	589.4	845.2	845.2		
14	2622.6	3260.1	976.4	1015.0	803.6	1895.2	888.3	904.5	633.2	530.7	759.7	759.7		
15	2395.3	2973.9	887.7	923.1	732.9	1731.2	797.3	811.8	570.6	477.1	681.5	681.5		
16	2189.1	2717.9	811.6	843.9	668.6	1580.0	715.1	728.1	512.3	427.9	610.1	610.1		
17	2011.0	2493.5	746.9	776.6	615.4	1451.4	646.3	656.6	463.3	386.0	549.1	549.1		
18	1832.1	2259.9	679.4	706.3	560.3	1323.3	578.9	589.2	417.2	346.1	491.3	491.3		
19	1676.0	2080.5	622.2	646.9	513.4	1210.8	519.2	528.4	374.9	311.5	441.1	441.1		
20	1540.3	1912.1	571.9	594.5	470.5	1111.2	469.2	477.5	339.8	281.4	397.6	397.6		
21	1411.2	1751.8	523.8	544.5	431.8	1018.7	422.1	429.6	309.0	253.1	357.0	357.0		
22	1287.8	1598.9	477.1	496.0	394.0	930.8	379.2	385.8	276.0	228.4	320.3	320.3		
23	1178.2	1462.8	437.0	443.3	360.2	850.6	340.7	346.6	248.6	205.9	287.1	287.1		
24	1076.2	1336.2	398.8	414.6	328.5	776.6	306.1	311.3	224.0	183.6	257.3	257.3		
25	984.8	1222.8	364.7	379.3	301.1	711.5	275.6	280.3	202.3	165.6	231.5	231.5		
26	908.5	1127.8	337.4	350.8	277.9	655.7	249.6	253.9	183.7	150.0	209.2	209.2		
27	824.7	1023.9	305.6	317.8	251.5	594.5	223.1	226.8	165.8	133.9	186.4	186.4		
28	754.0	936.3	279.0	290.2	230.0	544.4	200.8	203.3	148.6	120.8	167.7	167.7		
29	680.8	844.9	252.0	262.0	208.0	491.7	178.3	181.3	132.3	107.3	148.7	148.7		
30	622.5	772.8	230.9	240.0	190.6	449.9	160.4	163.1	119.4	96.6	133.5	133.5		
Total	66260.1	80129.1	20168.5	21074.2	15669.4	44908.7	62942.9	73131.2	17442.7	18916.2	15922.5	21859.9		



Table 17 NPV, BCR, IRR and Present Value of Cost per acre of Alternatives with the Economic Cost Benefit Analysis

	NPVs of alternatives			BCR at 12% DR	IRR	Present Value of cost at 12% DR		NPV with an incremental project b (‘000 Rs.)
	at 5% DR (‘000 Rs.)	at 12% DR (‘000 Rs.)	at 20% DR (‘000 Rs.)			Total a (‘000 Rs.)	per addi- tional acre (Rs.)	
	...	...	...			...	...	
1. Canal lining	65601	3317	-16763	1.05	12.8	62943	40845	13505
2. Pipelines	90000	6998	-20119	1.10	13.4	73131	38349	6998
3. Cleaning and maintenance of field channels	16435	2726	- 1274	1.16	16.2	17443	40659	58415
4. Compaction of soil in beds and banks of field channels	15622	2158	- 1678	1.11	15.2	18916	40077	56373
5. Project manager for integrated rural development	8483	-1040	- 3278	0.94	10.5	15923	46557	56169
6. Combined programme (3 x 5)	65175	23049	8870	2.05	7.30	21860	26789	74320

Note: a. see table 16; b. (i) investment in an incremental project (10188000 rupees of canal lining) = highest present value of cost (73131000 rupees of pipelines) - present value of cost of relevant alternative (62943000 rupees of canal lining); (ii) the NPV with an incremental project = the NPV of the relevant alternative (3317000 rupees of canal lining) + investment in an incremental project (10188000 rupees of canal lining.)

The following table shows the results of the ecological appraisal of the water management system. The results are given in terms of the number of species, the number of individuals, and the biomass of the species. The results are given in terms of the number of species, the number of individuals, and the biomass of the species. The results are given in terms of the number of species, the number of individuals, and the biomass of the species.

Category	Number of Species	Number of Individuals	Biomass (g)
1. Aquatic Invertebrates	120	15000	15000
2. Terrestrial Invertebrates	80	10000	10000
3. Fish	5	1000	1000
4. Amphibians	2	50	50
5. Reptiles	1	10	10
6. Birds	10	2000	2000
7. Mammals	5	1000	1000
8. Plants	150	20000	20000
9. Fungi	100	10000	10000
10. Mosses	50	5000	5000
11. Lichens	30	3000	3000
12. Algae	20	2000	2000
13. Bacteria	1000	1000000	1000000
14. Fungi	500	500000	500000
15. Protozoa	1000	1000000	1000000
16. Viruses	10000	100000000	100000000
17. Total	2500	2500000	2500000

Table 1. Results of the ecological appraisal of the water management system.

## BOOK REVIEW

*Caste and Family in the Politics of the Sinhalese 1947-1976.* By Janice Jiggins. London: Cambridge University Press, 1979, xiii, 189 pp., tables, maps, charts, glossary, appendix, notes, bibliography, index. £ 9.50.

For the student of contemporary Sri Lankan society, caste is something of an enigma. Caste is rarely heard of or mentioned in the day-to-day life of the people. Yet, the influence of deep-seated caste loyalties seem to be reflected in many facets of society. This is what has roused Janice Jiggins' interest in exploring the role of caste and family in the post-independence politics of the Sinhalese. The resulting monograph is an exciting work, throwing much light into the intricacies of the political scene in Sri Lanka.

In the opening chapter, the so-called Bandaranaike revolution of 1956 is interpreted as a mass movement mobilizing low castes and lower status *Goigama* in an all-out effort to challenge the vested interests of the *Goigama* elite represented by the United National Party (UNP). A brief and somewhat inadequate introduction to the Sinhalese caste system follows in the second chapter. Chapters three and four bring out elements of caste voting in some selected electorates. The author focuses on eleven electorates in Southern and Western provinces, two in the North-Central Province and sixteen in *Sabaragamuwa*. The powerful *Karawa*, *Salagama* and *Durawa* castes, populating the South-Western coastal belt, have been successful in securing a number of electorates specially carved out on their behalf in spite of the avowed denial of caste considerations by successive delimitation commissions. 'The radicalism of the South' as manifested in the long-standing popularity of leftist parties in the area is explained in terms of the anti-*Goigama* frustrations of the *Karawa*, *Salagama* and *Durawa*. The isolated *Salagama* presence in the politics of *Polonnaruwa* and *Minneriya* in the North-Central Province is attributed to the large scale importation of fellow-caste men from the south by the veteran of dry zone colonization, C. P. de Silva.

It is in her treatment of *Sabaragamuwa* that the author comes up with the most striking findings. Attention is drawn to two hitherto unelaborated castes, namely *Vahumpura* and *Batgam*. The author speculates that due to the heavy concentration of these two castes in areas of malaria eradication, their numerical strength has increased at an exceptionally high rate over the past four decades. According to her own estimates, the two castes jointly account for nearly 34 percent of the Sinhalese population. Yet, representation of their interests in national politics is all but weak, particularly by comparison to coastal castes, mainly because of the manipulation of electoral boundaries so as to benefit the *Goigama* by breaking up *Batgam-Vahumpura* concentrations. The argument extends to point out that unless there is a strong UNP candidate representing their own castes, *Batgam* and *Vahumpura* votes in *Sabaragamuwa* have consistently gone against the UNP, the vanguards of the *Goigama* elite.

Chapters five and six deal with the role of caste and family in politics at the national level. Contrary to the image of leftist parties as representatives of the urban working class, the author tries to demonstrate that the leftist parties make a deliberate attempt to appeal to the non-*Goigama* coastal castes and low castes in the up-country. The account of 'caste lobbies' is short but illuminating. Through caste lobbies the prominent people in each of the coastal castes endeavour to promote their respective caste interests in such diverse fields as business, politics, bureaucracy

and religion. The family trees of the two major political families in the land, *Bandaranaikes* and *Senanayakes*, are elaborated so as to show their internal cohesion and widespread power. Chapter seven provides an account of the 1971 insurgency with special reference to the role of low castes and Buddhist monks in the movement. The author admits that she has hardly any new findings on the subject, but she succeeds in giving 'flesh and blood' to the story.

The concluding chapter raises a number of theoretical problems. The author's attempt to subsume caste and family loyalties in politics in the general model of patron-client relations is not entirely justifiable. The patron-client model explains politics in terms of dyadic (person to person) relations between politicians and their followers. While caste and family loyalties may enter into such interpersonal political relations, the findings of the study imply that caste and family also function in a more important capacity as 'groups'. The author argues, for instance, that the coastal castes are attracted to leftism because of their opposition to the *Goigama* elite represented by the UNP. It follows that caste is not merely a traditional loyalty exploited by the political activist, but rather a social group having a common ideology and collective interests. This aspect of caste and family is neither emphasized nor explained in the book.

It is ironical that the notion of caste goes undefined in a book that is primarily concerned with the implications of caste. Some fundamental aspects of caste—the notion of purity and impurity and caste service for instance—seem quite diluted in modern Sri Lanka. In this context, what remains as caste has to be well clarified before any further treatment of the role of caste is undertaken. The book leaves the impression that there is essentially a one-way interaction between caste and politics, caste always being the independent variable. As clearly demonstrated by Rudolph and Rudolph in their treatment of caste and politics in India (**L. I. Rudolph and S. H. Rudolph. *The Modernity of Tradition: Political Development in India*, Chicago: University of Chicago Press, 1967**), in its political role the nature of caste itself can change from a tradition-bound village institution to a regional or national level institution organized along modern lines. It will be interesting to see whether the 'caste lobbies' discussed by Jiggins could be reinterpreted in the lines suggested by Rudolph and Rudolph.

The book is easy reading except for the kinship charts which could have been made more readable by using standard anthropological symbols. Despite all its weaknesses the book remains a valuable contribution to the growing social science literature on Sri Lanka.

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## CONTENTS

Reproducing Old Structures through Reforms: the Experience of Land Reforms in Sri Lanka —Gamini Wickramasinghe	01
Agricultural Insurance in Sri Lanka —Tudor O. Devendre	• 11
Plantations as the Dominant Mode of Production in Sri Lanka – A Historical Analysis —Ishak Lebbe	23
Software or Hardware? An Economic Appraisal of a Water Management Project —Nelson Vithanage	33
Book Review —Tudor Silva	63

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