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AN ASSESSMENT OF POLICY CONSTRAINTS ON SRI LANKA'S AGRO-INDUSTRIAL SECTOR

A Special Policy Study

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PREFACE

The authors conducted this study from June 1, 1995 through July 12, 1995. We wish to thank all members of the Agro-Enterprises (AgENT) team for their assistance in collecting documents, arranging interviews with AgENT clients and agro-industry leaders, and reviewing the project's experience with policy constraints.

We are particularly grateful to Richard Hurelbrink, the AgENT Chief of Party, for his assistance in organizing briefings and arranging our logistical support.

We have attempted to collect relevant information and collect our findings and conclusions in a logical manner. However, we are solely responsible for any errors in reporting or interpreting facts. And finally, we are solely responsible for recommendations to alleviate agro-industrial policy constraints.

ACRONYMS

AgENT	Agro-Enterprises Project
CLEO	Crown Lands Encroachment Ordinance
DARP	Diversified Agricultural Research Project
DOA	Department of Agriculture
GSL	Government of Sri Lanka
LDO	Land Development Ordinance
LMRB	Lanka Market Research Bureau (Pvt.) Ltd.
NIC	Newly Industrialized Country
OFCs	Other Field Crops
SRL	Survey Research Lanka (Pvt.) Ltd.

EXECUTIVE SUMMARY

Purpose of Study

The main objective of this study was to undertake a critical review of the major policy constraints in the agro-industrial sector that would help government planners and policy analysts formulate policies and programs to remove the constraints. The review was based primarily on the findings of the above survey and included specific policy options, with emphasis on those that could be implemented in the short run (i.e., within a two-year time frame).

Constraints Identified

Prior to beginning this study, AgENT conducted a survey of AgENT clients and agro-industry trade associations to identify critical sector constraints. The survey revealed significant land, seed, and processed foods packaging shortages. In the course of assessing the scope and nature of these constraints, inadequacies in the government's current agro-industry policy framework were also identified.

Land Constraint Assessment Results

Findings

Current protective tariffs cause significant land and labor resources to be tied up in relatively less competitive crops, but removal of the tariffs would not lead to quick resource allocation because of land productivity limitations, lack of market infrastructure and cultivation knowledge for non-traditional crops, and historic dependence on the current crop mix. Strong competition for residential and commercial uses renders most privately owned land too expensive for long-term agricultural use. There is currently no practical means available for determining the full economic potential of government-operated lands. The political opposition to selling even modest amounts of government-owned arable lands is so pervasive that it must be considered an immutable limitation.

Conclusions

Residential and commercial demand for land is rapidly causing agriculture to be an uncompetitive use of privately owned arable lands. Government-owned arable lands will not be allocated according to their long term economic productivity until a transparent land market process is implemented. Even if all government-owned arable lands were immediately offered for competitive leasing or sale to the private sector, the incremental increase in total agricultural land supply will not be adequate to support food self-sufficiency.

Recommendations

The government should rationalize the land market by:

- Promoting transparency in current usage of government lands. The government should publish annual business statements for all government-owned agricultural lands. This information would serve both as an inventory of government lands, and a first-round measure of its opportunity cost in its current usage.
- Promoting transparency in shifting government lands to better uses. The government should use competitive bidding to award leases to firms or government agencies that offer higher agricultural rents than the current usage.

Seed Constraint Assessment Results

Findings

Government seed production costs are well above the market price of government seeds. There are no uniform, annual operating statements for government seed production operations available to the public. Private seed producers want protective tariffs on competing imported seeds. The Department of Agriculture's seed policy does not admit the importance of productivity in determining farmer demand for seeds. The DOA's emphasis on supply aspects of seed policy fails to differentiate and accommodate the four fundamental factors affecting seed supply: R&D, seed multiplication, post-harvest processing, and marketing. There are no reliable statistics available on the effect of genetic quality on local crop yields. The local seed industry (public and private) does not have a clear understanding of the trends and scope of the local seed market. The DOA's seed certification program is an effective model of international phytosanitary standards. However, the DOA prohibits the importation of chili, bean, and okra seeds, not on phytosanitary grounds, but because it believes the country is self-sufficient in the production of those seeds. Non-traditional crop seeds are being imported without unreasonable delays and constraints, and anecdotal evidence suggests that these imports have increased sharply during the past two years.

Conclusions

The DOA's often-cited maximum potential crop yields, typically two or three times greater than actual field yields, are not realistic production targets under current market conditions. The maximum potential crop yields cannot be differentiated into seed, management, and other input components. The domestic seed industry will not become an effective supplier until the DOA ceases commercial seed production. The domestic seed industry will benefit from imported seed competition. The public nature of seed research and development requirements make the DOA well suited to support the domestic seed industry with a targeted adaptive seed research program. Local seed research and development, whether performed by the private or public sectors, will not be effective until it is linked to the relative commercial potential of all crops. Seed import

barriers, whether protective tariffs or import licenses, are a serious barrier to domestic crop production.

Recommendations

The government should rationalize the seed market by:

- Privatizing the remaining DOA commercial seed production operations. These seed farms may be leased by private seed companies or converted into commercial crop production, according to the country's ability to produce seeds at competitive prices.
- Removing all quantitative barriers to seed imports. The current practice of requiring import licenses for chili, okra, and beans effective bars growers and consumers from the benefits of superior genetic materials that may well exist in other countries specializing in these crops.
- Increasing DOA adaptive research and development on seeds. Since the DOA has a competitive advantage in crop breeding expertise, this important resource should be exploited for its unique ability to help private seed companies adapt local and foreign seeds to evolving local production conditions.

Packaging Constraint Assessment Results

Findings

The quality of local packaging materials is not competitive for exporting processed fruits and vegetables. Removing the 35 percent tariff on imported glass bottles and tin cans will yield a price reduction of at least two percent on exported processed fruit and vegetable products. The extent of the tariff's impact on the total processed food industry cannot be estimated until industry production statistics are desegregated to reflect the complete demand for bottle and tin can packaging. The low volume of fruit and vegetable processing is a major impediment to packaging innovation. The local supply of packaging materials is so erratic and unreliable that processors regularly suffer large losses of fresh fruits and vegetables at harvest time.

Conclusions

While removal of the 35 percent tariff on imported glass bottles and tin cans will lower the wholesale prices of exported processed fruits and vegetables, the benefits (about two percent) cannot be justified solely on the basis of the export processed food market. In the short term, the main benefits of removing of protective tariffs on imported packaging materials will be not the cost savings on the tariffs, but the increase in availability of quality packaging at the time of harvest.

Recommendations

In the case of packaging, the government should accelerate innovation and competition by:

- Accelerating the schedule for lowering tariffs on imported glass and tin packaging materials. In general, removing the current tariff would lower processed food prices by at least two percent, and expand production by at least the same proportion as the price change.
- Removing any remaining barriers to importing improved packaging technology. Using new technologies will strengthen processors' competitive position in export markets and expand the relatively large domestic market base.

Policy Framework Constraint Assessment Results

Findings

Maintaining high farmgate prices is the most common agricultural policy objective. Protective tariffs are explicitly supported. Attainment of NIC status is a recurring objective of overall economic policy, but no attention is given to the structural transformation that will be required in agro-industry if that objective is to be achieved. Policy initiatives do not consider the implications of the supply and demand structure of agro-industry products and inputs.

Conclusions

Current policy formulations are ineffective because they do not cast policy initiatives in terms of realistic goals and the implications of tradeoffs necessary to meet those objectives. The traditional inward-directed focus of agro-industrial policy is a major barrier to technical innovation in agricultural production and marketing. The price and production implications of technical innovation in food production would be a major improvement in the formulation of both agricultural and industrial policies.

Recommendations

The government should strengthen the agro-industrial policy framework by:

- Shifting agricultural policy goals away from farmgate price enhancement and toward improving rural income opportunities. The current practice of focusing on farmgate price enhancement perpetuates growers' expectations that their costs of production will be covered by farmgate prices, regardless of whether technical efficiency is improved.
- Casting policy initiatives in terms of the economic potential of the resource base, and the tradeoffs that are inevitable as agro-industry competes with the rest of the economy. Without a more coherent understanding of agro-

industrial resource productivity possibilities and the reductions in food costs that will be necessary for the structural transformation of the economy, the stagnation that pervades agriculture will inexorably restrict economic progress throughout the rest of the economy.

Institutional Vehicles for Policy Reform

Identification of policy constraints and the formulation of effective remedies is, unfortunately the easiest part of Sri Lanka's policy dialogue process. The main challenge is to identify an institutional platform for gaining political acceptance of a strategy that recognizes the need to shift labor out of agriculture and increase non-food consumer demand. AgENT has more than 300 clients who are seasoned entrepreneurs. These clients represent an important core of influence for reducing agro-industry constraints. AgENT clients can use the expertise they have gained from the project to better understand the artificial policy limits that constrain their businesses. Knowledge of the nature of these constraints makes them important policy change agents in the course of their business dealings. However, their individual actions do not constitute a critical mass of influence on government agro-industry policy formulation.

The AgENT Advisory Board is well situated to serve as an influential voice for agro-industry before relevant government agencies. The Board should be used as a sounding board for identifying other policy formulation and analysis initiatives that can address AgENT's concerns in detail.

The country's agro-industry trade associations do not have a strong tradition of policy advocacy. The associations also have not been responsive in treating their members as clients who demand their services to strengthen their industries' competitive positions. Moreover, the trade associations are often reluctant to openly challenge the government on a sensitive policy issue. However, the AgENT clients are well positioned to influence their respective trade associations to become more active participants in the agro-industry policy dialogue process.

Research Needed to Support Policy Reform Dialogue

If the government is to reduce constraints on the agro-industry sector, new information will be needed on the magnitude of economic possibilities and the tradeoffs required to resolve conflicts between contradictory economic goals. Research is needed to support the policy dialogue on removing policy constraints. Increasing access to government-owned land for agricultural use requires research on productivity of government-operated lands and the long-term potential for shifting arable lands to alternative crop mixes. Seed policy reforms need to be supported by research on yield gains from improved genetic materials, the nature and magnitude of seed production costs, and seed marketing. Formulating policies to increase the supply of packaging materials for processed foods should be supported by research on the scope of packaging demand and the impact of improved packaging technology on food processing costs. Efforts to strengthen the agro-industry policy framework should be supported by research on rationalizing product demand and supply relationships in policy action plans and

rationalizing the goals of agro-industry development with the tradeoffs that must be accommodated if Sri Lanka's overall goal of NIC status is to be realized.

SECTION I INTRODUCTION

A. Background

The Agro-Enterprises Project (AgENT) has encountered a wide range of problems in Sri Lanka's agro-industrial sector, many of which are caused by shortcomings in the policy environment for private-sector participation and development. To clarify the scope and nature of these problems, the project conducted a survey of private agro-industrial firms to assess the policy environment for agriculture and identify critical constraints affecting development of the agro-industrial sector. Data collection was confined to six principal elements of agro-enterprise development: land, infrastructure, production and processing, labor, marketing, and finance.

Preliminary survey results indicated that local agro-industrial firms face several constraints which need to be addressed through an appropriate mix of policies, programs, and projects. Given the nature of the required interventions, some are feasible only in the long and medium term, while others could be implemented in the short term, provided the government recognizes the need for such measures and is committed in principle to improving the policy climate for private agro-industrial development.

Project implementation experience with business development constraints and the survey's preliminary results demonstrated that a special study of agro-industrial policy constraints would be useful in designing future AgENT programs. The study was programmed to be conducted over a six-week period, beginning in late May or early June 1995.

B. Study Objectives

The main objective of this study was to undertake a critical review of the major policy constraints in the agro-industrial sector that would help government planners and policy analysts formulate policies and programs to remove the constraints. The review was based primarily on the findings of the above survey and included specific policy options, with emphasis on those that could be implemented in the short run (i.e., within a two-year time frame). The full study scope of work is presented in Annex A. Specific tasks to be accomplished were as follows:

- i. Undertake a critical assessment of the major constraints faced by private entrepreneurs in Sri Lanka's agro-industrial sector, based on the findings of the private agro-enterprises survey (recently conducted by AgENT) and other relevant material.
- ii. Conduct interviews with a variety of agro-industrial firms and trade associations and undertake extensive field work in order to substantiate the findings of the AgENT survey and obtain more detailed information on specific problems and policy issues under each of the following categories:

land, infrastructure, production/processing, labor, marketing, and finance. (If necessary, specific case studies based on personal interviews could be included.)

- iii. Identify policy initiatives and reforms required to remove key constraints in the agro-industrial sector, with principal focus on those that could be implemented in the short run (within two years).
- iv. Undertake a detailed assessment of the short-term policy options and their likely benefits.
- v. Based on the findings of this study and discussions with Agent board members and other relevant experts, outline future research priorities and activities for the project that will contribute to the improvement of the policy climate for Sri Lanka's agro-industrial sector.

C. Organization of Study

The following sections address the study objectives in three parts. In Section II, the critical agro-industrial policy issues are identified and refined. Section III develops an analytical framework and applies it to the issues identified in Section II. In the final section, recommendations are made for an action plan to remove the critical constraints.

SECTION II IDENTIFICATION OF CRITICAL ISSUES

A. Policy Issue Survey

A1. Methodology

After consulting with the AgENT team, Lanka Market Research Bureau developed questionnaires to record agro-enterprise policy information from two different perspectives. In the first survey, a mail questionnaire was sent to 130 active AgENT client firms. This survey concentrated on enterprise-level problems that indicate policy constraints. A second survey consisted of interviews between LMRB survey specialists and representatives of 15 trade associations identified by AgENT for their involvement and leadership in agro-industry development. The results of the mail (enterprise) survey and the direct (association) interviews were tabulated and summarized in a final report.

A2. Results

The mail survey of enterprises was the more structured and the more effective of the two target respondent groups. A total of 68 respondents, or 52 percent of the targeted enterprises returned usable questionnaires. The key issues identified by the enterprises are summarized in Table 1. While responses were recorded over several aspects of all six enterprise categories (land, infrastructure, production/processing, labor, marketing, and finance), the table focuses only on issues where at least 50 percent of the respondents considered the issues "important" or "very important" (compared with the alternative responses, "not applicable" and "not so important").

The association responses were less structured and less specific in their descriptions of problems. Surprisingly, the associations did not provide more comprehensive and strategic recommendations for addressing the issues. While they were not specifically asked for recommendations, their responses appeared more tactical and less cohesive than would be expected from trade associations' acute knowledge of business conditions.

B. Refinement of Critical Issues

In collaboration with the AgENT team, the key issues listed in Table 1 were discussed with the LMRB policy assessment study director. LMRB agreed to provide the names of enterprise respondents who considered land, quality or supply of seed, feed, and planting materials, and packaging costs to be "important" and "very important." In concentrating on these issues, many other responses from both enterprises and associations were found to be outside the constraints that sector-specific reforms can reduce or alleviate in the short- to medium-term.

Table 1. Key Issues Identified in LMRB Policy Assessment

(from 68 Respondents, % stating an issue is "Important" or "Very Important")

1.	LAND	
a.	More land is needed for business, but leasing from govt is difficult.	56%
2.	INFRASTRUCTURE	
a.	Industrial water quality/supply is unreliable/inadequate.	54%
b.	Power supply is unreliable/inadequate.	58%
c.	Telecommunications are unreliable/inadequate.	82%
d.	Marketing infrastructure (roads, mkt centers) is poorly developed.	75%
3.	PRODUCTION/PROCESSING	
a.	Open market quality/supply of raw materials (excluding feed, seed) is highly variable.	66%
b.	Quality/supply of raw materials from connected companies is highly variable.	50%
c.	Quality/supply of seed/feed/planting materials, etc. in open market is highly variable.	70%
d.	Quality/supply of seed/feed/planting materials, etc. from connected companies is highly variable.	51%
e.	Difficult to import seed/feed/planting materials, etc. because of local customs regs/procedures.	53%
f.	Difficult to import equipment because of local customs regulations/procedures.	53%
g.	Little or no published material is available on relevant production/processing technologies.	57%
4.	LABOR	
a.	Difficult to find/keep trained/experienced technical staff.	59%
5.	MARKETING	
a.	Range/quality of packing materials available in local market is limited.	59%
b.	Cost of packing materials is prohibitive.	77%
c.	Available information on foreign markets is poor.	74%
d.	Available information on domestic markets is poor.	59%
e.	Could compete in the world market if I knew how to package/promote my products abroad.	71%
f.	Govt regulations/procedures discourage exports.	52%
g.	Govt regulation of exchange rate discourages ag exports.	55%
h.	Incentives for pioneering agro industries are inadequate.	90%
6.	FINANCE	
	No category had a 50%+ response rate.	

SOURCE: Lanka Market Research Bureau, "Policy Assessment: A Report on the (AgENT) Research Study," May 1995.

B1. Clarification of the Nature of Policy Issues

In view of the wide range of issues identified by respondents in the policy assessment, it is useful to summarize the nature of policy issues and how reforms can be effective. An "issue" is a problem, which means a restriction on the sector's economic potential¹. The types of restrictions need to be recognized if the proposed reforms are to be fruitful.

A limit is a restriction so fundamental and cross-sectorial that it is beyond the scope of sector-specific remedies (geographical restrictions, exchange rates, national

¹ In this study, "economic potential" is defined as economic welfare, according to Annex C, Exhibit C-1. In this context, the goal of AgENT is to expand the shaded areas in Exhibit C-1. The most common market development initiatives are cost-reducing measures, such as resource-saving technologies and direct producer cost savings, such as tariff reductions and sourcing less expensive production inputs.

security, etc.) For example, many enterprises and associations commented with great sincerity and feeling about the importance of adequate infrastructure and the need to devalue the exchange rate. However, these issues are fundamental macroeconomic problems that are common to all sectors. So, the agro-industrial sector, which already suffers from a lack of political clout, has little hope of unilaterally instigating reform of those problems. In other words, the sector's enterprises and trade associations would be better served by addressing policy issues closer to home, where they can more clearly highlight the costs of current policies and the benefits of reforms.

And those more fruitful initiatives are often realized by addressing sector constraints, rather than intractable limits. A constraint is a restriction that is solvable within the sector's policy reform capacity. In this case, regulations and policies that limit competition or restrict access to inputs and markets are practices and behavior that can be modified within the existing policy environment.

B2. Validation of LMRB Results

Most of the survey results were verified and clarified through a series of interviews with a selected group of agro-industrial firms, trade associations, and government officials to collect detailed information on specific policy issues and recommendations. Various survey respondents were interviewed to sharpen and validate the overall survey results. Respondents' specific concerns with "land," "seed/feed," and "packaging" issues were examined to identify the nature and extent of problems. In all cases, respondents were asked to elaborate on the intent of their survey responses. Particular emphasis was placed on identifying problems with broad-based importance at the industry or sector level, rather than firm-specific problems.

The interviews were structured to identify practices that constitute barriers to open competition in the areas of land usage, the supply of seeds, feeds and planting materials, and the supply of packaging for food processors. Respondents (both LRMB respondents and other sector experts identified in the course of this study) were asked the following questions:

- Do you have evidence of fundamental barriers to private sector development -- commercial practice/law? financial/lending regulations? outright barriers to new entrants in an industry? are public sector enterprises blocking competition?
- Why are/not land, seeds/feed, and packaging important issues? What are some specific examples of each, in terms of:
 - costs and/or production (with/without) the problem?
 - other issues that directly restrict an entrepreneur's ability to maximize returns from available resources under his control?
- What are, or should be, the strategic objectives for Sri Lanka's agro-industry policy?
- How does, or how should AgENT address these policy concerns in its program?

B3. Critical Issues

Discussions with a wide range on agro-industry specialists quickly confirmed that land, seed and packaging shortages are serious problems that require direct attention if AgENT's technical assistance is to be fully utilized and sustained. However, these discussions also revealed a striking absence of concern about the more fundamental causes of the land, seed, and packaging problems. The discussions and reviews of a large assortment of documents demonstrated that the country's shift from the centrally planned policies of the past is far from complete. There is a widespread belief that domestic agriculture, although acknowledged to be plagued by high production costs, must be protected from international competition.

B3a. Land Shortage

Interviews were conducted with agro-industry leaders and LMRB survey respondents to consider the follow issues:

- To what extent is the "land shortage" problem simply a reflection of the country's high man/land ratio?
- Is there a significant amount of unused/underutilized land, and if so, where is located?
- Can lands on government plantations be shifted to new, more productive uses?
- How much land is tied up by protective tariffs for rice and other crops?
- Would the decreased use of land for paddy free up significant new amounts of crop land?
- What is the most appropriate crop or enterprise for highlighting land acquisition issues?

B3b. Seed Shortage

Seed industry representatives were asked:

- How much planting seed are required annually per crop? What proportion are improved? What is the average yield advantage of improved seed (per crop)?
- What are specific examples of barriers to importing improved seeds?
- What parts of the government's new seed policy should be modified to accommodate seed supply and demand factors in maximizing Sri Lanka's agricultural land and labor productivity?
- How can the seed policy guide the seed industry to a rational allocation of seed supply between imported and domestic sources?

B3c. Packaging Shortage

Processed food industry representatives were asked

- Which industry/product line is the best vehicle for demonstrating this problem?
- What are the key problems with packaging? Are these problems more serious with domestic or imported packaging materials? Why?
- How important is packaging quality in exporting processed foods? Is quality packaging available locally?
- What are the specific cost/tariff levels? What are the proportion (%) of total costs due to this packaging input? What is the tariff (%) on this packaging input? What are annual industry sales and production of product using this packaging?

B3d. Inadequate Policy Framework

In the course of assessing the land, seed, and packaging issues, agro-industry experts were asked:

- How is agricultural policy evolving to address the implications of national aspirations to become a NIC?
- How are consumer and producer interests treated in agro-industrial policy formulation?
- How is trade policy used to stimulate domestic production innovation?
- How do policy implementation processes affect entrepreneurs' rational expectations?

SECTION III ANALYSIS OF POLICY CONSTRAINTS

A. The Framework for Assessing Agro-Industry Policy Reforms

The main objective of removing business constraints is to promote economic growth. One of the most fundamental means of achieving that objective is through lower unit costs of production, which opens new markets, domestic and foreign, and thus expands output. The benefits of economic reforms are realized through new products, new and expanded markets, new and expanded firms, new technologies (cost-reducing innovations). These developments expand economic welfare by lowering product prices and expanding production. Annex C summarizes the methodology use to measure the benefits of policy reforms.

A1. International Price Competitiveness

Free trade allows goods and services to trade at values equal to, or greater than their opportunity costs in other uses. If the opportunity cost is not attainable, individual owners of resources lose economic surplus, as does the entire economy.

A2. Maximizing Resource Productivity

Factors of production should be employed at levels where the value of the last incremental output equals the competitive price of the factor. This means land, labor, capital, machinery, agricultural chemicals, seed, and feed should earn revenues equal to their purchase prices, or they should be employed in enterprises where their incremental returns exceed or equal "the next most beneficial use."

A3. Freedom of Enterprise Entry and Exit

When entrepreneurs are free to start or end a business, they have the freedom to employ resources to earn the highest returns. What benefits the entrepreneurs also benefits consumers in the market-place.

A4. Transparency

When governments formulate and implement commercial regulations without public scrutiny, bureaucrats are vulnerable to rent-seeking by special interest groups that will share their rents as a cost of doing business. These actions distort markets by allowing special interests to gain franchises to claim parts of economic surplus that consumers and producers would otherwise claim in the marketplace. The remedy for these market distortions is to conduct government's regulatory affairs in the open arena of public scrutiny of the relevant parties' actions and motives. The imposition of transparency in regulatory procedure thus establishes a competitive foundation for knowledge of how governments operate, and thus prevents interest groups from gaining

exclusive access to the market, like "insider trading" violations of stock market trading rules.

B. The Benefits of Reform

In this section, the constraints on the use of land, seed, and packaging materials are assessed in terms of market changes in price and quantity. Some of the consequences of these price-quantity changes are evaluated with respect to objective measures of changes in economic welfare, as defined in Annex C. Finally, in the course of assessing land, seed, packaging constraints, weaknesses in the present agro-industry policy framework were also treated as a significant policy constraint.

B1. Improved Access to Agricultural Land

Improved access to agricultural land requires a full appreciation of the background of Sri Lanka's unique land situation. Improving land productivity also requires an assessment of how current agricultural pricing policies affect land use, and how the country would benefit from improved land utilization.

B1a. Background

The evolution of Sri Lanka's land policy has been guided by physical constraints, the impact of those constraints on crop diversification, and the history of land tenure legislation.

B1ai. Physical Constraints

Any assessment of agricultural land use has to consider the implications of the country's high land-man ratio, scarcity of land, and scarcity of water.

High Man-Land Ratio -- There are three major physical constraints that Sri Lanka faces with regard to its agricultural development. The first is its density of population (279 persons per square kilometer), which is one of the highest in the region. Only a few other Asian countries, primarily Bangladesh, South Korea and Singapore, surpass Sri Lanka in terms of the man-land ratio. (In these three countries, the man-land ratio is 774, 441 and 4,666 persons per square kilometer, respectively.)

Due to increasing population pressure and the tendency of rural families to remain in the countryside, Sri Lankan farmers are forced to cultivate smaller and smaller plots of land. According to the Agricultural Censuses of 1962 and 1982, the total extent of agricultural land increased by only 1.0 percent (i.e., from 1.86 million hectares to 1.95 million hectares) during the intercensal period, thereby indicating that the land lost to urbanization and industrialization was nearly equal to the newly developed land for agriculture. On the other hand, the number of agricultural holdings increased by 50 percent (i.e., from 1.2 million to 1.8 million), while the average of size of holdings declined from 1.53 hectares to 1.08 hectares. Meanwhile, the number of holdings under

2 hectares, as a proportion of the total, increased from 84.8 percent to 90.3 percent. These facts clearly demonstrate that fragmentation of agricultural holdings has occurred over the intercensal period. (No data available for the 1990s.)

In Sri Lanka, over 80 percent of the total land area is owned or controlled by the state, of which a significant share falls into the agricultural sector. Due to this fact, it is virtually impossible for the consolidation of agricultural holdings to occur through market mechanisms. Hence the problem of land fragmentation will continue to worsen in the future and prevent the majority of small farmers from entering the mainstream of commercial agricultural production.

Scarcity of Land -- The second physical constraint is the scarcity of agricultural land, given that most of the arable land has been brought under the plough. During the past 40-50 years, the state has re-settled thousands of landless peasants (mainly from the wet zone) on newly irrigated lands in the dry zone, at a cost of several billion dollars. But the limits to land development, irrigation, and re-settlement in the dry zone have by and large been reached, with the result that more and more rural families are being forced out into marginal areas.

The problem of encroachment is leading to severe environmental degradation, especially in the mid-country and up-country wet zone, where the terrain is steep and hilly and pre-disposed to soil erosion. Farmers who tear down the forest and cultivate commercial field crops, such as potatoes, in these areas, do not practice scientific methods of soil and water conservation. As a result, flash floods, landslides, and the silting of rivers and streams have become major environmental hazards in the wet zone.

In the dry zone, farmers have practiced chena cultivation - a system of upland slash-and-burn agriculture - for centuries, in conjunction with rice cultivation in the gravity-irrigated lowlands. In bygone eras, a farmer would cultivate a different plot each year and return to the original chena plot only once in 15-20 years, thereby giving the forest vegetation sufficient time to regenerate. In this way, both environmental harmony and ecological balance were maintained. But now, due to continually expanding population pressure, the chena "cycle" has broken down and given way to a semi-permanent system of agriculture. This has led to a depletion of forest cover in the dry zone - a problem which will continue to worsen over time as more and more families encroach on the uplands and attempt to secure a permanent or semi-permanent niche for themselves.

Scarcity of Water -- The third physical constraint is the scarcity of water - the consequence of a rainfall pattern that is highly variable with regard to both intensity and distribution. The wet zone (i.e., the central hills and south-western littoral) receives two monsoons every year whereas the dry zone receives only one. (It is for this reason that the bulk of the perennial crops are grown in the wet zone.) Although the dry zone is "wet" for only three months of the year (October-December), it is able to produce a paddy crop in both the wet season (maha) and the dry season (yala) due to the existence of irrigation facilities.

The other field crops (OFCs), which include coarse grain cereals, pulses, yams, tubers, vegetables and condiments, are produced mainly under rainfed conditions. In bygone eras, these crops were produced under the chena system, which, as we saw, has given way largely to a system of semi-permanent agriculture in the uplands. This system, however, is inherently unstable as it is dependent purely on the vagaries of the weather and is also subject to increasing population pressure.

Some farmers grow OFCs on their rice lands during the yala season. This is possible only in areas where the soil types and topography are suited for diversified cropping. The main areas where this system is practiced are Mahaweli System H, Uda Walawe, Polonnaruwa and Anuradhapura. In most other parts of the dry zone, it appears that the gravity-irrigated lands are not suited for diversified cropping.

Most of the lands under agro-wells are located in the Jaffna peninsula and a small part of the north-western province. A hard rock aquifer prevents this stable system of upland agriculture from being replicated in other parts of the dry zone, with the exception of some pockets in the north-central province.

In the wet zone there is very little irrigated agriculture. The main difference between the wet zone and the dry zone is that the former is continually wet whereas the latter has a distinct dry period. (The dry zone receives most of its rain in the last three months of the year.) On the average, the wet zone receives twice as much rainfall as the dry zone (2,540 mm. and 1,270 mm. respectively). It would appear therefore that water is not a constraint in the wet zone. But paradoxically the wet zone is vulnerable to short but intense periods of drought which tend to coincide with critical stages of plant growth and maturation. For this reason, yields tend to fluctuate widely from year to year in the wet zone.

B1aii. Potential for Crop Diversification

Dry Zone -- The dry zone contains a mix of irrigated and rainfed agriculture. Paddy is the mainstay of irrigated agriculture whereas the OFCs are the mainstay of rainfed agriculture. The scarcity of water imposes a major constraint on the extent to which OFC cultivation could be stabilized in the dry zone.

The Mahaweli irrigation systems have emerged as the engine of agriculture in the dry zone. Around 75,000 hectares of new land were cultivated under these systems in maha 1992-93. The Mahaweli is somewhat of a special case because the uplands are gravity-irrigated. Hence it is widely believed that the potential for diversified cropping in these areas is high. The evidence from a recent study ("Potential for Diversified Cropping in the Paddy Lands of Sri Lanka") suggests, however, that this potential is limited mainly to System H.

Two principal factors determine whether crop diversification is possible on irrigated uplands (assuming stability of the irrigation supply): (a) the actual nature of the landscape, and (b) the soil type. Crop diversification is possible only if the landscape has a relatively steep gradient and the uplands are well drained.

Table 2. Crop Diversification Under Mahaweli Development, 1992/93

Season/Crop	System H	System B	System C	System G	System L	Total Hectares
Maha 1992/93	33,390	13,591	21,521	5,414	1,095	75,011
Rice	29,117	12,513	19,289	5,096	684	66,699
OFCs	4,273	1,078	2,232	318	411	8,312
Yala 1993	11,660	12,594	19,976	3,732	82	48,044
Rice	2,291	11,956	19,089	2,269	42	35,647
OFCs	9,369	638	887	1,463	40	12,397

Source: Central Bank of Sri Lanka, Annual Report, 1993.

It appears that these two conditions are fully satisfied only in System H, whereas in Systems B and C, they are only partially satisfied (Table 2). Hence the potential for intensive dry season diversified cropping is relatively high in System H, whereas in Systems B and C, it is relatively low. Systems B, C, and H collectively comprised 91 percent of the area cropped during maha 1992/93 and 92 percent of the area cropped during yala 1993.

The data clearly show that significant crop diversification has occurred only in System H, where 80.4 percent of the land sown in the yala was planted to OFCs, as compared to 5.1 percent in System B and 4.4 percent in System C. System H, on the whole, accounted for over 75 percent of the area planted to OFCs in the yala.

It is estimated that on the average, around 10,000 hectares of gravity-irrigated lands are planted to OFCs during the yala season in major irrigation schemes outside the Mahaweli. (The extent of dry season diversified cropping in gravity-irrigated lands within minor irrigation schemes is negligible.) The total extent of irrigated rice land utilized for diversified cropping during the yala season is hence around 22,000 hectares. The maximum potential appears to be around 35,000 hectares, which constitutes 10 percent of the total land under major irrigation. It may be difficult to promote sustained crop diversification on the balance 13,000 hectares, as much of this land is not assured of a stable water supply during the yala season.

These facts support the conclusion that the potential for intensive dry season diversified cropping in the gravity-irrigated lands is generally limited. The major constraints in this regard are water supply, soil type, and landscape. In terms of volume, a major share of the OFCs will continue to be produced in the rainfed uplands of the dry and wet zones.

Wet Zone -- The lands under paddy in the wet zone are generally not suited for diversified cropping as they are poorly drained. The only exception is in Nuwara Eliya district, where potatoes and beans are grown as a yala crop in the rice fields.

There are no new or unutilized lands in the wet zone which could be brought under OFC cultivation. Evidence, however, indicates that the productivity of the large, government-owned tea and coconut plantations could be significantly enhanced through diversification into horticulture and floriculture. The tea lands (around 136,000 hectares) are managed by private companies while the coconut lands (around 20,000 hectares) are managed mainly by various government agencies. Diversification will yield substantial benefits in terms of employment, income, and export earnings, but estimates are not currently available on the extents of under-utilized tea and coconut lands which could be used for this purpose. The state also owns around 60,000 hectares of rubber, which are largely under private management.

The private sector could play a key role in improving the total productivity of the government-owned tea, rubber, and coconut plantations, provided the state offered adequate incentives, such as long-term lease arrangements, and consistent, coherent and rational fiscal and monetary policies.

BIa.iii. Land Policy

The present land tenure systems of Sri Lanka are significantly different from those that existed prior to colonial intervention, although some historical influences and practices still remain, particularly with regard to temple lands. Under the Sri Lankan monarchy, private ownership of land was permitted, but the King, being the trustee of all lands, had the power to acquire and distribute land as he pleased. The forests, which occupied a major portion of the total land area, were communally owned and utilized for chena cultivation. During the British period, the Sri Lankan monarchy came to an end and the land tenure situation underwent radical change. Through the Crown Lands Encroachment Ordinance (CLEO) of 1840, the colonial rulers vested over 90 percent of the total land area in the crown. According to one study ("A Policy Review of Impacts of Land Tenure in the Food Crop Sector"), between 1850 and 1930, over 800,000 hectares of crown land were sold by the colonial regime to private individuals, both local and foreign. The main buyers were British planters who were brought in to establish large-scale commercial plantations in the hill country. As a result, the Kandyan peasantry lost most of its traditional chena and grazing lands.

The state-sponsored colonization programs, which involved the re-settling of landless peasants from the wet zone in the dry zone, commenced with the Land Development Ordinance (LDO) of 1931. After Independence these programs gained momentum, culminating in the Mahaweli Development Program, under which about 90,000 rural families have been settled to date.

The land policy has not changed significantly since colonial times, in so far as the state continues to be the largest owner of land in the country. The total land area is 6.6 million hectares, of which the state owns 5.4 million hectares (82 percent). The latter includes lands alienated under colonization schemes, youth settlements, and middle-class allotments (approximately 900,000 hectares), for which the state retains ultimate ownership with time specific leases or leases in perpetuity. These lands cannot be sold or transferred in the open market.

The state-owned lands include a number of large-scale, commercial plantations which were acquired through the Land Reform Laws of 1972 and 1975. (A total of 406,240 hectares were nationalized during this period, of which about one-third consisted of lands other than tea, rubber and coconut.) In 1992, 49 estates were handed out to 22 private management companies under a time-specific lease (5 years). It is understood that a decision was recently taken by the government to extend this lease to 50 years, but this is yet to be legally enforced. The total extent of land (tea, rubber, and coconut) managed by the private companies is around 200,00 hectares.

Most of the coconut estates continue to remain under state ownership and management. Anecdotal evidence suggests that the management of these estates (which are occupying prime agricultural land) is highly inefficient and should be privatized.

The land owned by the private sector (approximately 1.2 million hectares) contains a mix of free-holds and "land grants." The latter consist of lands alienated by the state to landless families, mainly for residential purposes. Over 100,000 hectares of unused lands have been alienated under this program to date. The land grants are not considered free-holds as they are subject to certain conditions on transfer and sub-division.

While the state is committed to alienating land to landless families (a tradition which dates back 60 years), it is at the same time preventing the emergence of a rural land market by retaining ownership or control of a major share of the country's total land resources. This is likely to be counter-productive in the long run as a major agricultural transformation cannot occur in the absence of a dynamic rural land market.

B1b. The Impact of Pricing Policy on Land Use

While there is considerable disagreement among entrepreneurs as to whether government lands are being used to full economic advantage, there is almost no thought about the impact of pricing policy on private land use. To survey crop trends for 1985-1993, as detailed in Annex D and summarized in Table 3, is to see a picture of production stagnation or decline. Production and yield are declining for both major and minor crops. Major crop land use is declining, while minor crop land is increasing. However, because the major crop land base is more than four times larger than the minor crop land base, increased minor crop land use is not absorbing lands shifting out of major crop use.

The trends in farmgate prices signal a lack of technical innovation in crop production. All crop price trends are positive when prices are in current rupees. But after discounting factor price inflation over the reference period the trend in real farmgate prices (1985 constant prices) is still positive for most crops. By dividing the trend in production by the trend in constant farmgate prices, a real price elasticity is presented in the right-most column of Table 3. The real price-quantity trends imply four categories of crops, as depicted in Table 4. In econometric terms, these elasticities indicate that most crop market trends have identified demand relationships. This means supply has likely shifted relatively more than demand. The result is that the shifts map the negative price-quantity relationship normally associated with a demand curve. Surprisingly, only two crops, groundnuts and blackgram, in case 4, demonstrate the market trend that AgENT is

Table 3. Sri Lanka Crop Trends, 1985-1993

	Land	Production	Yield	Farmgate Price		Current Farmgate Value	Real Price Elasticity (a)
				Current	Constant 1985 prices		
-----average annual percentage change-----							
Major Crops							
Tea	-0.4	-0.4	-0.1	8.1	-0.1	7.7	4.3
Rubber	-0.6	-3.8	-3.7	7.8	-0.4	4.0	9.4
Paddy	-0.8	-0.3	-0.4	11.3	3.1	11.0	-0.1
Subtotal	-0.7	-0.5	-0.5			8.7	
Minor Crops							
Maize	2.4	5.6	3.2	12.4	4.2	18.0	1.3
Chillies	1.8	-2.0	-3.8	15.7	7.5	13.8	-0.3
Red Onions	0.2	2.3	2.1	14.1	5.8	16.4	0.4
Ground Nuts	1.9	0.9	-0.9	6.1	-2.1	7.1	-0.5
Greengram	7.2	7.1	-0.1	9.5	1.3	16.6	5.5
Soyabeans	-12.3	-10.9	1.4	11.7	3.5	0.8	-3.1
Potatoes	-4.6	-9.7	-5.1	16.6	8.4	6.9	-1.2
Big Onion	34.9	33.5	-1.3	--	--	0.0	
Kurakkan	-8.1	-6.3	1.8	13.5	5.3	7.2	-1.2
Gingelly	-15.0	1.6	3.3	8.8	0.6	10.4	2.9
Cowpea	1.5	2.8	1.3	9.0	0.7	11.8	3.8
Blackgram	-0.1	0.4	0.5	7.4	-0.9	7.8	-0.5
Beans	-0.1	-16.6	-2.0	12.8	4.5	10.7	-3.7
Tomato	-0.4	-20.8	0.5	12.9	4.7	13.0	-4.4
Capsicum	-3.2	-15.9	-2.7	--	--	0.0	
Cabbage	1.4	-18.4	-2.8	7.4	-0.8	4.7	23.2
Raddish	-2.5	-17.0	-1.9	8.2	0.0	3.5	-1441.6
Carrot	8.6	-17.3	3.9	11.4	3.2	23.9	-5.5
Beetroot	2.1	-13.4	-0.9	10.6	2.4	11.8	-5.6
Knolkhol	0.3	-12.0	2.7	7.0	-1.2	10.0	9.9
Leeks	2.9	-8.4	1.9	11.3	3.0	16.1	-2.8
Brinjal	-0.9	-0.9	-3.5	9.3	1.1	4.8	-0.9
Bandakka	-0.3	-0.3	-1.8	11.0	2.8	9.0	-0.1
Red Pumpkin	-3.2	-3.2	-3.9	9.6	1.4	2.4	-2.3
Bittergourd	1.4	1.4	-0.6	10.5	2.3	11.3	0.6
Snakegourd	-1.0	-1.0	-1.9	10.0	1.7	7.0	-0.6
Cucumber	-1.1	-1.1	-2.5	10.7	2.4	7.1	-0.5
Plantain	-5.2	-5.2	-6.3	13.7	5.4	2.2	-1.0
Ash Pumpkin	-4.4	-4.4	-4.0	11.6	3.4	3.2	-1.3
Subtotal	0.8	-2.7	-3.5			10.2	
TOTAL	-0.5	-1.0	-1.3			9.1	

SOURCE: Annex D

(a) An arc elasticity, based on the production column divided by the farmgate constant price column.

Table 4. Characteristics of Sri Lanka Crop Markets, 1985-1993

Case	Characteristic	Key Features	Crops
1	Falling Demand	Falling Prices, Falling Output	Tea, Rubber, Cabbage, Knolkhol
2	Falling Supply	Rising Prices, Falling Output	All Other Crops
3	Rising Demand	Rising Prices, Rising Output	Maize, Red Onions, Greengram, Gingelly, Cowpeas, Bittergourd
4	Rising Supply	Falling Prices, Rising Output	Groundnuts, Blackgram

SOURCE: Table 3., real price elasticity column.

promoting: rising supply, as demonstrated by falling real prices and rising output.

The fact that the current tariff on most imported agricultural commodities is 35 percent (the seed import tariff is 10 percent) should be a key indicator of land misallocation. Since rice has played a pivotal role in the Mahaweli Development Program and the country's overall food security strategy, its land requirements have become a matter of casual acceptance. To estimate how much land and labor resources are tied up in rice production beyond the requirements of a competitive market, a partial equilibrium model was constructed for the 1993 wholesale rice market, assuming a demand elasticity of -0.4 and a supply elasticity of 0.2. The model was structured to reflect 1993 conditions, where 209 thousand tons of rice were required to cover a production shortfall at an estimated wholesale price of Rs 14.71/kg. The model was then used to estimate the wholesale prices and quantities that would have prevailed if no imports had been allowed, and alternatively, if no tariffs were levied, which would have effectively caused the wholesale price to fall to the actual import price of Rs 11.42/kg.

The results of the rice price analysis are summarized in Annex E, Table E-1. In contrast to the actual or base scenario, a "no imports," or self-sufficiency scenario would have caused the wholesale price to rise to Rs 17.42, while domestic production would have increased about 64 thousand tons, to 1.812 million tons. Because of the higher price, consumption would have fallen from 1.957 million tons to match the supply available only from domestic farmers. Paddy land requirements would have increased by 30,000 hectares and 13,000 additional man-years of rice production labor would have been required². At the retail level, prices would have increased from 16.95 in the base scenario, to a record high of 19.66. Such price increases did not occur because the government chose a middle course, using tariffs to keep prices above the lower import price of Rs 11.43, but well below the politically risky "self-sufficiency" price.

Removing all import restrictions would have produced the opposite results of the self-sufficiency scenario. Domestic production would have fallen from 1.748 million tons

² Paddy land requirements were based on yield data reported in Annex C. Annual paddy labor requirements were assumed to be 133 man-days per hectare, or 0.44 man-years per hectare, based on 300 man-days per man-year. The 133 man-day requirement per hectare was based on:

Abeyratne, Seneka, "Labor Utilization in Field-Crop Agriculture," draft report, dated July 31, 1992.

to 1.670 million tons, while consumption would have increased to 2.131 million tons and created an import demand of 461 thousand tons. Paddy land requirements would have fallen by 190 thousand hectares, to 630 thousand hectares, and labor requirements would have fallen by 85 thousand man-years.

The farmer-consumer tradeoffs in the rice market reflect the country's high-cost predicament. Banning rice imports would have lowered consumer welfare by 14 percent, but a free trade policy would have meant a 17 percent improvement to consumers. From the farmers' perspective, banning imports would have increased their economic well-being by 21 percent, while the free trade option would have caused a 24 percent loss.

While the results of this analysis are instructive, the free trade scenario is not plausible in the short to intermediate term. So much land has been devoted to rice under long-term protective policies that few technical options could be fully adopted within a five year period. And even if farmers had the technical capacity, the market infrastructure for other crops is weak or nonexistent. So, if domestic rice prices fell to the long-term import level, many farmers would continue to produce rice on a subsistence level until other crop opportunities arose or they decided to abandon the land.

Minor crops also suffer from high production costs. Table E-2 in Annex E shows the results of removing the 35 percent import tariff protection for three key minor crops, chillies, red onions, and potatoes, that are storable, and thus much more importable than leafy vegetables and other non-storable fresh produce. Using price and production data from Annex D, the 1993 farmgate weighted price for all three crops was estimated as Rs 46.8/kg. Assuming a demand elasticity of -1.0 and a supply elasticity of 0.4, market equilibrium was set at a self-sufficient production level of 176 thousand tons. The no-import assumption is generally valid because the few vegetable imports are mainly for the hotel and institutional trade, and chillies, red onions, and potatoes still require import licenses when they are infrequently imported. There is no immediate evidence that the current tariff is an effective import barrier to every minor crop, but it is a popular policy with many growers. Following the approach used for the rice model, except that the base scenario is now a no-imports policy, removing the tariff (free imports) would cause the farmgate price to fall 26 percent to Rs 34.67, while domestic production would fall nine percent, or 16 thousand tons. Imports of 64 thousand tons would be required to meet increased consumption needs. Annual cropland requirements would fall six thousand hectares from the current level of 59 thousand hectares, and eight thousand fewer man-years of labor would be required. And like rice, allowing the free import of these three minor crops would be sharply in favor of consumers. Farm economic welfare would fall by 31 percent while consumers would enjoy a 117 percent gain. And while overall economic welfare would remain relatively unchanged among the three rice price scenarios, free trade in the three minor crops would increase total economic well-being by 26 percent.

B1c. Benefits from Improved Land Utilization

AgENT clients strongly believe that significant amounts of land currently operated by government agencies could be more productive if it were cultivated by the private sector. Because of the long history of government domination of

the land market, there is no practical method of accurately predicting the impact of privatizing government lands, whether by sale or lease. What is clear, however, is that the private sector and the public at large have very little knowledge of the net income that is being earned under the government's stewardship of its land. Various proposals are regularly proposed by private firms for commercial farming operations on government lands. These proposals include whole-farm budgets for crop enterprise mixes that farm managers have designed to maximize net farm income and maintain long-term soil fertility. Unfortunately, it is not possible to use these proposals as a realistic measure of the potential rents that could be earned under these alternative uses. In many cases, new crops are being proposed that have not been cultivated on a large scale. The necessary market infrastructure and the cultivation expertise would therefore often require at least five years of learning experience.

The most basic benefits from converting government lands to private cultivation can be obtained by reviewing the production and yield trends in Annex D. The employment benefits of either converting unused lands or lands currently in tea, rubber, or coconut plantations to minor crops can be estimated from Annex E. Where paddy requires about 0.44 man-years per hectare, minor crops require at least three times as much labor (1.33 man-years per hectare, according to Annex E).

But productivity gains are only part of the land utilization issue. Where government agencies are managing arable lands, there is little doubt that the public interest is not being served. Many of these operations are running regular annual net losses, and those with net profits are not competitive with private-sector commercial farm returns. The term "profit" is difficult to measure for government enterprises because of the regular application of hidden subsidies.

B1d. Key Findings

The above analyses, reviews of available documents, and interviews with a wide range of experts have yielded the following key findings:

- Current protective tariffs cause significant land and labor resources to be tied up in relatively less competitive crops, but removal of the tariffs would not lead to quick resource allocation because of land productivity limitations, lack of market infrastructure and cultivation knowledge for non-traditional crops, and historic dependence on the current crop mix.
- Strong competition for residential and commercial uses renders most privately owned land too expensive for long-term agricultural use.
- There is currently no practical means available for determining the full economic potential of government-operated lands.
- The political opposition to selling even modest amounts of government-owned arable lands is so pervasive that it must be considered an immutable limitation.

B1e. Conclusions

These findings, in turn, have prompted the following conclusions:

- Residential and commercial demand for land is rapidly causing agriculture to be an uncompetitive use of privately owned arable lands.
- Government-owned arable lands will not be allocated according to their long term economic productivity until a transparent land market process is implemented.
- Even if all government-owned arable lands were immediately offered for competitive leasing or sale to the private sector, the incremental increase in total agricultural land supply will not be adequate to support food self-sufficiency.

B2. Increased Supply of Seeds

The historical development of the seed industry and the government's seed pricing policy have to be considered in understanding the nature of constraints facing agro-industry and how benefits would accrue from improved seed supply.

B2a. Background

Sri Lanka's seed industry is currently undergoing a major structural transformation. In the late 1980s, policy measures were introduced to liberalize seed imports, rationalize phytosanitary controls and regulations, and allow private companies to produce, process and distribute improved in the open market. Prior to this, the seed industry was virtually a government monopoly.

The agency responsible for producing or importing seeds and planting materials was the Department of Agriculture (DOA). The participation of the private sector in the activities of the seed industry was limited to the importation of exotic vegetable seeds (which had been permitted since 1983) and the production of certified seed by private contract growers. There were about 15,000 contract growers, who were producing 75 percent of the seed paddy requirement under supervision of DOA personnel.

The program for developing improved varieties of rice and other field crops (OFCs) was initiated by the DOA in the early 1920s. The DOA did not commence the large-scale commercial production of improved seed until the late 1940s. A number of commercial farms were established for this purpose, which were operated by the Seed Division of the DOA. As the demand for improved seed began to grow, private farmers were contracted to produce commercial seed from basic seed. Well-trained personnel were provided to certify the seed and ensure that high phytosanitary standards were maintained. A number of donors provided support to the DOA's breeding and adaptive research programs, including Japan, Australia, Holland, West Germany, and the U.S.

By the 1960s, the DOA had achieved significant breakthroughs in rice breeding by mixing local and foreign genetic material. Pest and disease resistance were also incorporated into the new high-yielding varieties, which were quickly adopted by the farmers. As a result Sri Lanka underwent a green revolution. The DOA developed improved varieties of selected OFCs, such as chilli, potato, cowpea, greengram, blackgram, and sesame (gingelly), which were also widely adopted.

In the 1970s, the DOA continued to build on the foundation laid in the previous two decades. Soybean was established as a new crop in Sri Lanka with technical assistance from the U.S. and the rice breeding activities continued to make good progress under the aegis of a USAID-funded rice varietal improvement project.

Table 5. Government Contribution to Total Seed Requirements, 1985

Crop	Seed Requirement (kg)	GSL Contribution (%)
	----- Maha 1984/85 and Yala 1995 -----	
Paddy	89,218,870	14.8
Soybean	240,120	7.0
Cowpea	887,070	2.1
Blackgram	297,660	4.5
Greengram	956,440	3.1
Groundnut	609,720	2.1
Gingelly	44,472	29.9
Chilli Pods	30,862	--
Maize	826,525	9.8
Kurakkan	130,700	3.5
Meneri	4,885	--
Sorghum	8,820	--

SOURCE: Abeygunawardena, P., et. al., "Cost of Seed Production on Selected Government Farms, 1987"

In the 1980s, the USAID-funded Diversified Agricultural Research Project (DARP) was initiated to strengthen the seed program for OFCs. During this period, however, the DOA suffered a range of setbacks, including reductions in budgetary allocations and institutional fragmentation. Consequently, the overall seed improvement program lost its momentum and the efficiency of the commercial seed farm operations also declined. A study undertaken in 1988 ("An Economic Assessment of the Sri Lankan Seed Program") indicated that all the seed farms (with the exception of the seed potato farms) were incurring heavy losses. The DOA was by and large unable to satisfy the growing demand for improved paddy and vegetable seeds (see Table 5). The time had come for a major restructuring of the Sri Lankan seed industry.

The government therefore introduced far-reaching measures for de-regulating the seed industry. Private entrepreneurs were allowed to import and distribute high-quality vegetable seeds under a liberal import permit system. (Import bans were unofficially imposed, however, on selected crops, such as paddy, chilli, okra, and beans). A modern plant quarantine center was established at Katunayake Airport and customs procedures were simplified to facilitate imports of foreign genetic material. Seed production also ceased to be a government monopoly. The private sector was allowed to produce certified paddy and vegetable seeds from basic seed supplied by the DOA and to sell them independently in the open market.

The imports of exotic vegetable seeds (such as carrots and leeks) have been increasing steadily in recent years, which indicates that the response of the private sector to these policy initiatives has been positive. A few private companies have also begun to produce quality seed for the local market (paddy, chilli, vegetables, etc.).

The DOA, however, has retained control over most of its commercial seed farms, which are continuing to run at a loss. (The reasons for this include high overheads, poor decisions on input allocation, low yields, and low seed prices.) The most valuable resource the DOA possesses is its scientific expertise, which has a key role to play in future research and development. In order to optimize the utilization of this scarce resource, the DOA should be engaged primarily in research and development and not in commercial seed production. Evidence from other countries clearly shows that the latter role could be performed more efficiently by the private sector than by the state. By transferring the management of its seed farms to the private sector, the DOA could "invest" its energy and scarce resources in activities that will maximize the benefits to society, namely seed improvement, adaptive research, and technological transfer.

B2b. Government Seed Pricing Policy

It is claimed by the private sector that the government is producing and selling certified seed at artificially low prices, thereby distorting the domestic seed market and making it difficult for private firms to enter the industry. There appears to be a grain of truth in this assertion.

Various studies undertaken in the 1980s have revealed that the DOA does not have clear guidelines and procedures for estimating the total cost of farm operations; consequently seed prices do not reflect the full or "true" cost of production per unit of output. In other words there are "hidden" subsidies, which if they are properly accounted for, would cause seed prices to be much higher.

It appears that for a particular crop, the factors which determine the price at which government-produced seeds are sold in the open market are mainly the variable costs of production, i.e., the costs of direct farm labor, fertilizer, agro-chemicals, machinery, etc. The (a) fixed overhead costs, such as salaries, allowances, electricity, fuel, maintenance and upkeep of physical assets), (b) indirect expenses, such as office maintenance, and (c) costs of depreciation on machinery, equipment, buildings, etc. are either ignored or not calculated. Therefore, since the total cost of production per unit of output is underestimated, the seeds are sold at low prices.

Private companies operating in a competitive environment, on the other hand, will try to sell their products at prices which reflect the "true" costs of production. In order to eliminate price distortions in the domestic seed market, the government must do one of two things: either adopt a more realistic pricing policy (based on the full nature of the costs of production) or allow the private sector to take over its commercial seed farm operations. The latter option is more desirable, considering that the government seed farms are incurring heavy losses due to high overheads and poor management practices (as reflected in the low average yields of paddy and OFCs in these farms).

B2c. Constraints on Private-Sector Expansion in the Seed Industry

The focal point of the seed industry is the farmer, who requires a steady supply of quality seed at costs which are in line with productivity. As a consequence of liberalization, the private sector is playing an increasing role in meeting the farmers' seed requirements. Commercial farmers are now able to obtain a regular supply of high-quality imported seed through private channels, whereas before they had to rely exclusively on the government for their supply of improved seed. The demand for quality seed is greatest among the high-value vegetable crops, such as potato, large onion, leeks and carrots, which is being met exclusively through private-sector imports.

Many developing countries have introduced policies for liberalizing the seed industry combined with measures for maintaining high phytosanitary standards, particularly with regard to imported genetic material. The impact on yields and production has been dramatic. The seed restructuring effort in Sri Lanka, however, has not produced similar results. The majority of field crops have been showing a downward trend with regard to both yields and production (1985-93).

Perhaps the main reason for this decline is that the seeds planted by farmers are of poor quality, *i.e.*, they plant their own seed and are not willing to purchase high-quality seed from formal sources. In actual fact the current effective demand, *i.e.*, the quantity of seed purchased by farmers from formal sources (or to put it another way, the extent planted to seed purchased from formal sources), seems to vary significantly from crop to crop. As Table 6 shows, the current effective demand ranges from 93.1 percent for non-traditional vegetables to only 5.8 percent for paddy. On the average, though, it would seem that a significant proportion of the farming community plant their own seeds, which tend to lose their genetic purity and robustness after a few seasons.

Ironically, only a few crops, such as leeks and carrots (non-traditional vegetables), are showing a positive trend with regard to yields. The producers of these crops purchase all their seed from private dealers, who obtain it from importers.

Some farmers wish to keep their costs of production down, which is probably why they prefer to plant their own seed. By planting improved seed, however, farmers can often double their yields. Evidence from other countries indicates that farmers will innovate once they become convinced that they can make more money from buying improved seed from formal sources than from planting their own seed. The private sector can hence play a critical role in raising current effective demand by distributing and

Table 6. Sources of Farmers' Planting Seeds

Crop	Own Seed	Formal Supplier	Other Sources
		----- Percent -----	
Chilli	43.8	49.6	6.6
Beans	52.6	45.4	2.0
Traditional Vegetables	27.7	70.1	2.2
Non-Traditional Vegetables	--	93.1	6.9
Paddy	67.7	5.8	26.5
Potato	24.5	55.1	20.4

SOURCE: Pattie, Preston S., and W.P. Madawanarachchi, "Factors Affecting Seed Marketing in Sri Lanka, 1993.

actively promoting improved seed. While it is doing this effectively for some crops, it is not doing so for others.

There clearly are some constraints the private sector is facing in this regard, which are as follows:

Trade Policy -- The government does not have a consistent trade policy for seeds. An unofficial ban exists on chilli, bean, okra, and paddy seed imports. Evidently the reason for this ban is that the country is producing all the seed requirements for these four crops and therefore does not need to import seed. In other words, the ban is meant to protect local seed producers from competition by private seed importers. But as the above data show, the current effective demand is 49.6 percent for chilli, 45.4 percent for beans, 70.1 percent for okra, and only 5.8 percent for paddy. (The last statistic is a surprising revelation, given that paddy is the largest crop in the island.) The above figures, on the whole, indicate that current effective demand could be significantly raised through imports of improved seed.

Paddy cultivation is a special case as it is the basis of agriculture, indeed the basis of religion, culture, and politics in Sri Lanka. Consequently it is deeply immersed in the ethos of protectionism. Moreover, paddy is grown in a variety of micro-environments for which specific plant types are required. Thus indiscriminate imports of seed paddy could play havoc with the farming community. Nevertheless, it is critically important for the government to incorporate new genetic material into its rice breeding program to offset the overall decline in productivity.

In the case of the other three crops, it is difficult to understand why they have been singled out for protection, especially since yields have been declining over time. There is a clear need for the injection of new genetic material among traditional vegetable crops as well.

Seed Pricing Policy -- The government does not have a realistic seed pricing policy. The sales of seed produced by the DOA are subsidized, and thus serve to restrain the expansion of a competitive seed market.

Crop Production Data -- The government does not have an effective communication strategy. The public has limited access to official crop statistics (production, yields, extents, prices, imports, costs of cultivation, seed requirements, recommended seed varieties, etc.). These data are vital to private entrepreneurs who are interested in contributing to the development of the Sri Lankan seed industry.

B2d. The Seed Industry's Perspectives

The private-sector seed industry strongly believes that government subsidized seed production promotes inefficient production practices by government seed farms and effectively blocks competition by the private sector. Private sector seed producers believe government seed prices do not reflect the full cost of production.

The Department of Agriculture has a long tradition of concentrating more on commercial seed production than on research and development to improve the genetic base of the country's food crops. The DOA is not confident the private sector can supply growers' seed needs, despite the fact that the DOA does not dominate the full seed market.

On the trade side, private-sector seed producers are decidedly against liberalized seed import policies. They admit that their costs of production are well above import prices, and they do not make any special claims for superior quality or yield potential of their locally produced seeds.

B2e. Benefits from Improved Seed Supply

It is not possible to quantify the direct impact of improved seed quality on Sri Lanka's agricultural productivity. The maximum potential crop yields reported in the Department of Agriculture's "Crop Recommendations Technoguide" (1990) are generally twice or triple actual field yields. The maximum potential yield estimates are based on plot research trials, and thus do not reflect the learning experience of growers to adapt to the new management and input requirements.

In the absence of solid commercial evidence of the yield advantages of improved seeds, it is useful to ask how the markets for minor crops would behave if supply were arbitrarily increased by some small increment, rather than the 100-200 percent gains agricultural researchers typically mention. In Table 7, the results of simulated 10 and 25 percent increases in minor crop supply are summarized. Assuming no imports are allowed, the farmgate price would fall about Rs 2 per kg, or 7.1 percent, for each 10 percent increase in supply. (Note that the full 10 percent supply increase is not realized in the market because the rightward shift of the supply curve is intersected by a negatively sloped demand curve, as in Annex C, Exhibit C-4). Producer surplus remains relatively unchanged as supply increases, but consumer welfare increases by 15 and 39

Table 7. Estimated Effects of Increasing Minor Crop Supply, 1993

		Base	Supply Increase	
			10 %	25%
Price (a)	Rs/Kg	17.00	15.79	13.96
Supply (domestic) (a)	000 Tons	912	977	1,075
Demand	000 Tons	912	977	1,075
Imports	000 Tons	0	0	0
Cropland (a)	000 HT	284	296	304
Labor (b)	000 ManYrs	378	393	404
Labor (b)	ManYrs/HT	1.33	1.33	1.33
Crop Yield (c)	Tons/HT	3.21	3.44	3.64
Margin Assumptions (d)				
Retail-Wholesale	Rs/Kg	11.90	11.90	11.90
Farmgate-Wholesale	Rs/Kg	3.40	3.40	3.40
Implied Price				
Retail	Rs/Kg	32.30	31.09	29.26
Wholesale	Rs/Kg	20.40	19.19	17.36
Farmgate	Rs/Kg	17.00	15.79	13.96
Economic Welfare				
Consumer Surplus	Million Rs	7,752	8,899	10,768
Producer Surplus	Million Rs	12,403	12,751	12,917
Total	Million Rs	20,155	21,650	23,685
Total	Million \$US	455	489	535
Consumer Surplus	Million Rs	100	115	139
Producer Surplus	Million Rs	100	103	104
Total	Million Rs	100	107	118
Total	Million \$US	100	107	118

(a) Base price and quantity values are based on minor crop data in Annex D.

(b) Labor requirement is based on a 1992 draft report by Seneka Abeyratne, entitled, "Labor Utilization in Field-Crop Agriculture."

(c) The base crop yield is estimated from minor crop data in Annex D. For each successive supply increase, the yield increase is assumed to be 50% of the yield increase that would be required if the land supply were fixed.

(d) Margins were assumed based on various crop prices reported by the Department of Census and Statistics.

percent, respectively. But do these market effects constitute the incentives necessary to encourage improved seed supply? Consumers obviously benefit, but farmers's welfare position would be static. The most innovative producers would gain from lowered production costs, but their derived demand for seed is not likely to be sufficient to

support local high-cost seed prices. This suggests that imported seeds are more likely to be the growers' least-cost option.

B2f. Key Findings

The above analyses, reviews of available documents, and interviews with a wide range of experts have yielded the following key findings:

- Government seed production costs are well above the market price of government seeds.
- There are no uniform, annual operating statements for government seed production operations available to the public.
- Private seed producers want protective tariffs on competing imported seeds.
- The Department of Agriculture's seed policy does not admit the importance of productivity in determining farmer demand for seeds.
- The Department of Agriculture's emphasis on supply aspects of seed policy fails to differentiate and accommodate the four fundamental factors affecting seed supply: R&D, seed multiplication, post-harvest processing, and marketing.
- There are no reliable statistics available on the effect of genetic quality on local crop yields.
- The local seed industry (public and private) does not have a clear understanding of the trends and scope of the local seed market.
- The Department of Agriculture's seed certification program is an effective model of international phytosanitary standards.
- The Department of Agriculture prohibits the importation of chili, bean, and okra seeds, not on phytosanitary grounds, but because it believes the country is self-sufficient in the production of those seeds.
- Non-traditional crop seeds are being imported without unreasonable delays and constraints, and anecdotal evidence suggests that these imports have increased sharply during the past two years.

B2g. Conclusions

These findings, in turn, have prompted the following conclusions:

- The Department of Agriculture's often-cited maximum potential crop yields, typically two or three times greater than actual field yields, are not realistic production targets under current market conditions.
- The maximum potential crop yields cannot be differentiated into seed, management, and other input components.
- The domestic seed industry will not become an effective supplier until the Department of Agriculture ceases commercial seed production.
- The domestic seed industry will benefit from imported seed competition.
- The public nature of seed research and development requirements make the Department of Agriculture well suited to support the domestic seed industry with a targeted adaptive seed research program.
- Local seed research and development, whether performed by the private or public sectors, will not be effective until it is linked to the relative commercial potential of all crops.
- Seed import barriers, whether protective tariffs or import licenses, are a serious barrier to domestic crop production.

B3. Increased Supply of Packaging

High packaging costs have been a regular problem for food processors. The problem is particularly acute for export markets, where high packaging quality is required to present products to their best advantage in highly competitive markets.

B3a. Background

The most comprehensive picture of the food packaging industry is based on a 1993 study for AgENT by Survey Research Lanka (Pvt.) Ltd. survey of 15 fruit and vegetable processing firms. The survey documented the firms' use of glass bottles and tin cans to package their products for export markets. The firms uniformly reported high tariffs on imported bottles and cans as a primary cause of Sri Lanka's low degree of competitiveness in processed fruit and vegetable exports.

B3b. The Food Exporters' Perspectives

Fruit and vegetable processors are in agreement that local sources of glass and tin packaging materials are low in quality and supplies are unreliable. In a typical case, a processor was required to place a 50 percent deposit with a local packaging supplier three months before the order was to be delivered. But at the delivery date, when fresh produce was being harvested, the supplier failed to deliver any of the order. The processor lost all of the value added from the expected processing run, plus part of the fresh produce that had been bought in anticipation of the packaging being available. The processor believes this is a typical example of the costs borne by the fruit

and vegetable processing industry because the local packaging industry enjoys a 35 percent protective tariff.

B3c. The Benefits of Removing Tariffs on Packaging

The main difficulty in estimating packaging tariff effects is the lack of accurate data on the total agro-industrial packaging requirement. SRL estimated that 11 of the firms accounted for more than 90 percent of all processed fruit and vegetable products manufactured in Sri Lanka. However, Central Bank statistics indicate that 16.75 tons of processed fruits and vegetables worth Rs 628 million were exported in 1993. By estimating the annual total sales for the sampled SRL firms, a value of just under Rs 600 million is obtained. This would suggest that if the SRL firms handle more than 90 percent of the country's processed fruit and vegetable market, then all of their product is exported. This conclusion is not valid because a considerable amount of the product is consumed locally.

While the full extent of the processed fruit and vegetable market could not be determined within the scope of this study, it is still useful to use the export volume to illustrate the impact of packaging tariffs on price and sales. The effects of removing the 35% tariff on imported glass bottles and tin cans were estimated using Central Bank quantity and price statistics for exported processed fruits and vegetables for 1993. According to SRL, about 30 percent of the firms' cost of production are due to glass bottles and tin cans. To place the firms in an industry market, price elasticities were assumed to be -1.2 for demand and 0.5 for supply. It might be argued that export demand for Sri Lankan products in a relatively large world market would be perfectly elastic. For short periods of time, that condition might hold, but these markets are highly competitive and even slight offers of more volume will most likely face direct resistance, or a quick request for a price discount.

The results of the analysis³ are summarized in Table 8. In contrast with the base, "with tariff" case, removal of the import tariff on glass bottles and tin cans would be felt immediately on imported packaging costs, and soon thereafter as local bottle and can suppliers have to accept the imported price to preserve market share. For the individual fruit and vegetable processor, the removal of a 35 percent tariff on an input that has constituted 30% of total production costs would cause production costs to fall about 7.8 percent, from a sales price of Rs 37.50/kg to Rs 34.58. However, this Rs 2.92 cost advantage is rarely fully captured. The industry-wide supply effect causes the market price to fall along the demand curve. In the case of packaging materials, the market equilibrium price would most likely fall only about 2.3 percent, to Rs 36.60, as industry supply increased about 2.7 percent, to 17.2 tons. Annual sales (exports, in this case) would increase about Rs 2.5 million. Both consumers and producers of processed fruits and vegetables would benefit from the tariff removal. Consumer surplus would increase about 5.6 percent and producer surplus would increase about two percent. Overall economic welfare would increase about 3.3 percent. The losses to the local packaging

³ The analysis is based on the supply shift depicted in Annex C, Exhibit C-5.

Table 8. Effects of Removing Tariffs on Imported Packaging for Processed Exported Fruits and Vegetables, 1993

		With Tariff	Without Tariff	Net Change	
				Absolute	%
Price	Rs/Kg	37.50	36.64	-0.86	-2.3
Quantity	OOO Tons	16.74	17.20	0.46	2.7
Market Value	Mil Rs	628	630	2.48	0.4
Economic Welfare					
Consumer Surplus	Mil Rs	262	276	15	5.6
Producer Surplus	Mil Rs	471	480	10	2.0
Total Welfare	Mil Rs	732	757	24	3.3
Total Welfare	Mil \$US	25	26	1	

industry due to removal of a 35 percent protective tariff would cause immediate dislocations. However, the long term issue the government has to address is the benefits of stimulating production in agro-industry versus rents collected to a small, inefficient packaging industry.

B3d. Key Findings

The above analyses, reviews of available documents, and interviews with a wide range of experts have yielded the following key findings:

- The quality of local packaging materials is not competitive for exporting processed fruits and vegetables.
- Removing the 35 percent tariff on imported glass bottles and tin cans will yield a price reduction of at least two percent on exported processed fruit and vegetable products.
- The extent of the tariff's impact on the total processed food industry cannot be estimated until industry production statistics are desegregated to reflect the complete demand for bottle and tin can packaging.
- The low volume of fruit and vegetable processing is a major impediment to packaging innovation.
- The local supply of packaging materials is so erratic and unreliable that processors regularly suffer large losses of fresh fruits and vegetables at harvest time.

B3e. Conclusions

These findings, in turn, have prompted the following conclusions:

- While removal of the 35 percent tariff on imported glass bottles and tin cans will lower the wholesale prices of exported processed fruits and vegetables, the benefits (about two percent) cannot be justified solely on the basis of the export processed food market.
- In the short term, the main benefits of removing of protective tariffs on imported packaging materials will be not the cost savings on the tariffs, but the increase in availability of quality packaging at the time of harvest.

B4. Inadequate Policy Framework

This study began with the premise that the AgENT clients have valid claims of serious agro-industry policy constraints. In the case of land, seed, and packaging issues, those claims are well founded. However, the clients have focused their concerns on firm-level issues. In the course of studying the firms' perspectives, it has become evident that these issues are transcended by the lack of a coherent agro-industry policy framework.

B4a. The Scope of the Problem

A brief summary of the evolution in the country's political economy over the past two decades helps explain the predicament agro-industry faces today. In 1977, following the defeat of the left-wing coalition government, Sri Lanka made the switch from an inward-looking economy to an outward-looking economy. The new Finance Minister summed up the nature of the economy his government had inherited as follows:

"The last seventeen years witnessed a rapid expansion in the role of the public sector in direct production. In the agricultural sector, through the implementation of the Land Reform Act of 1972 and its subsequent amendment in 1975, the public sector now accounts for 63 percent of the ownership of the acreage under tea, 32 percent under rubber and 10.5 percent of the coconut acreage. In manufacturing, the public sector accounts for 54 percent of the value of production. State agencies also occupy a dominant place in wholesale, retail and foreign trade and in banking and insurance."

He pledged to replace the closed economy with a competition-regulated market economy and to create an environment in which the private sector would prevail over the public sector. A comprehensive policy reform package was announced for ending the "sickness" of controls and restrictive practices and for gradually eliminating state

monopolies in production, trade, banking and insurance. Thus the country was put on a course radically different from the previous government.

But despite the government's liberalization efforts over the past 17 years, the vision of a "competition-regulated market economy" has yet to be fully realized. Consequently, the growth of per capita income and per capita exports has been far below expectations. One of the main constraints in this regard has been the "dirigiste" ideology, which is continuing to linger in the public service and distort the policy environment. Although significant macroeconomic reforms have been implemented, the collective government "psyche" has yet to adjust to the idea that until the state is prepared to abolish restrictive controls and practices and divest ownership of productive resources, the economy will not embark on the path of rapid private-sector expansion and accelerated economic growth.

If the Sri Lankan economy is to emulate the achievements of Thailand, Malaysia, and other emerging newly industrialized countries (NICs), it must strive to become strongly outward-looking, competitive, and market driven. In the emerging NICs, private investment in manufacturing and agro-industrial processing is strongly encouraged and actively promoted. The government therefore needs to take decisive action towards removing market distortions (particularly with regard to land) and creating a sound, consistent and coherent policy framework for promoting increased private-sector participation in economic development. It is probably due to the lack of a strong and healthy policy environment that the full potential for private-sector development is not being realized in Sri Lanka.

And while most of the government's economic policy rhetoric over the last two decades has been outward-looking, the attitude in the agro-industrial sector remains decidedly inward-looking. Protective tariffs are endorsed as a key tool for raising farmgate prices. The fact that food accounts for more than 50 percent of most households' budgets does not enter the debate about improving economic opportunities and preparing the country for NIC status.

B4b. Key Findings

The above analyses, reviews of available documents, and interviews with a wide range of experts have yielded the following key findings:

- Maintaining high farmgate prices is the most common agricultural policy objective.
- Protective tariffs are explicitly supported.
- Attainment of NIC status is a recurring objective of overall economic policy, but no attention is given to the structural transformation that will be required in agro-industry if that objective is to be achieved.
- Policy initiatives do not consider the implications of the supply and demand structure of agro-industry products and inputs.

B4c. Conclusions

These findings, in turn, have prompted the following conclusions:

- Current policy formulations are ineffective because they do not cast policy initiatives in terms of realistic goals and the implications of tradeoffs necessary to meet those objectives.
- The traditional inward-directed focus of agro-industrial policy is a major barrier to technical innovation in agricultural production and marketing.
- The price and production implications of technical innovation in food production would be a major improvement in the formulation of both agricultural and industrial policies.

SECTION IV AGRO-INDUSTRY POLICY OPTIONS

The analysis of constraints in Section III identified avenues for improving land, seed, and packaging supplies to agro-industry. In the following sections, specific reforms are described. The institutional support of these reforms is discussed and research topics are recommended to support institutions' policy reform dialogues.

A. Recommended Reforms

The nature of the constraints identified in this study does not offer remedies that can realistically be implemented in the short term (two years). Land and seed supply issues have been the subject of countless studies and policy dialogues, with little results to date. The approach proposed below relies heavily on the basic requirements of good governance: transparency and full access to the government's decision-making process.

A1. Increasing Land Supply

The government's restrictive land policy has been critically viewed and discussed in a large number of studies and policy reviews. The divestiture of state-owned lands is a major political issue which is unlikely to be addressed in the short run. An encouraging sign, however, is the government's intention to proceed with the divestiture of the state-owned tea plantations - a major policy reform which is likely to send out positive signals to local and foreign private investors.

Outside the tea sector, little or no progress has been made with the divestiture of state-owned lands, such as the coconut estates, commercial seed farms, and Mahaweli lands reserved for private agro-industrial ventures. Efforts made to date by various local groups, organizations and agencies to promote policy change have been with strong political resistance.

The onus therefore is on the government to address the land issue vis-a-vis their agricultural development and privatization programs. A dialogue needs to be initiated, involving key decision-makers in the government, with a view to developing a land policy for Sri Lanka that would be consistent with the present demands of the economy.

The immediate land allocation issue is not whether to sell government lands, but how to establish a transparent market mechanism for maximizing social returns from all government-held lands. The government should rationalize the land market by:

- Promoting transparency in current usage of government lands. The government should publish annual business statements for all government-owned agricultural lands. This information would serve both as an inventory of government lands, and a first-round measure of its opportunity cost in its current usage.

- Promoting transparency in shifting government lands to better uses. The government should use competitive bidding to award leases to firms or government agencies that offer higher agricultural rents than the current usage.

A2. Increasing Seed Supply

The role of the government in the seed market is to provide opportunities for the private sector to supply the producers' seed requirements at competitive prices. Although the government has relinquished its monopoly on seed production and imports, it continues to distort the seed market by (i) prohibiting the imports of selected vegetable seeds (chilli, okra and beans), and (ii) subsidizing the production and distribution of seeds by the public sector. These two factors are significant barriers to the emergence of a dynamic, efficient and competitive seed industry in Sri Lanka.

The government should rationalize the seed market by:

- Privatizing the remaining DOA commercial seed production operations. These seed farms may be leased by private seed companies or converted into commercial crop production, according to the country's ability to produce seeds at competitive prices.
- Removing all quantitative barriers to seed imports. The current practice of requiring import licenses for chilli, okra, and beans effectively bars growers and consumers from the benefits of superior genetic materials that may well exist in other countries specializing in these crops.
- Increasing DOA adaptive research and development on seeds. Since the DOA has a competitive advantage in crop breeding expertise, this important resource should be exploited for its unique ability to help private seed companies adapt local and foreign seeds to evolving local production conditions.

A3. Increasing Packaging Supply

Processed fruit and vegetable exports suffer from high packaging costs because local packaging suppliers have managed to maintain high protective tariffs. However the exporters also do not have enough sales volume to achieve economies of size in packaging technology and sourcing low-cost alternative suppliers. The government's long-term intentions to gradually lower the general 35 percent tariff are a key stimulus in expanding markets and encouraging competition. In the case of packaging, the government should accelerate innovation and competition by:

- Accelerating the schedule for lowering tariffs on imported glass and tin packaging materials. In general, removing the current tariff would lower processed food prices by at least two percent, and expand production by at least the same proportion as the price change.

- Removing any remaining barriers to importing improved packaging technology. Using new technologies will strengthen processors' competitive position in export markets and expand the relatively large domestic market base.

A4. Strengthening the Agro-industrial Policy Framework

Much of the problem in dealing with land, seed, and packaging constraints is due to the lack of a comprehensive framework for casting the agro-industry's economic opportunities within the national economy. The government should strengthen the agro-industrial policy framework by:

- Shifting agricultural policy goals away from farmgate price enhancement, and toward improving rural income opportunities. The current practice of focusing on farmgate price enhancement perpetuates growers' expectations that their costs of production will be covered by farmgate prices, regardless of whether technical efficiency is improved.
- Casting policy initiatives in terms of the economic potential of the resource base, and the tradeoffs that are inevitable as agro-industry competes with the rest of the economy. Without a more coherent understanding of agro-industrial resource productivity possibilities and the reductions in food costs that will be necessary for the structural transformation of the economy, the stagnation that pervades agriculture will inexorably restrict economic progress throughout the rest of the economy.

B. Institutional Vehicles for Policy Reform

Identification of policy constraints and the formulation of effective remedies is, unfortunately the easiest part of Sri Lanka's policy dialogue process. The agro-industrial sector is widely acknowledged to be one of the economy's least attractive investment option. Furthermore, agro-industry suffers from a history of governmental neglect. It is in keeping with this negative perception of agro-industry's development potential that many government planners sincerely believe NIC status can be achieved by leapfrogging agriculture's many problems. Full acceptance of this strategy would be a tragic mistake. Agriculture shelters such a large share of the national labor supply and food costs are such a large share of household budgets that the national economy's prospects inexorably depend on shifting labor out of agriculture and increasing non-food consumer demand. Who then, will speak for agro-industry's policy issues?

B1. AgENT Clients

AgENT has more than 300 clients who are seasoned entrepreneurs. These clients represent a important core of influence for reducing agro-industry constraints. AgENT clients can use the expertise they have gained from the project to better understand the artificial policy limits that constrain their businesses. Knowledge of the nature of these constraints makes them important policy change agents in the course of

their business dealings. However, their individual actions do not constitute a critical mass of influence on government agro-industry policy formulation.

B2. The AgENT Advisory Board

The AgENT Advisory Board is well situated to serve as an influential voice for agro-industry before relevant government agencies. The Board should be used as a sounding board for identifying other policy formulation and analysis initiatives that can address AgENT's concerns in detail.

B3. Agro-industry Trade Associations

The country's agro-industry trade associations do not have a strong tradition of policy advocacy. The associations also have not been responsive in treating their members as clients who demand their services to strengthen their industries' competitive positions. Moreover, the trade associations are often reluctant to openly challenge the government on a sensitive policy issue. However, the AgENT clients are well positioned to influence their respective trade associations to become more active participants in the agro-industry policy dialogue process.

C. Research Needed to Support Policy Reform Dialogue

If the government is to reduce constraints on the agro-industry sector, new information will be needed on the magnitude of economic possibilities and the tradeoffs required to resolve conflicts between contradictory economic goals. In the following sections, key research topics are suggested for strengthening the policy dialogue to remove policy constraints.

C1. Land

C1a. Productivity of Government-Operated Lands

Concurrent with government steps to publicize the costs and returns from current use of government-operated agricultural lands, research should be conducted on the extent to which improved management will boost land productivity. In most cases, the implications of this research will point to the superiority of private-sector management in organizing resources and making profit maximizing plans congruent with maximizing social returns to land.

C1b. Crop Substitution Flexibility

The long term competitive position of the country's crops needs to be assessed in terms of changing international markets and the long-term reduction in tariffs under the new World Trade Organization.

C2. Seed

C2a. Yield Gains from Improved Genetic Materials

The DOA seed specialists should summarize all research results on crop yield differences due to genetic quality. This fundamental knowledge is needed if the private-sector seed companies are to make rational decisions on whether to produce seeds locally or import superior varieties.

C2b. Seed Production Costs

As a matter of clarifying the nature of seed production costs, the DOA should join with the private-sector seed industry in publishing an annual summary of seed production costs, including research and development, multiplication, post-harvest handling, and marketing.

C2c. Seed Market Research

Almost no attention is given to seed marketing by either the DOA or the private sector seed industry. Other countries have demonstrated that even superior seed products will fail to be adopted by farmers if there is no aggressive marketing program. Research should be conducted on how seed marketing has been successful in other countries, and how successful wholesale and retail marketing techniques can be adapted to support the seed industry.

C3. Packaging

C3a. The Scope of Packaging Demand

The importance of packaging cost reduction cannot be fully appreciated until the full scope of demand for packaging by the processed food industry is more fully estimated. The SRL study provides important information on the scope of packaging required for exported processed fruits and vegetables. However the larger packaging requirements of the domestic processed food industry need to be determined if consumers and agro-industry producers are to make effective arguments for reducing tariffs on imported packaging materials.

C3b. Assessment of Improved Packaging Technology

If the domestic packaging industry is to become competitive with imported materials, it will have to raise its packaging technology to international standards. The processing industry should assess the scope of current packaging technologies and compare them with international standards that will be required if a strong export market for Sri Lankan processed foods is to be realized.

C4. Agro-industry Policy Framework

C4a. Rationalizing Product Demand and Supply Relationships

The policy dialogue process should be based on a solid understanding of the product demand and supply relations that the sector faces. Considerable research has been done on Sri Lanka's food demand structure. However, it is remarkable that very little of this important work has been acknowledged or used in framing new food policies. On the supply side, the cross-price effects of supply shifts need to be estimated in order to better understand how enterprise mixes would change under alternative price policies.

C4b. Rationalizing the Goals of Agro-industry Development

The process of establishing sector goals is perhaps the most important step in developing the agro-industry sector. Research on the efficacy of income-generating goals, as opposed to (higher) farmgate price goals, would help the government rationalize the structural transformation of agro-industry as the country strives to attain NIC status. The latest version of the Sri Lanka Input-Output Model should be modified to demonstrate the linkages between agro-industry and the rest of the economy.

ANNEX A STUDY SCOPE OF WORK

I. Background

During the past 2-3 years, the Agro-Enterprises Project (AgENT) has encountered a wide range of problems in Sri Lanka's agribusiness sector, many of which are caused by shortcomings in the policy environment for private-sector participation and development. The project recently conducted a survey of private agro-industrial firms with a view to assessing the policy environment for agriculture and identifying critical constraints affecting development of the agribusiness sector. Data collection was confined to six principal "components": land, infrastructure, production/processing, labor, marketing, and finance. Though the survey report is not available at this time, the project has been able to make some preliminary observations based on the raw survey data.

The data indicate that there are several constraints faced by local agro-industrial firms which need to be addressed through an appropriate mix of policies, programs and projects. Given the nature of the required "interventions", some are feasible only in the long and medium term, while others could be implemented in the short term, provided the government recognizes the need for such measures and is committed in principle to improving the policy climate for private agribusiness development.

II. Objectives

The main objective of this study is to undertake a critical review of the major policy constraints in the agribusiness sector that would be of benefit to government planners and policy analysts. The review will be based primarily on the findings of the above survey and will include specific policy options, with emphasis on those that could be implemented in the short run (i.e., within a two-year time frame). The consultants will be required to interview a selected number of agro-industrial firms and trade associations and undertake extensive field work in order to provide detailed information on specific policy issues and recommendations.

III. Duration of Study

One and one-half months of expatriate technical assistance (one specialist for six-person weeks) are required for this study, which should commence o/a May 15, 1995. The specialist will give a de-briefing five weeks after his arrival and submit a final report (which should include a 3-5 page executive summary) prior to his departure from the island. The specialist will be assisted in his work by a local consultant.

IV. Qualifications

The team leader (expatriate consultant) will have a Ph.D. in Agricultural Economics (or related field) and be a recognized agribusiness specialist. 15-20 years of professional work experience and proven expertise in agricultural policy analysis and formulation are required. The team leader will have undertaken previous assignments in South Asia, preferably Sri Lanka.

The local consultant will have an M.S. in agricultural economics (or related field) and proven expertise in agricultural policy analysis.

V. Statement of Work

The two-person team will undertake a critical assessment of major policy constraints in the agribusiness sector that will be of benefit to the Sri Lankan government. The study will include a detailed analysis of relevant policy issues and recommendations, with emphasis on policies which could be implemented in the short run. The specific terms of reference are as follows:

- i. Undertake a critical assessment of the major constraints faced by private entrepreneurs in Sri Lanka's agribusiness sector, based on the findings of the private agro-enterprises survey (recently conducted by AgENT) and other relevant material.
- ii. Conduct interviews with a variety of agro-industrial firms and trade associations and undertake extensive field work in order to substantiate the findings of the AgENT survey and obtain more detailed information on specific problems and policy issues under each of the following categories: land, infrastructure, production/processing, labor, marketing, and finance. (If necessary, specific case studies based on personal interviews could be included.)
- iii. Identify policy initiatives and reforms required to remove key constraints in the agribusiness sector, with principal focus on those that could be implemented in the short run (within two years).
- iv. Undertake a detailed assessment of the short-term policy options and their likely benefits.
- v. Based on the findings of this study and discussions with Agent board members and other relevant experts, outline future research priorities and activities for the project that will contribute to the improvement of the policy climate for Sri Lanka's agribusiness sector.

ANNEX B
LIST OF PERSONS INTERVIEWED

1. Abeynaike, Patrick, Regional Director, Agricultural Development Authority, Colombo.
2. De Silva, Padmanath, Sales Promotion Manager, CIC Fertilizers (Pvt) Ltd., Colombo.
3. Cader, Shaheen, Project Director, Lanka Market Research Bureau, Colombo.
4. Fernando, Jinasiri, Acting Director General, Department of Agriculture, Peradeniya.
5. Gamage, Kuda, Deputy Director, Horticulture Institute, Gannoruwa.
6. Gleason, Jane, Consultant, Development Alternatives, Inc.
7. Jayasuriya, Nimal, Managing Partner, Foreconns Canneries, Beruwala.
8. Jayatileke, M.A.R., Assistant Director, Plant Quarantine Center, Gannoruwa.
9. Jiron, Rolando, Consultant, Abt. Associates.
10. Karunaratne, Rohan, Managing Director, CIC Agri Biotech (Pvt) Ltd., Colombo.
11. Madawanarachchi, W.P., Deputy Director, Seeds and Planting Materials Division, Department of Agriculture, Peradeniya.
12. Mahroof, A.R.M., Agricultural Economist, Horticulture Institute, Gannoruwa.
13. Manoharan, V., President, Seedsmen Association, Colombo.
14. Mirando, Tryphon R., Swiss Cheese Company (Pvt) Ltd., Colombo.
15. Mohideen, Faiz, Additional Director General, Department of National Planning.
16. Nanayakkara, Leo, President, Seed Producers' Association, Colombo.
17. Panabokke, C.R., Consultant, IIMI, Colombo.
18. Pieries, Kumar, Managing Director, Richard Pieris Agricultural Enterprises Ltd., Maharagama.
19. Ranaweera, Nimal, Director, Department of Agriculture, Peradeniya.

ANNEX B (Continued)

20. Somaratne, S.M., Deputy Director, Department of Agriculture, Peradeniya (Chairman, Task Force/Vegetables).
21. Svinningen, Arne, Green Farms Limited Sri Lanka, Colombo.
22. Watawala, Lakshman R., Financial and Management Consultant, Colombo.
23. Weerakoon, Aruna, Chairman/Managing Director, Agro-Culture Trends (Pvt) Ltd., Colombo.
24. Zarook, M.C.M., Managing Director, Sinbad (Pvt) Ltd., Colombo.

ANNEX C

ESTIMATION OF MARKET EFFECTS OF ALTERNATIVE PRICE POLICIES

Much of Sri Lanka's agro-industrial competitive advantage in export markets depends on how the price of a product is determined in the domestic market, and whether this product is subject to unfettered competition from imports. In the following sections, the methodology for measuring the effects of alternative pricing policies will be summarized. In the first section, economic welfare will be defined for what is commonly called, "the original market position," in a closed economy without government intervention. Next, the effects of price controls are summarized for cases where the price is set below the market clearing level, where the quantity supplied equals the quantity demanded. In the third section, the effects of supply expansion policies, primarily through technical innovation, are analyzed in terms of AgENT's efforts to expand agro-industrial markets. Included in this section is a special application of this cost-reducing policy to measure the effects of removing or reducing tariffs on imported inputs used in the processing of agro-industrial exports.

A. The Reference Point for Measuring the Effects of Alternative Pricing Policies

A1. The Original Position

The original market position in a closed economy (no trade) is defined by using benchmark information on the current market price and quantity (which are assumed to be in equilibrium) and assumed price elasticities of supply and demand to estimate the supply and demand equations that define the following price-quantity equilibrium:

"Before" System M:

$$\text{Demand: } P_m = a + bQ_{dm} \quad [1]$$

$$\text{Supply: } P_m = c + eQ_{sm} \quad [2]$$

$$\text{Equilibrium: } Q_{dm} = Q_{sm} \quad [3]$$

where,

P_m = the price per unit of consumption or production
 Q_{dm} = the quantity demanded "before" the supply shift
 Q_{sm} = the quantity supplied "before" the supply shift

a = the intercept of the demand equation

c = the intercept of the supply equation

b = the slope of the demand equation ($b < 0$)

e = the slope of the supply equation ($e > 0$)

The demand equation is estimated by setting the assumed price elasticity of demand equal to the elasticity formula, where P_m and Q_m are the assumed current market equilibrium values and the slope is unknown:

$$E_d = (dQ_{dm}/dP_m) * (P_m/Q_m) \quad [4]$$

where,

- E_d = the assumed price elasticity of demand
- dQ_{dm}/dP_m = the slope of the quantity-dependent demand equation
- P_m = the current observed market (equilibrium) price
- Q_m = the current observed market (equilibrium) quantity demanded

Therefore, the slope, b, in equation [1] is found by taking the inverse of dQ_{dm}/dP_m from equation [4].

The supply equation is similarly estimated by setting the assumed supply elasticity equal to the elasticity formula, where P_m and Q_m are the assumed current market equilibrium values and the slope is unknown:

$$E_s = (dQ_{sm}/dP_m) * (P_m/Q_m) \quad [5]$$

where,

- E_s = the assumed price elasticity of supply
- dQ_{sm}/dP_m = the slope of the quantity-dependent supply equation
- P_m = the current observed market (equilibrium) price
- Q_m = the current observed market (equilibrium) quantity supplied

Therefore, the slope, e, in equation [2] is the inverse of dQ_{sm}/dP_m , and the respective intercepts are found by substituting the slopes and P_m, Q_m in equations [1] and [2]. The estimated equation system is then specified as:

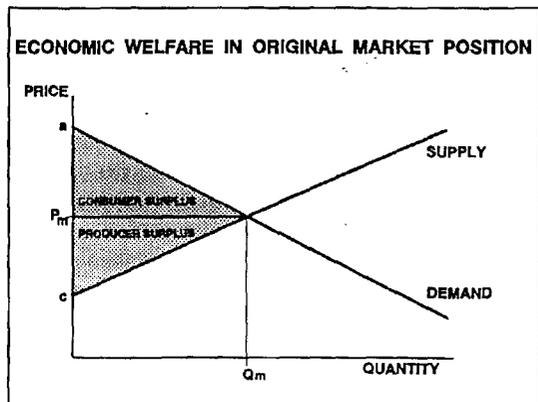
$$\begin{aligned} P_m - bQ_m &= a \\ P_m - eQ_m &= c \end{aligned} \quad [6]$$

which, when solved by simultaneous equation methods, will yield the same values of P_m "before" and Q_m "before" that were substituted in the price elasticity equations above. Equations [1] and [2] are now ready to serve as the "before" reference for evaluating the market effects of alternative pricing policies.

A2. The Economic Value of the Original Position

The supply and demand curves for the above system are presented in Exhibit C-1. The shaded area above the equilibrium price, P_m , and below the demand curve, defines consumer surplus, or the gains to consumers. The shaded area above the supply curve and below the equilibrium price defines

Exhibit C-1. Economic Welfare in Original Market Position

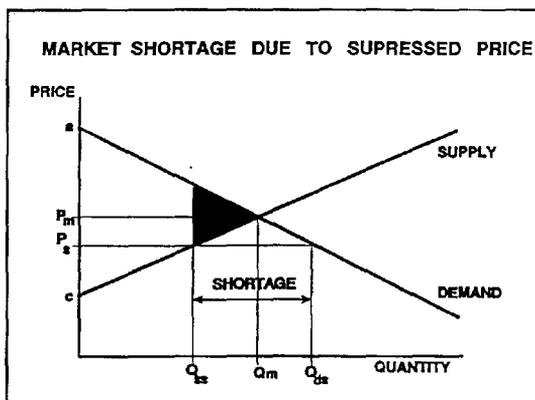


producer surplus or gains to producers. Thus, at price P_m and quantity Q_m , the economic welfare gains from this market are the combined values of producer and consumer surplus. If all producers and consumers are free to trade under the conditions of open competition, this level of economic welfare is also the social optimum. This valuation provides an objective method of defining the market without trade, and without government interventions to set prices. This is an artificial proposition because barring trade usually means the price has been distorted, and thus a socially suboptimum level of production and consumption are the result.

B. The Consequences of Setting Prices Below the Domestic Equilibrium

The equilibrium price, P_m , in the original position is also the "self-sufficiency" price. But, if government finds this price politically untenable and arbitrarily sets a lower price, it would appear that consumers gained. However, the net effect of arbitrarily lowering prices is illusionary because producers reduce their output to the level where their marginal costs of production equal the new, lower price. The result of the controlled, lower price is a shortage, as illustrated in Exhibit C-2. A policy of arbitrarily setting the price at P_s , causes producers to react by reducing output to Q_{ss} while consumers increase the quantity demanded to Q_{ds} . This results in the shortage, $Q_{ds} - Q_{ss}$, and rationing is often required to maintain market order. The lower price represents a suboptimal market allocation and its impact is measured by the shaded triangle as a net welfare loss, compared to the original position.

Exhibit C-2. Market Shortage Due to Supressed Price



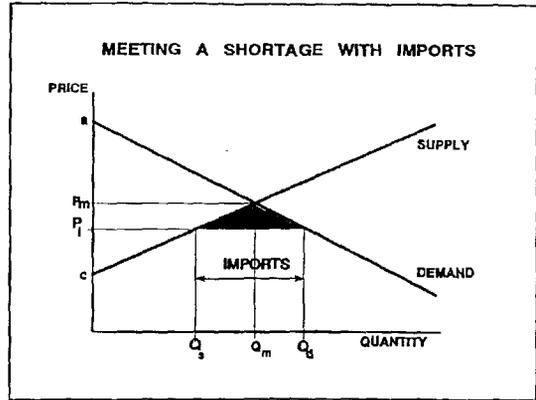
If imports are available at a lower price than P_m , the government can reduce some of the political cost of consumer dissatisfaction with the original price. If the import price happens to be the same as price P_s , then the shortage is just matched by imports, as shown in Exhibit C-3. In this case, the lower price causes consumers to be satisfied at quantity Q_d , while producers refuse to offer more than quantity Q_s . Producers will undoubtedly prefer the original, "self-sufficiency" position, but the admission of lower cost imports leads to a net increase in economic welfare, as described by the shaded triangle below the supply and demand curves and above the import price, which becomes the new domestic producer price.

C. Supply-Based Price Policy Options

The agro-industrial sector's high cost nature has limited its ability to expand markets, both domestic and international. AgENT is addressing this situation by assisting

Exhibit C-3. Meeting a Shortage With Imports

entrepreneurs with investments in new, cost-cutting technologies. The impact of these innovations can be demonstrated with a simple partial equilibrium analysis of an exogenous supply shift in supply over a fixed demand curve. Multi-market and interindustry effects are deliberately excluded, to focus on the immediate, first-round changes on the market price and quantity due to a narrowly defined change in supply. The analysis can be performed at any level in the market channel for an agro-industry product: production inputs; farmgate production; wholesale market services; or retail market services. The analytical process requires three separate operations: the original "before" market position is defined; then an exogenous supply shift is introduced; and finally, the effects of the supply shift are calculated and presented in terms of percentage changes in price and quantity and relative changes in economic welfare, as defined by producer and consumer surplus.

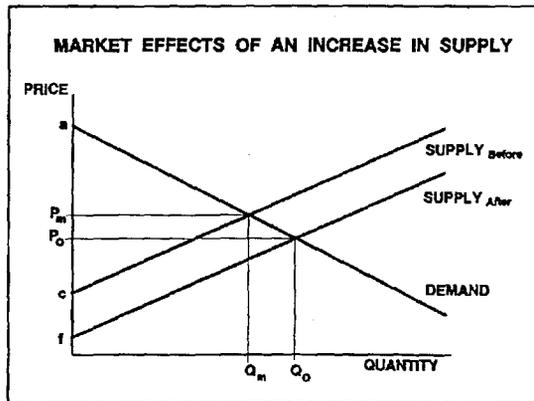


C1. The Supply Shift

The supply equation [2] is assumed to be shifted horizontally due to an exogenous market force, such as a trade restriction on a production input (supply decrease, or leftward shift). The model assumes that the original shift occurs at the original price, P_m . This means the supply equation [2] shifts left or right along the original price. So, at the original price and the new level of quantity supplied, Q_{sm} , equation [2] is solved for a new intercept, f , yielding a new market equilibrium at P_o , Q_o .

In Exhibit C-4, an increase in supply (rightward shift) causes the equilibrium price to fall, while the equilibrium quantity increases. This fundamental relationship is one of the central objectives of the AgENT market development strategy because lower prices expand domestic and export markets. Horticultural crops generally have more elastic demand characteristics than cereal crops. The econometric evidence on Asian horticultural crops is weak, but demand elasticities are generally reported in the range of -0.9 to -1.5. If the Sri Lankan

Exhibit C-4. Market Effects of an Increase in Supply



horticultural demand system is price elastic, it follows that decreases in price along a relatively fixed demand curve will result in increased total revenue to the producer and increased economic welfare to both producers and consumers.

After the supply shift, the new market system is defined as follows:

"After" System O:

$$\text{Demand: } P_o = a + bQ_{do} \quad [1]$$

$$\text{New Supply: } P_o = f + eQ_{sno} \quad [7]$$

$$\text{Equilibrium: } Q_{do} = Q_{sno} \quad [8]$$

where,

P_o = the price per unit of consumption or production
 Q_{do} = the quantity demanded "after" the supply shift
 Q_{sno} = the quantity supplied, "after" the supply shift, under the "new" supply equation

a = the intercept of the demand equation

f = the intercept of the new supply equation

b = the slope of the demand equation ($b < 0$)

e = the slope of the new supply equation ($e > 0$)

C2. The Effects of the Supply Shift

The supply shift produces two key results that are critical ingredients of any policy reform program: market prices and quantities are changed; and the levels and shares of economic welfare shifts between producers and consumers.

The price-quantity effects are measured by solving the equation system:

$$\begin{aligned} P_o - bQ_o &= a \\ P_o - eQ_o &= f \end{aligned} \quad [9]$$

which, when solved by simultaneous equation methods, will yield values of P_o "after" and Q_o "after" that differ from the results from equation system [6] because the supply equation intercept has changed from c in equation [2] to f in equation [7] (see exhibit B-1 above). The new equilibrium price will rise or fall, relative to the original price, according to whether the supply change is negative or positive, respectively. Conversely, the new equilibrium quantity will rise or fall, relative to the original quantity, according to whether the supply change is positive or negative, respectively. It should be noted that Q_o will fall between Q_m and the amount of the full supply shift horizontally along the original price level, due to the intersection of the supply curve with a fixed, negatively sloped demand curve.

The welfare effects of the supply shift are measured by comparing economic welfare before and after the shift. In the original market position, before the supply shift, consumer and producer surplus are evaluated to determine the original levels and relative shares of economic welfare realized by the two key economic interest groups in this market. In Exhibit C-4, the intersection of the fixed demand curve and the original supply curve, "before" the shift, define the welfare positions of consumers and producers. After the supply curve is shifted, the new price-quantity position defines a new welfare position which can then be compared with the original position to evaluate the net effects of the supply shift.

At the original supply level, consumer surplus is defined as the triangle formed by the vertical price axis, the horizontal line formed by the equilibrium price (P_m), and the demand curve, or,

$$\text{Consumer Surplus "before"} = .5((a-P_m)*Q_m). \quad [10]$$

At the original supply level, producer surplus is defined as the triangle formed by the vertical price axis, the horizontal line formed by the equilibrium price (P_m), and the supply curve, or,

$$\text{Producer Surplus "before"} = .5((P_m-c)*Q_m). \quad [11]$$

The total welfare level "before" the supply shift is defined as the sum of Consumer Surplus "before" and Producer Surplus "before."

After the supply shift (see Exhibit C-4), the new consumer surplus is defined as the triangle formed by the vertical price axis, the horizontal line formed by the equilibrium price (P_o), and the demand curve, or,

$$\text{Consumer Surplus "after"} = .5((a-P_o)*Q_o). \quad [12]$$

After the supply shift, producer surplus is defined as the triangle formed by the vertical price axis, the horizontal line formed by the equilibrium price (P_o), and the supply curve, or,

$$\text{Producer Surplus "after"} = .5((P_o-f)*Q_o). \quad [13]$$

The total welfare level "after" the supply shift is the sum of the Consumer Surplus "after" and Producer Surplus "after." The differences between the "before" and "after" levels of consumer surplus, producer surplus, and total welfare therefore measure the respective effects of the supply shift.

C3. Measuring Economic Effects of Changes in Technology

At any of the four major levels in any agro-industrial commodity market channel (purchased production inputs, farmgate production, wholesale market services, and retail market services), changes in technical efficiency can be translated into shifts in

the supply of production inputs, farm products, and wholesale/retail market services. The supply equation at a particular market level can be defined as:

$$Q_s = g + hP + iK, \quad [14]$$

where,

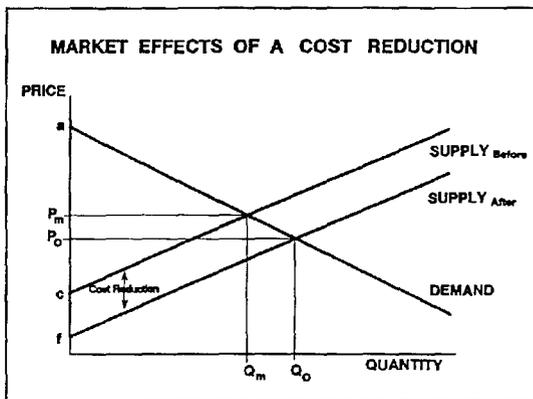
- Q_s = the quantity of an input, product or service being supplied
- P = the price required for the amount Q_s to be offered in the market
- K = a special supply shifter, representing an increase in output per unit of input, due to an improved technology
- g = the intercept of the supply equation
- h = the slope of the supply equation
- i = the slope of the supply shifter.

Changes in K can be translated into some measure of relative change in Q_s , which can be simplified by incorporating the shift effect into the intercept, i.e., g_m is the intercept adjusted for iK_m (the level of the shifter "before,") and g_o is the intercept adjusted for iK_o (the level of the shifter "after"). Examples of technology shifters could be new varieties, improved seeds, labor-saving machinery, and superior management. The welfare effects of the resulting supply shift indicate either the opportunity costs the market forgoes by failing to adopt the technology or the benefits realized by adopting the technology. Alternatively, the welfare effects provide an estimate of the maximum cost that can be incurred to employ the technology.

C4. Economic Effects of Market Input Changes

Part of the stagnation in Sri Lanka agro-industry is due to low availability of inputs or input prices that have been inflated by trade barriers and monopoly practices. In this case, K in equation [14] can be modified to represent a change in input prices, or the availability of inputs. The mere change in the availability of planting seeds, without regard to the technical superiority of improved varieties, can be modeled to reflect shifts in the supply curve at the farmgate level. Downstream from the farmgate, the cost of market services can be incorporated as a measure of the vertical distance between two supply curves, as shown in Exhibit C-5. For instance, packaging is widely cited as a major source of

Exhibit C-5. Market Effects of a Cost Reduction



excessive post-farm marketing costs. If the wholesale price of a processed good can be shown to be reduced by 10 percent if packaging tariffs or other cost elements of packaging can be reduced, this price margin can be incorporated in equation [7] as an equivalent supply shift that would increase the quantity supplied at the original price and result in a lower market price and a greater quantity marketed.

ANNEX D

SRI LANKA CROP TRENDS, 1985-1993

TABLE D-1. CROPLAND CULTIVATED, 1985-1993, THOUSAND HECTARES

	1985	1986	1987	1988	1989	1990	1991	1992	1993	Average Annual Value	Annual Growth Rate (%)	
Major Crops												
Tea	231.7	222.9	221.5	221.7	221.1	221.8	221.7	221.8	na	223.0	-0.4	(a)
Rubber (b)	204.3	202.8	201.9	200.2	199.6	199.0	198.5	194.6	192.3	199.2	-0.6	(a)
Paddy (b)	865.0	835.0	879.0	816.0	690.0	828.0	791.0	766.0	820.0	787.8	-0.8	(a)
Subtotal	301.0	1,260.7	1,102.4	1,237.9	1,110.7	1,248.8	1,211.2	1,182.4	1,012.3	1,210.0	-0.7	(a)
Minor Crops												
Maize	37.9	36.4	39.2	50.6	37.2	47.9	40.2	41.1	49.9	42.3	2.4	
Chilies	32.1	39.9	26.4	32.7	27.0	38.1	34.2	31.4	42.8	33.8	1.8	
Red Onions	5.8	8.8	11.0	11.0	10.2	8.5	8.3	8.2	8.8	8.7	0.2	
Ground Nuts	8.0	10.3	8.8	12.5	10.2	11.7	10.1	9.6	10.8	10.2	1.9	
Greengram	21.5	24.4	34.8	33.5	25.1	38.1	42.7	48.5	33.2	33.5	7.2	
Soybeans	2.4	6.3	8.7	8.3	4.7	6.9	2.9	2.0	1.5	4.5	-12.3	
Potatoes	8.4	7.9	7.1	6.6	6.8	7.7	3.5	5.3	7.7	6.8	-4.6	
Big Onion	0.2	0.5	0.4	0.8	1.0	1.8	2.4	2.5	3.5	1.4	34.9	
Kurakkan	10.9	11.4	10.4	11.1	6.1	7.3	7.3	6.7	6.4	8.5	-8.1	
Gingelly	14.1	11.5	17.4	17.5	15.8	17.7	16.3	10.8	11.8	14.7	-15.0	
Cowpeas	22.7	22.7	21.8	24.9	19.9	28.1	27.6	25.9	22.3	24.0	1.5	
Blackgram	12.2	10.1	14.1	18.2	10.9	17.8	10.2	8.8	15.7	13.1	-0.1	
Beans	8.5	6.5	7.1	7.0	7.0	6.5	6.8	6.7	6.4	6.7	-0.1	
Tomato	4.7	4.4	4.5	4.8	4.4	4.9	4.5	4.6	4.2	4.6	-0.4	
Capicum	3.5	3.4	3.3	3.7	3.3	2.7	2.8	2.6	3.1	3.2	-3.2	
Cabbage	2.9	2.7	2.5	2.6	2.5	2.8	2.7	3.4	2.9	3.0	1.4	
Raddish	2.7	2.5	2.3	2.1	2.1	2.1	2.2	2.1	2.1	2.5	-2.5	
Carrot	1.0	1.1	1.0	1.1	1.2	1.3	1.6	1.6	2.0	1.4	8.6	
Beetroot	1.2	1.3	1.3	1.4	1.5	1.5	1.3	1.4	1.5	1.4	2.1	
Knolthot	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.3	
Leeks	0.8	0.6	0.7	0.7	0.8	0.8	0.7	0.8	1.0	0.7	2.9	
Brijjal	10.0	9.5	9.4	9.7	9.5	9.5	9.4	9.0	8.1	9.4	-0.9	
Bandakka	7.6	7.2	7.4	8.3	7.6	7.8	7.6	7.4	7.2	7.6	-0.3	
Red Pumpkin	7.8	7.2	6.8	7.5	6.4	7.2	6.5	5.8	5.8	6.8	-3.2	
Bittergourd	3.3	3.4	3.4	3.7	3.6	3.8	3.7	3.8	3.6	3.5	1.4	
Snakegourd	3.1	2.9	2.8	3.1	3.0	3.0	2.8	2.6	2.8	2.9	-1.0	
Cucumber	2.2	2.3	2.6	2.2	2.3	2.3	2.3	2.1	2.1	2.3	-1.1	
Plantain	18.8	17.5	16.2	17.7	16.6	15.2	13.6	12.3	12.8	15.6	-5.2	
Ash Pumpkin	1.3	1.3	0.8	1.0	0.8	0.8	0.6	0.7	1.3	0.9	-4.4	
Subtotal	254.9	265.3	271.7	305.7	247.6	303.5	274.3	269.3	263.6	275.6	0.8	
TOTAL	1,555.9	1,526.0	1,374.1	1,543.6	1,358.3	1,552.3	1,485.5	1,451.7	1,295.9	1,485.6	-0.5	(a)

Source: Department of Census and Statistics, Department of Agriculture, Ministry of Agriculture, Lands and Forestry

(a) Annual growth rate is based on 1985-1992 because tea acreage was not reported for 1993.

(b) Harvested acreage is reported for rubber and paddy.

ANNEX D (Continued)

TABLE C-2. CROP PRODUCTION, 1985-1993, THOUSAND TONS

	1985	1986	1987	1988	1989	1990	1991	1992	1993	Average	
										Annual	Annual
										Value	Rate (%)
Major Crops											
Tea	214.1	211.3	213.3	226.9	207.0	233.2	240.7	178.9	213.9	215.5	-0.4
Rubber	137.5	137.8	121.8	122.4	110.7	113.1	103.9	106.1	104.2	117.5	-3.8
Paddy	2,851.0	2,668.0	2,128.0	2,477.0	2,063.0	2,538.0	2,389.0	2,340.0	2,570.0	2,417.1	-0.3
Subtotal	3,012.6	2,937.1	2,483.1	2,826.3	2,380.7	2,884.3	2,733.6	2,625.0	2,888.1	2,750.1	-0.5
Minor Crops											
Maize	77.7	40.6	45.2	70.6	36.4	63.9	48.5	46.9	69.3	50.6	5.6
Chillies	35.6	46.1	27.0	40.3	30.0	39.1	33.2	23.5	40.4	35.1	-2.0
Red Onions	52.7	76.5	112.6	113.6	107.7	74.0	76.9	87.0	91.0	88.0	2.3
Ground Nuts	8.3	9.8	17.2	11.9	8.8	9.7	11.5	9.8	12.3	11.0	-0.5
Greengram	15.4	17.2	23.1	23.1	19.3	29.7	36.5	23.8	26.4	23.8	7.1
Soyabeans	2.8	7.3	10.1	9.8	2.9	7.3	3.6	2.5	2.3	5.4	-10.9
Potatoes	118.2	108.1	91.6	78.2	93.7	84.3	41.5	45.0	77.2	82.0	-9.7
Big Onion	2.4	5.6	4.2	6.8	11.1	18.8	21.6	27.6	38.0	15.1	33.5
Kurakkan	6.6	6.5	8.8	7.9	3.8	4.6	4.4	4.8	4.6	5.5	-6.3
Gingelly	6.9	6.3	10.3	9.0	3.5	7.3	13.1	9.4	6.1	8.0	1.6
Cowpeas	17.3	16.8	17.4	18.1	14.9	19.5	20.0	21.8	20.0	18.4	2.8
Blackgram	8.8	7.8	12.6	13.2	6.5	7.4	7.8	6.3	16.1	9.8	0.4
Beans	36.6	37.0	37.3	37.7	36.1	36.6	35.0	35.5	28.0	35.4	-18.6
Tomato	34.5	32.9	27.1	35.2	33.0	35.2	32.2	34.7	30.9	32.9	-20.8
Capelum	17.0	15.9	15.3	17.6	14.0	11.0	11.3	10.5	12.6	13.9	-15.9
Cabbage	50.6	45.1	36.0	45.9	37.6	36.4	39.1	45.4	34.0	41.1	-18.4
Raddish	34.7	24.6	18.3	16.5	17.4	16.6	19.0	18.9	20.3	20.7	-17.0
Carrot	10.2	11.0	11.1	10.5	11.9	13.1	20.5	25.4	24.6	15.4	-17.3
Beetroot	12.3	13.8	14.0	14.0	13.3	11.5	12.7	15.0	15.4	13.6	-13.4
Knolthol	10.4	10.8	9.2	9.7	9.9	11.3	12.1	12.2	12.4	10.9	-12.0
Leeks	12.7	5.7	10.8	10.2	9.8	7.9	10.9	12.5	15.4	10.6	-8.4
Brijal	90.3	82.7	74.3	80.9	73.6	69.7	65.6	62.5	62.8	73.6	-0.9
Bandakke	43.7	41.4	44.6	43.3	40.2	39.3	38.8	37.9	37.9	40.8	-0.3
Red Pumpkin	94.1	101.1	94.5	140.0	81.1	87.7	64.4	65.4	60.5	87.6	-3.2
Bittergourd	21.2	19.5	19.5	21.8	20.8	19.9	20.6	22.1	21.7	20.8	1.4
Snakegourd	29.8	27.2	24.2	25.9	27.5	27.8	22.3	23.0	22.4	25.6	-1.0
Cucumber	25.7	22.9	20.4	22.9	22.1	25.8	19.1	17.5	18.3	21.6	-1.1
Plantain	190.8	168.0	166.4	146.7	128.8	109.4	86.0	83.9	81.9	130.2	-5.2
Ash Pumpkin	14.8	13.0	8.3	10.6	6.0	6.2	6.1	6.7	9.3	9.0	-4.4
Subtotal	1,037.1	1,021.3	1,009.9	1,091.8	921.1	930.2	844.3	837.1	912.0	956.1	-2.7
TOTAL	4,049.7	3,958.4	3,473.0	3,918.1	3,301.8	3,814.6	3,577.9	3,462.1	3,800.1	3,706.2	-1.0

Source: Department of Census and Statistics, Department of Agriculture, Ministry of Agriculture, Lands and Forestry

ANNEX D (Continued)

TABLE D-3. CROP YIELD, 1985-1993, TONS PER HECTARE

	1985	1986	1987	1988	1989	1990	1991	1992	1993	Average Annual Value	Annual Growth Rate (%)
Major Crops											
Tea	0.92	0.95	0.96	1.02	0.94	1.05	1.09	0.81		0.97	-0.1 (a)
Rubber (b)	0.89	0.92	0.83	0.84	0.75	0.77	0.71	0.73	0.71	0.79	-3.7 (a)
Paddy (b)	3.47	3.50	3.56	3.41	3.37	3.45	3.40	3.43	3.51	3.46	-0.4 (a)
Subtotal	2.32	2.33	2.23	2.28	2.14	2.31	2.26	2.22	2.85	2.33	-0.5 (a)
Minor Crops											
Milze	0.89	1.12	1.15	1.40	0.98	1.33	1.21	1.14	1.39	1.18	3.2
Chillies	1.11	1.16	1.05	1.23	1.11	1.03	0.97	0.75	0.95	1.04	-3.8
Red Onions	9.09	8.90	10.24	10.33	10.56	8.72	12.26	10.87	10.40	10.13	2.1
Ground Nuts	1.04	0.95	1.95	0.95	0.86	0.83	1.13	1.02	1.18	1.10	-0.9
Greengram	0.72	0.70	0.88	0.89	0.77	0.78	0.86	0.49	0.80	0.72	-0.1
Soybeans	1.17	1.16	1.51	1.19	0.82	1.24	1.26	1.24	1.49	1.21	1.4
Potatoes	14.07	13.88	12.90	11.85	13.78	10.95	11.86	8.47	9.99	11.95	-5.1
Big Onion	12.00	11.20	10.50	11.33	11.10	10.58	9.00	11.22	10.83	10.86	-1.3
Kurakkan	0.81	0.57	0.65	0.71	0.71	0.62	0.60	0.72	0.71	0.66	1.8
Gingelly	0.49	0.55	0.59	0.51	0.22	0.41	0.80	0.87	0.52	0.55	3.3
Cowpeas	0.78	0.74	0.80	0.73	0.75	0.69	0.72	0.84	0.90	0.77	1.3
Blackgram	0.72	0.77	0.89	0.73	0.80	0.42	0.78	0.72	1.03	0.74	0.5
Beans	5.50	5.68	5.27	5.36	5.15	5.49	5.18	5.27	4.36	5.25	-2.0
Tomato	7.38	7.50	8.04	7.30	7.46	7.23	7.13	7.80	7.28	7.21	0.5
Capelcum	4.86	4.58	4.62	4.72	4.29	4.03	3.99	4.10	4.03	4.37	-2.7
Cabbage	14.44	16.53	14.17	17.32	14.88	14.17	14.21	13.38	11.70	14.53	-2.8
Raddiah	12.15	9.89	8.08	7.69	8.23	7.97	8.52	9.01	9.44	9.00	-1.9
Carrot	9.85	10.40	10.70	9.17	9.81	10.39	12.81	13.79	12.58	11.03	3.9
Beetroot	10.23	10.63	10.81	10.18	8.92	7.91	9.49	10.86	10.18	9.89	-0.9
Knotkhol	7.35	7.94	6.65	6.87	7.24	7.88	8.36	8.72	8.81	7.76	2.7
Leeks	15.81	8.92	16.32	15.47	14.98	12.87	15.66	15.71	14.72	14.50	1.9
Brijjal	9.07	8.72	7.86	8.38	7.72	7.33	7.01	6.93	6.84	7.77	-3.5
Bandakka	5.77	6.73	5.99	6.20	6.28	5.18	5.12	5.12	5.23	5.40	-1.8
Red Pumpkin	12.08	14.02	13.89	18.57	12.62	12.19	9.87	11.19	10.48	12.77	-3.9
Bittergourd	6.42	5.70	5.70	5.82	5.79	5.28	5.59	5.84	5.94	5.79	-0.6
Snakegourd	9.54	9.32	8.52	8.42	9.04	9.16	7.95	8.26	7.91	8.68	-1.9
Cucumber	11.87	9.96	7.91	10.18	9.78	11.07	8.33	8.34	8.89	9.59	-2.5
Plantain	10.13	9.57	10.28	8.28	7.75	7.20	7.04	6.79	6.41	8.16	-6.3
Ash Pumpkin	11.14	10.30	10.02	11.10	7.53	8.17	9.50	9.29	7.31	9.37	-4.0
Subtotal	4.07	3.85	3.72	3.57	3.72	3.07	3.08	3.11	3.22	3.49	-3.5
TOTAL	2.60	2.59	2.53	2.54	2.43	2.48	2.41	2.38	2.93	2.54	-1.3 (a)

Source: Department of Census and Statistics, Department of Agriculture, Ministry of Agriculture, Lands and Forestry

(a) Annual growth rate is based on 1985-1992 because tea acreage was not reported for 1993.

(b) All yields are based on Tables D-1 and D-2, except Rubber and Paddy, where separate yield data are reported.

ANNEX D (Continued)

TABLE D-4. FARMGATE PRICES, 1985-1993, RUPEES PER KILOGRAM (CURRENT PRICES)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	Average	
										Annual	Annual
										Value	Rate (%)
Major Crops											
Tea	60.62	44.52	52.97	55.95	66.91	91.78	84.12	81.98	91.16	70.00	8.1
Rubber	21.34	23.83	27.63	37.33	38.18	35.50	34.55	37.65	44.34	33.15	7.8
Paddy	3.90	3.94	4.15	4.25	5.66	7.33	7.23	8.06	8.20	5.86	11.3
Minor Crops											
Maize	2.62	3.56	3.73	3.75	4.28	5.81	5.60	7.35	7.13	4.87	12.4
Chillies	35.92	33.05	35.33	50.02	61.81	65.56	97.87	101.88	91.93	63.66	15.7
Red Onions	11.45	10.56	8.82	10.51	9.11	21.38	31.88	22.49	23.72	16.63	14.1
Ground Nuts	15.30	12.29	10.82	10.40	15.21	15.47	15.96	18.36	21.22	15.00	6.1
Greengram	12.25	12.92	12.52	13.51	21.82	20.46	20.65	22.59	23.59	17.81	9.5
Soyabans	5.29	7.47	10.43	12.20	10.91	14.98	12.84	14.79	15.88	11.62	11.7
Potatoes	10.80	12.89	11.02	16.00	16.30	21.77	37.30	35.01	30.94	21.34	18.6
Big Onion	Farmgate Prices Not Available										
Kurakkan	3.52	4.45	4.37	5.64	6.55	9.09	7.76	8.83	10.88	6.77	13.5
Gingelly	10.74	13.00	7.69	9.13	13.05	16.56	16.76	18.36	18.07	13.71	8.8
Cowpea	8.52	9.28	9.47	10.66	16.23	15.47	13.66	15.70	16.72	12.88	9.0
Blackgram	9.72	11.77	12.48	10.70	17.72	12.66	14.06	18.77	18.71	14.06	7.4
Beans	5.80	6.16	6.10	6.78	8.03	12.98	12.65	12.76	13.46	9.41	12.8
Tomato	5.63	6.40	6.00	6.29	7.58	10.58	11.34	12.42	15.18	9.05	12.9
Capelcum	Farmgate Prices Not Available										
Cabbage	4.80	5.70	4.57	5.06	4.76	7.61	7.19	7.77	8.36	6.20	7.4
Raddish	3.30	3.30	2.56	3.07	3.33	4.45	4.87	4.96	5.53	3.93	8.2
Carrot	5.48	6.56	7.42	7.53	8.77	12.63	12.97	13.02	12.02	9.80	11.4
Beetroot	5.85	6.47	6.49	6.48	7.02	10.19	10.27	12.52	12.43	8.84	10.6
Knolkhol	4.36	3.83	3.45	3.76	3.94	5.54	6.67	6.25	5.89	4.72	7.0
Leeks	6.20	7.79	6.24	8.38	7.87	13.10	13.10	12.63	14.46	9.97	11.3
Brinjal	4.64	5.27	5.73	4.57	6.65	7.56	8.21	9.02	9.22	6.76	9.3
Bandakka	4.62	5.50	4.74	6.37	6.25	8.34	9.17	9.83	10.24	7.10	11.0
Red Pumpkin	3.37	3.98	3.33	3.72	4.40	5.41	6.08	6.44	6.70	4.83	9.6
Bittergourd	5.19	5.88	5.07	5.51	6.40	6.69	9.51	9.76	11.18	7.47	10.5
Snakegourd	3.59	4.07	3.85	3.97	4.30	5.91	6.29	6.71	7.80	5.17	10.0
Cucumber	2.60	3.15	2.85	3.45	3.59	4.99	5.06	5.55	5.77	4.11	10.7
Plantain	4.64	5.15	4.63	5.13	5.90	7.65	9.54	10.99	12.88	7.39	13.7
Ash Pumpkin	2.86	3.45	2.93	2.83	3.20	4.81	6.07	6.25	6.28	4.27	11.8

Source: Department of Census and Statistics, Department of Agriculture, Ministry of Agriculture, Lands and Forestry

ANNEX D (Continued)

TABLE D-5. FARMGATE PRICES, 1985-1993, RUPEES PER KILOGRAM (CONSTANT 1985 FACTOR PRICES)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	Average Annual Value	Annual Growth Rate (%)
Major Crops											
Tea	60.62	42.21	47.20	45.25	50.17	59.90	51.06	46.93	49.51	50.32	-0.1
Rubber	21.34	22.60	24.62	30.19	27.13	23.17	20.97	21.55	24.06	23.96	-0.4
Paddy	3.90	3.74	3.70	3.44	4.24	4.78	4.39	4.61	4.45	4.14	3.1
Minor Crops											
Maize	2.62	3.38	3.32	3.03	3.21	3.79	3.40	4.21	3.87	3.43	4.2
Chillies	35.92	31.34	31.48	40.46	46.20	42.79	59.28	58.31	49.93	43.97	7.5
Red Onions	11.45	10.01	7.86	8.50	6.83	13.95	19.22	12.88	12.88	11.51	5.8
Ground Nuts	15.30	11.65	9.64	8.41	11.40	10.10	9.69	10.51	11.53	10.91	-2.1
Greengram	12.25	12.25	11.16	10.93	16.36	13.35	12.53	12.93	12.81	12.73	1.3
Soyabeans	5.29	7.08	9.29	9.87	8.18	9.78	7.79	8.47	8.52	8.25	3.5
Potatoes	10.80	12.22	9.82	12.94	12.22	14.21	22.64	20.04	16.81	14.63	8.4
Big Onion	Farmgate Prices Not Available										
Kurakkan	3.52	4.23	3.89	4.56	4.91	5.93	4.71	5.06	5.80	4.73	5.3
Gingelly	10.74	12.33	6.85	7.38	9.79	10.81	10.17	10.51	9.81	9.82	0.6
Cowpea	8.52	8.80	6.44	8.62	12.17	10.10	6.28	8.99	9.08	9.22	0.7
Blackgram	9.72	11.16	11.12	8.66	13.29	8.26	8.53	10.75	10.16	10.18	-0.9
Beans	5.80	5.84	5.44	5.48	6.02	8.47	7.68	7.30	7.31	6.59	4.6
Tomato	5.63	6.07	5.36	5.09	5.68	6.90	6.88	7.11	8.25	6.33	4.7
Chickpea	Farmgate Prices Not Available										
Cabbage	4.80	5.40	4.07	4.69	3.57	4.87	4.36	4.45	4.54	4.47	-0.8
Raddish	3.30	3.13	2.28	2.48	2.50	2.90	2.96	2.84	3.00	2.82	0.0
Carrot	5.48	6.22	6.61	6.09	6.58	8.24	7.67	7.45	6.53	6.79	3.2
Beetroot	5.85	6.13	5.78	5.24	5.26	6.65	6.23	7.17	6.75	6.12	2.4
Knotkhol	4.36	3.44	3.07	3.04	2.95	3.62	3.44	3.58	3.20	3.41	-1.2
Leeks	6.20	7.29	5.56	6.78	5.90	8.55	7.95	7.23	7.85	7.05	3.0
Brinjal	4.64	5.00	5.11	3.70	4.99	4.93	4.98	5.16	5.01	4.83	1.1
Bendakka	4.82	5.22	4.22	4.34	4.69	5.44	5.57	5.51	5.56	5.02	2.8
Red Pumpkin	3.37	3.77	2.97	3.01	3.30	3.53	3.69	3.69	3.64	3.44	1.4
Bittergourd	5.19	5.58	4.52	4.46	4.80	5.67	5.77	5.59	6.07	5.29	2.3
Snakegourd	3.59	3.86	3.43	3.21	3.22	3.86	3.82	3.84	4.24	3.67	1.7
Cucumber	2.60	2.99	2.54	2.79	2.69	3.26	3.07	3.16	3.13	2.92	2.4
Plantain	4.64	4.88	4.13	4.15	4.42	4.99	5.79	6.29	7.00	5.14	5.4
Ash Pumpkin	2.86	3.27	2.61	2.13	2.40	3.14	3.58	3.58	3.40	3.01	3.4

Source: Department of Census and Statistics, Department of Agriculture, Ministry of Agriculture, Lands and Forestry

ANNEX D (Continued)

TABLE D-6. FARMGATE VALUE OF PRODUCTION, 1985-1993, MILLION RUPEES (CURRENT PRICES)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	Average Annual Value	Annual Growth Rate (%)
Major Crops											
Tea	12,979	9,407	11,299	12,695	13,850	21,403	20,248	14,666	19,499	15,116	7.7
Rubber	2,934	3,284	3,365	4,569	4,005	4,015	3,590	3,995	4,620	3,820	4.0
Paddy	10,378	10,197	8,831	10,527	11,877	18,804	17,272	18,860	21,074	14,158	11.0
Subtotal	26,291	22,888	23,495	27,791	29,532	44,022	41,110	37,521	45,193	33,094	8.7
Minor Crops											
Maire	88	145	169	265	168	371	272	345	484	256	18.0
Chillies	1,279	1,524	975	2,016	1,848	2,563	3,243	2,394	3,714	2,173	13.8
Red Onions	603	808	993	1,194	981	1,582	2,435	1,957	2,159	1,412	16.4
Ground Nuts	127	120	188	124	134	150	184	180	261	163	7.1
Greengram	189	222	289	312	421	608	754	533	623	439	16.6
Soybeans	15	55	105	121	32	108	46	37	34	62	0.8
Potatoes	1,277	1,393	1,009	1,251	1,527	1,835	1,548	1,575	2,389	1,534	6.9
Big Onion	Farmgate Prices Not Available										
Kurakkan	23	29	30	45	24	41	34	42	49	35	7.2
Gingelly	74	82	79	82	46	121	220	173	110	110	10.4
Cowpea	147	156	166	193	242	302	273	339	334	239	11.8
Blackgram	88	92	157	141	115	94	110	118	301	135	7.8
Beans	207	228	228	256	290	465	443	453	377	327	10.7
Tomato	194	211	182	221	250	372	366	431	470	297	13.0
Capicuan	Farmgate Prices Not Available										
Cabbage	243	257	184	232	179	277	281	353	284	252	4.7
Raddish	115	81	47	51	58	74	92	94	112	80	3.5
Carrot	56	72	82	79	104	166	267	331	298	162	23.9
Beetroot	72	89	91	91	93	117	131	187	191	118	11.8
Knolkhol	46	39	32	36	39	63	69	76	73	52	10.0
Leeks	79	45	67	86	76	104	143	158	223	108	16.1
Brinjal	419	436	426	370	490	527	538	564	579	483	4.8
Bandakka	202	228	211	233	262	328	358	365	388	285	9.0
Red Pumpkin	317	402	315	521	357	475	392	421	405	400	2.4
Bittergourd	110	114	99	119	133	173	195	216	242	156	11.3
Snakegourd	107	111	93	103	118	164	140	155	174	130	7.0
Cucumber	67	72	58	79	79	129	97	97	108	87	7.1
Plantain	885	865	771	752	759	837	916	922	1,055	862	2.2
Ash Pumpkin	42	45	24	28	19	30	37	42	58	36	3.2
Subtotal	7,067	7,921	7,028	8,999	8,821	12,075	13,578	12,557	15,502	10,395	10.2
TOTAL	33,358	30,809	30,523	36,791	38,353	56,097	54,688	50,078	60,696	43,488	9.1

Source: Department of Census and Statistics, Department of Agriculture, Ministry of Agriculture, Lands and Forestry

ANNEX E
IMPACTS OF ALTERNATIVE IMPORT POLICIES ON SRI LANKA'S CROPS

Table E-1. Estimated Effects of Alternative Import Policies on Sri Lanka's Wholesale Rice Market, 1993

		Base Actual	No Imports	Free Imports
Wholesale Price (a)	Rs/Kg	14.71	17.42	11.43
Supply (domestic) (b)	000 Tons	1,748	1,812	1,670
Demand	000 Tons	1,957	1,812	2,131
Imports	000 Tons	209	0	461
Paddy	000 Tons	2570	2665	2,455
Paddy Land (b)	000 HT	820	850	630
Labor	000 ManYrs	364	377	279
Labor (c)	ManYrs/HT	0.44	0.44	0.44
Margin Assumptions				
Retail-Wholesale	Rs/Kg	2.24	2.24	2.24
Wholesale-Farmgate	Rs/Kg	2.65	2.65	2.65
Implied Prices				
Retail	Rs/Kg	16.95	19.66	13.67
Wholesale	Rs/Kg	14.71	17.42	11.43
Farmgate	Rs/Kg	12.06	14.77	8.78
Economic Welfare:				
Consumer Surplus	Million Rs	35,974	30,858	42,262
Producer Surplus	Million Rs	23,135	27,967	17,532
Total Welfare	Million Rs	59,109	58,825	59,794
Total Welfare	Million \$US	1,335	1,328	1,350
Consumer Surplus	Index, Rs	100	86	117
Producer Surplus	Index, Rs	100	121	76
Total Welfare	Index, Rs	100	100	101
Total Welfare	Index, \$US	100	99	101

Assumed Price Elasticities: Demand, -0.4; Supply, 0.2

(a) Base wholesale price is based on Department of Census and Statistics data.

(b) Supply (domestic) and cropland estimated from Annex D.

(c) Labor requirement is based on a 1992 draft report by Seneka Abeyratne, entitled, "Labor Utilization in Field-Crop Agriculture."

Sri Lanka's Wholesale Rice Market, 1993

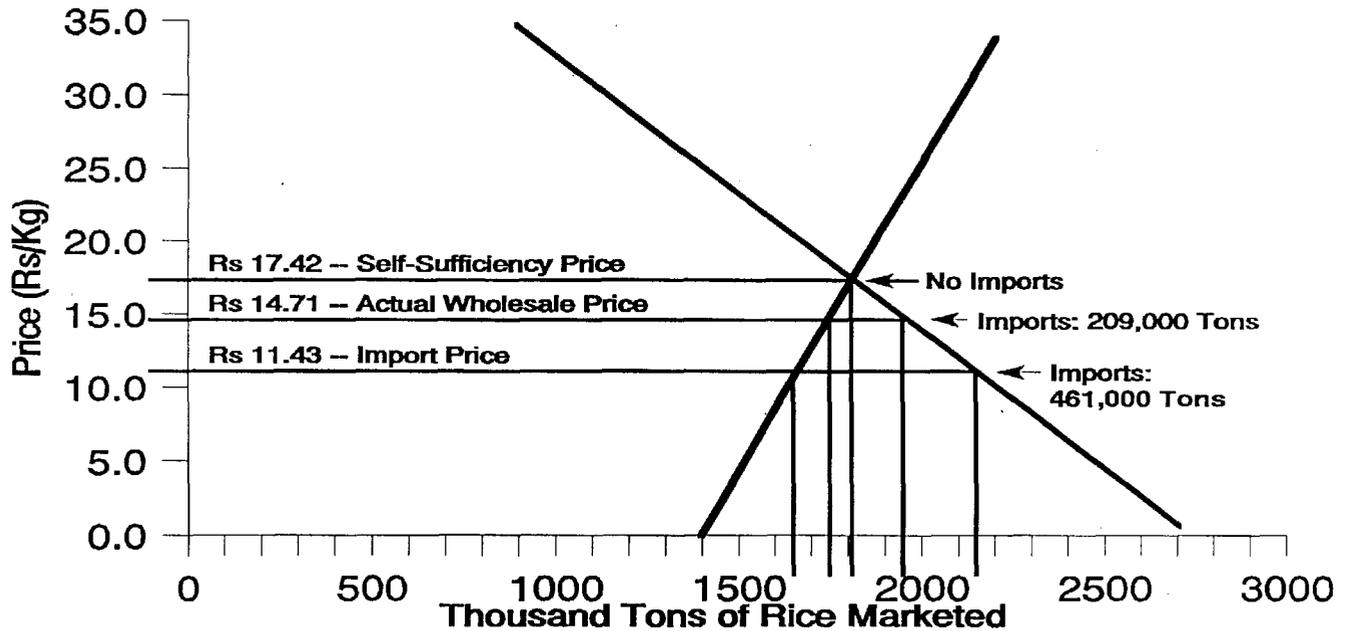


Table E-2. Estimated Effects of Alternative Import Policies on Sri Lanka's Farmgate Chillie, Red Onion, and Potato Crops, 1993

		Base-No Imports	Free Imports
Farmgate Price (a)	Rs/Kg	46.80	34.67
Supply (domestic) (a)	000 Tons	176	158
Demand	000 Tons	176	222
Imports	000 Tons	0	64
Cropland (a)	000 Ht	59	53
Labor	000 ManYrs	79	71
Labor (b)	ManYrs/HT	1.33	1.33
Margin Assumptions:			
Retail-Wholesale	Rs/Kg	32.76	32.76
Wholesale-Farmgate	Rs/Kg	9.36	9.36
Implied Prices:			
Retail	Rs/Kg	88.92	76.79
Wholesale	Rs/Kg	56.16	44.03
Farmgate	Rs/Kg	46.80	34.67
Economic Welfare:			
Consumer Surplus	Million Rs	4,128	8,963
Producer Surplus	Million Rs	6,604	4,575
Total Welfare	Million Rs	10,732	13,538
Total Welfare	Million \$US	242	306
Consumer Surplus	Index, Rs	100	217
Producer Surplus	Index, Rs	100	69
Total Welfare	Index, Rs	100	126
Total Welfare	Index, \$US	100	126

Assumed Price Elasticities: Demand, -1.0; Supply, 0.4

(a) Base farmgate price, supply (domestic) and cropland estimated from Annex D.

(b) Labor requirement is based on a 1992 draft report by Seneka Abeyratne, entitled, "Labor Utilization in Field-Crop Agriculture."

ANNEX F
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