

Reviving Sri Lanka's Agricultural Research and Extension System:

Towards More Innovation and Market Orientation

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Acronyms and Abbreviations

ADA	Assistant Director of Agriculture
AGDP	Agricultural Gross Domestic Product
AKIS	Agricultural Knowledge and Information System
AI	Agricultural Instructor
ARDA	Agricultural Research and Development Assistant
ARIS	Agricultural Research Information System
ASTI	Agricultural Science and Technology Indicators
BSc	Bachelor of Science
CARP	Council for Agricultural Research Policy
CBO	Community Based Organization
CEO	Chief Executive Officer
CIC	Chemical Industries Colombo Limited
DAIC	Divisional Agricultural Innovation Center
DAIT	Divisional Agricultural Innovation Team
DAPH	Department of Animal Production and Health
DD	Deputy Director
DEA	Department of Export Agriculture
DOA	Department of Agriculture
FAO	Food and Agriculture Organization
EO	Extension Officer
ETC	Extension and Training Centre
FAC	Farmer Advisory Committee
FCRDI	Field Crops Research and Development Institute
FTE	Full Time Equivalent
FVMAP	Faculty of Veterinary Medicine and Animal Production
GB	Governing Board
GDP	Gross Domestic Product
ha	Hectare
HARTI	Hector Kobbekaduwa Agrarian Research and Training Institute
HORDI	Horticultural Crop Research and Development Institute
HRD	Human Resources Development
ICAR	Indian Council for Agricultural Research
ICT	Information and communications technology
IP	Interprovincial
IPHT	Institute of Post-Harvest Technology
IRRI	International Rice Research Institute
IT	Information technology
JICA	Japan International Cooperation Agency
kg	Kilogram
KVSS	Krushikarma Viyapthi Sevakas (village extension workers)
MAS	Ministry of Agrarian Services and Development of Farming Communities
MASL	Mahaweli Authority of Sri Lanka
MEILD	Ministry of Estate Infrastructure and Livestock Development
mo	Month
MOA	Ministry of Agricultural Development
MSc	Master of Science
MPhil	Master of Philosophy
NAEC	National Agricultural Extension Center
NAIC	National Agricultural Innovation Council
NARS	National Agricultural Research System
NGO	Non Governmental Organization
NRC	National Research Council
NSF	National Science Foundation
OIC	Officer in Charge

PAIC	Provincial Agricultural Innovation Council
PDAPH	Provincial Department of Animal Production and Health
PDOA	Provincial Department of Agriculture
PhD	Doctor of Philosophy
PTWG	Provincial Technical Working Group
RRDI	Rice Research and Development Institute
SAEP	Second Agricultural Extension Project
S&T	Science and Technology
SLR	Sri Lankan Rupees
SMS	Subject Matter Specialist
SREP	Strategic Research and Extension Plan
t	ton
T&V	Training and Visit system
VC	Veterinary Centers
VRI	Veterinary Research Institute
yr	Year

Executive Summary and Recommendations

1. The idea for a study of the Sri Lankan agricultural research and extension system arose following publication of the 2003 World Bank report, "Sri Lanka: Promoting Agricultural and Rural Non-farm Sector Growth." The report concluded that Sri Lanka's agricultural research and extension system was weak and probably incapable of supporting agricultural growth. In early 2006, the Government of Sri Lanka and the World Bank jointly decided to commission an external review that would combine domestic knowledge and insights with international experience on research and extension. The review's objectives were to: (1) examine the structure and performance of the agricultural research and extension systems (public and private) at the central and provincial levels; (2) identify successes as well as constraints to improving the system's effectiveness for fostering innovation; and (3) propose options for further policy and institutional development, drawing on lessons from international experience. The review focused principally on nonplantation crops, although its main recommendations apply across the agricultural sector. This synthesis report summarizes the main findings of the review and builds upon them by adding some new elements. The conflict in Sri Lanka is explicitly recognized. Additionally, the implications of changes in the wider agricultural context for agricultural research and extension are explored, and have led to the adoption of an innovation systems perspective to organize the major findings.

Some remarkable successes

2. Sri Lanka's attainment of almost complete self-sufficiency in rice production has been a major achievement over the past 40 years. Success was achieved through a combination of factors including the introduction of high-yielding rice varieties, the development of irrigation capacity, and the provision of subsidized fertilizer. Improved varieties started replacing traditional varieties in the early 1960s, and by the 1990s they covered more than 90 percent of the rice area. Average rice yields increased from about 1,500 kilograms per hectare in the 1960s to about 4,000 kilograms per hectare at present. These production increases helped to reduce rice imports. Rice production as a percentage of rice availability increased from 40 percent in the early 1950s to over 95 percent in the early 2000.

3. Another major success, and a continuing strength of the extension system, is the organization of farmers into groups. These groups are instrumental in shifting farmers to high-value products and in helping them work together to achieve economies of scale in growing and marketing their produce. Farmer groups may also collaborate to reduce production costs by procuring key inputs, such as seed and fertilizer. In organizing farmers, Sri Lanka is ahead of other countries in South Asia.

4. Some extension units, such as the Western Provincial Department of Agriculture (PDOA), operate effectively and contribute significantly to national goals of maintaining food security, raising farm income, and increasing rural employment. This PDOA has a five-year strategic plan that is validated annually, plus medium-term and annual work plans. The program is largely market-driven, with a focus on high-value crops, especially export products (flowers and fruit) and fruits and vegetables for the Colombo market. Among other things, the program has been instrumental in establishing dragon fruit exports.

Negative trends and stagnation

5. Agricultural research expenditures as a percentage of agricultural gross domestic product dropped steadily from 0.66 percent in 1981 to 0.36 percent in 2003, even though relative investment levels in most other countries around the world have risen. In this and other

respects, Sri Lanka appears to be missing the boat in terms of moving towards a knowledge economy. For example, funding trends are reflected in the quality of research and extension staff. A substantial number of researchers lack a postgraduate degree (MSc or higher). The educational profile of research staff in government agencies has not improved in any significant way over the past 10 years. In the extension system, problems abound with both the number and quality of staff. Ratios of staff to farmers are low by most international standards, and staff qualifications are poor: only a few staff members possess a BSc or advanced degree. The entire base of the research and extension system is slowly eroding.

A vicious circle of inadequate funding and inadequate management

6. Research and extension find themselves in a vicious circle of inadequate funding and inadequate management. The lack of funding makes it difficult to institutionalize management systems that set clear objectives and to use strong incentive systems to achieve those objectives. The lack of vision and incentives then leads to lackluster performance, limited contributions to agricultural development, and an inability to convince decision makers that investments in research and extension are among the most profitable that can be made, as shown in many countries and many studies. A key challenge is to break out of this low-level equilibrium and move the system into an upward spiral.

Fragmentation

7. Sri Lanka's agricultural research and extension system is highly fragmented. Of the 53 ministries currently in existence in Sri Lanka, 9 deal with agriculture and rural development; of these, nearly all are involved in some type of agricultural research or extension. In addition, eight Provincial Councils run provincial extension services; the Ministry of Education deals with the university sector (including various faculties of agriculture); and the Ministry of Science and Technology sets science and technology policies and provides funding, some of which affect agriculture. Fragmentation aggravates the management difficulties described earlier and subjects the system to a regime of short-term political considerations rather than long-term development and poverty reduction considerations.

Development challenges for agricultural research and extension

8. Given that 18 percent of Sri Lanka's gross domestic product originates in agriculture, research and extension could make major contributions to sustainable and equitable development. Many of the country's poor live on small holdings and depend on agriculture for part of their income and a larger part of their livelihood. The increased agricultural productivity and profitability that an effective research and extension system can achieve could pull many of Sri Lanka's poor out of poverty, strengthen the economy and the balance of trade, foster more sustainable use of the natural resource base, and help to create a less conflict-prone setting. Now that the country is nearly self-sufficient in rice production, research and extension should focus on improving import substitution for other products (such as dairy) and on opening export markets for higher-value crops.

9. This report endorses the analysis of *Mahinda Chintana: Vision for a New Sri Lanka*. Future success requires the recognition of emerging labor shortages; consumers' changing demand for safety, variety, and quality; rapid developments in transportation and communications technologies; ongoing trade liberalization; and renewed environmental concerns. To bring about change in the shortest possible time, the agricultural sector requires a more responsive extension system that provides enhanced support for the adoption of available technologies (both locally generated and imported). To sustain the efficacy of research and extension over time, Sri Lanka needs to recognize that agriculture is becoming a knowledge-intensive sector,

and it needs to invest in mechanisms for generating and applying technologies in a user context. To better link the development and use of new knowledge and technologies, an innovation systems approach is proposed.

Reorienting agricultural research and extension

10. For the research and extension system to contribute to economic growth, it must shift from being supply-driven to becoming more market-driven, as farmers diversify their farming systems by producing more high-value crop, livestock, and related products. Research and extension must shift from increasing productivity to increasing profitability. To help farmers generate more income, it is essential for the system, especially the extension component, to become more “bottom-up.” Both the structure and culture (or mindset) of the research and extension system will need to change if this transformation is to be realized.

Principal recommendations

11. The external review’s far-reaching recommendations include an overall reorganization of the national research and extension system. The four main recommendations are summarized below. Although the analysis focused on the nonplantation segment of the agricultural sector, the effectiveness of these recommendations would be enhanced if they were applied across the entire agricultural sector.

12. *Recommendation 1: Create a National Agricultural Innovation Council (NAIC).* The Council for Agricultural Research Policy (CARP), the present apex body, is ineffective for various reasons, including its limited mandate and the dispersion of the research and extension system among many ministries. The NAIC should bring research, extension, and market development together in one apex body. The NAIC can evolve from the current CARP, principally by widening its mandate, authority, and responsibility and by repositioning it in the public sector hierarchy. The NAIC will provide a platform for all of the innovation actors to come together, will develop a vision and consensus on the required direction of the innovation system, and will fund the main initiatives. The NAIC will be governed by a Board consisting of key representatives of the public and the private sectors. Whereas currently CARP is part of the Ministry of Agricultural Development, it is proposed that the NAIC will be chaired by the President, as occurs with the Council of Scientific and Industrial Research in India.

13. *Recommendation 2: Develop, over time, a set of 8–10 mission-oriented innovation programs.* Innovation programs should be formulated in terms of an economic accomplishment, such as “the development of the dairy industry to reduce dairy imports to less than 40 percent of domestic consumption” or “the reduction of postharvest losses in fruit and vegetables production by 50 percent.” The implementation of each national innovation program will be assigned to a consortium representing the major stakeholders around the topic, involving the private sector, universities, farmer organizations, research and extension, and other government agencies. The lead agency of each program will be responsible for developing work plans and budgets for all members and submit these for approval to the NAIC. Through these consortia, significant momentum can be given to certain parts of the Sri Lankan agricultural economy, for example by reducing dairy imports or increasing self-sufficiency in maize production. These mission-mode programs may also have a regional orientation, such as increasing agricultural production in lagging regions or areas heavily affected by the conflict. It is important to understand that mission-mode programs focus not only on technology but also consider policy and institutional issues.

14. **Recommendation 3: Form Provincial Agricultural Innovation Councils.** These PAICs would be accountable to and linked directly with the NAIC, but they would focus on implementing strategic development initiatives at the provincial level, reflecting the different agro-ecological conditions within the country. The idea of the PAICs is based on success with the district-based Agricultural Technology Management Agencies (ATMAs) in India. In addition to helping link research to extension, the implementation mode for these new PAICs would involve bottom-up planning and full accountability to the stakeholders within each target area. The Governing Board (GB) for each PAIC would include a cross-section of stakeholder groups, dominated by farm leaders representing the different constituencies within the province, including women farmers. Input suppliers, traders, processors, exporters, and banking representatives would sit on the GB so that representatives of all key players within the province provide oversight for the activities proposed for funding under each PAIC. It is recommended that the PAICs be established only after the NAIC is effective and when the first mission-mode programs are operating, in order to learn from these experiences and best adapt the model to the specific conditions of Sri Lanka. The development of PAICs in conflict-prone areas will require special consideration, in which the potential benefits will be weighed with the possible risks.

15. **Recommendation 4: Support the institutional development of existing research and extension organizations,** so that they may become more effective players in a reenergized Sri Lankan agricultural innovation system. Institutional development will focus on: increased budgets, on condition of accountability; implementation of cost-sharing mechanisms for activities within the mandate; strengthening the capacity for partnerships with private organizations; strengthening facilities and equipment, especially information and communications technology; consolidating the number of operational units; introducing performance-based human resource management systems and improving educational levels and salaries; introducing consultative research and extension planning; strengthening evaluation procedures; developing strategic planning capacity; and strengthening internal capacity building. The large majority of institutional support should be linked with the implementation of the mission-mode programs, thereby ensuring that new modalities of operation are put in place and immediately made effective. Some institutional development activities (for example, institutional policies such as performance-based human resource management) should be implemented simultaneously across all research and extension organizations.

1. Organization, Rationale, and Approach of the Review

1.1 Objectives and organization

The present report explores prospects for improving Sri Lanka's agricultural research and extension system in the wake of notably slow growth in agricultural gross domestic product (AGDP) (1.5 percent, against 8.5 percent for industry and 6.3 percent for the service sector during the past 10 years), dwindling income opportunities (farm income as a proportion of the average rural household income has fallen to just 23 percent), and very low growth in agricultural employment (close to zero, compared with 6 percent in industry and the service sector). Agriculture's poor performance has accelerated urban migration. Many of those remaining in rural areas are among the nation's poorest: agriculture accounts for 50 percent of Sri Lanka's poorest households. Because of agriculture's lagging competitiveness in terms of supply, quality, cost, and innovation, substantial opportunities to improve rural incomes and alleviate poverty have been lost.

The idea for a study of the Sri Lankan agricultural research and extension system arose following publication of a World Bank report, "Sri Lanka: Promoting Agricultural and Rural Non-farm Sector Growth" (World Bank 2003). The report concluded that Sri Lanka's agricultural research and extension system was weak and probably incapable of supporting agricultural growth. The national government then requested that the World Bank to assist with an in-depth assessment of the agricultural research and extension system. After further interaction between the Ministry of Agricultural Development (MOA), its Department of Agriculture (DOA), the Sri Lankan Council for Agricultural Research Policy (CARP), and the World Bank, a joint decision was taken by early 2006 to commission an external review of the agricultural research and extension system. The review would combine domestic knowledge and insights with international experience on research and extension in a participatory and interactive mode of operation. The objectives for the review were to: (1) examine the structure and performance of the agricultural research and extension systems (public and private) at the central and provincial levels; (2) identify their successes as well as the main constraints to improving their effectiveness in fostering innovation; and (3) propose options for further policy and institutional development, drawing on lessons from international experience. The review was meant to focus on the nonplantation part of Sri Lankan agriculture, though many recommendations were expected to be relevant across the sector.

A Steering Committee, chaired by the Secretary of the MOA, was constituted to guide the review. The CARP and MOA were asked to coordinate the review process. As a first step, they commissioned background papers and invited organizations within the research and extension system to submit position papers. The background and position papers are listed among the References for this report.

CARP, MOA, and the World Bank then agreed on a review panel with the following membership: Dr. Han Roseboom, independent innovation consultant from the Netherlands and previously a staff member of the International Service for National Agricultural Research; Dr. T. Jogaratnam, Professor of Agricultural Economics at Peradeniya University; Mr. Sunil Mendis, former Governor of the Central Bank of Sri Lanka and former Chairman and Chief Executive Officer of the Hayleys Group of Companies; Dr. E. Siddiq, former Deputy Director General, Indian Council for Agricultural Research; and Dr. Burt Swanson, Emeritus Professor of Extension Sciences, University of Illinois at Urbana-Champaign.

The review was undertaken from September 10 to 30, 2006. During the first two weeks of the review, the panel studied the background papers, visited numerous organizations, and interacted with a large number of stakeholders of the research and extension system. At the beginning of the third week, a one-day workshop was held with the stakeholder community to discuss the review panel's preliminary assessments and recommendations. After the workshop, the panel prepared a first draft of the report, which was discussed in the Steering Committee on November 21 and further modified.

The participatory process for preparing the final report synthesized national, local, and international insights and expertise. In March 2007, a national workshop was organized in Colombo to obtain feedback and initiate dissemination of the main findings. At the same time, a peer review by six experts was undertaken in the World Bank to elicit additional suggestions for improvement. In May 2007, three further dissemination and feedback workshops were organized in Central Province (Kandi), North-Central Province (Anuradhapura), and Southern Province (Galle). The comments received in these meetings were generally positive and strengthened the final document.

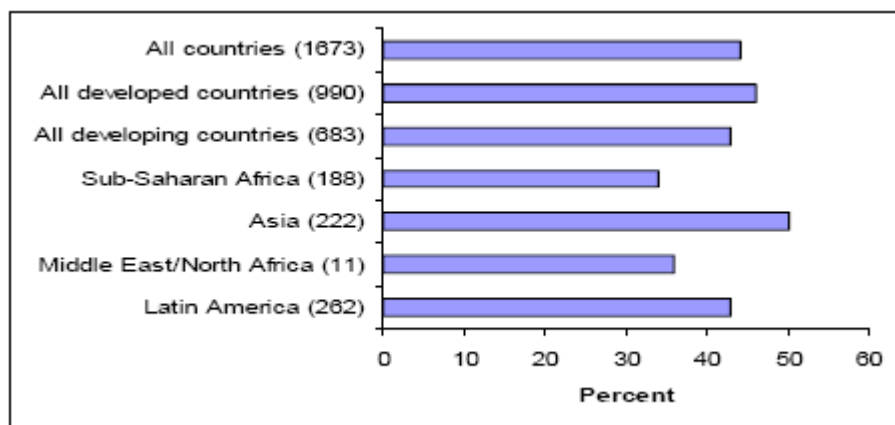
The report is structured as follows. The remainder of this chapter explores why it is important to invest in agricultural research and extension and then presents the conceptual background for the review. A brief overview of Sri Lanka's agricultural sector and the public agencies involved in agriculture is provided in Chapter 2. Chapter 3 presents the review's findings and suggestions for improving agricultural research; chapter 4 does the same for extension. Chapter 5 draws the various strands of the analysis together. It addresses the overarching issues emerging from the review and suggests how agricultural research, extension, and market development can be integrated within a market-driven agricultural innovation system. It concludes by presenting the final recommendations, many of which are relevant for nonplantation agriculture as well.

1.2 Why invest in agricultural research and extension?

Improvements in agricultural productivity have been linked closely to investments in agricultural research and development. Published estimates of nearly 700 rates of return on investments in research and extension in the developing world average 43 percent per year (figure 1.1). Returns are high in all regions of the world. Even discounting for selection bias in evaluation studies and other methodological issues, there is little doubt that investing in technology generation has been a resounding success. The high payoffs also indicate that investments in agricultural research and development (R&D) in general are below the economic optimum (World Bank 2007b).

Public investment in agricultural R&D is especially important where markets fail, because it is difficult to appropriate the benefits of such investments. For example, seed of many improved varieties can be reused by farmers and sold or shared with neighboring farmers; this characteristic makes the seed technology "nonexcludable," in economics terminology. Information on improved management practices can be exchanged freely and thus it is termed "nonrival." A major exception to the appropriation problem in agricultural R&D is private investment in developing hybrid seed. The intellectual property—the knowledge of which breeding lines produce the hybrid seed—can be protected by trade secrets, and farmers must purchase hybrid seed annually to maintain the high yields. These characteristics of hybrid seed can provide a steady market for private seed companies to serve farmers.

Figure 1.1 Rates of return to agricultural research investments in different regions of the world 1953-1997
(number of cases in parentheses)



Source: World Bank 2007b

For these reasons, the public sector conducts 94 percent of the agricultural research and a large though smaller part of extension in the developing world. The underinvestment in technology generation and dissemination continues because the political economy of public expenditure decisions tends to emphasize short-term payoffs and subsidies that are “politically visible,” whereas investments in agricultural R&D are both long-term (10 years or more) and risky. Second, trade subsidies and national policies that reduce incentives to farmers in developing countries have been a disincentive to public and private investment in R&D (World Bank 2007b).

A further reason to support technology generation and dissemination is that past gains in productivity need to be maintained. Improved varieties may give higher yields in the initial years after their release because they can resist major pests and diseases. Over time, as pests and diseases mutate, the resistance of improved varieties may erode and they may yield less. Farmers then need new materials, not necessarily to improve productivity but simply to maintain the yields they are accustomed to getting.

Global trends on returns to investments in research and extension are reflected in South Asia. Table 1.1 shows the impressive returns in terms of contributions to agricultural growth in India, Sri Lanka’s neighbor, as documented through 28 different studies.

Table 1.1: Internal rates of return to research investment in India
percent

<i>Measure</i>	<i>Aggregate analysis</i>	<i>Analysis for individual crops</i>	<i>All</i>
Mean	75.4	69.9	71.8
Median	58.5	53.0	57.5
Minimum	46.0	6.0	6.0
Maximum	218.2	174.0	218.2
Number of studies	10	18	28

Source: Pal and Byerlee 2006

It is important to observe, however, that the production potential of a given agricultural system cannot be realized in isolation. Other elements must be in place, including roads, irrigation systems, telecommunication, energy, education, health services, and security. The development of these elements must be carefully coordinated to realize the full benefits of R&D. In this regard it is worthwhile to note the development achievements of Thailand, where climatic, land, and socioeconomic conditions resemble those of Sri Lanka and where

research and extension are coordinated under the national agricultural development plans (Goonasekere 2006)

On a smaller scale, and based on more anecdotal evidence, the impact of investments in research and extension systems can also be observed in Sri Lanka. Concerted efforts to develop and disseminate improved rice varieties, together with other support measures, have brought the country close to self-sufficiency in rice production. Earlier on, the well functioning Tea Research Institute was a key factor behind the strength of the sector (World Bank 2007a). The full potential of investments in research and extension have not been realized, however, owing to underinvestment and inadequate organization.

To increase the priority given to agricultural R&D in public funding, greater political support is needed for agriculture, particularly for financing public goods. Forming coalitions of producer interests around particular commodities or value chains may be the most effective way to lobby for more public funding and for producers to cofinance R&D. In addition, institutional reforms will be needed to make investments in R&D organizations attractive, as well as to make funding transparent and open to a wider range of research providers in universities, civil society, and the private sector (World Bank 2007b).

1.3 Conceptual background

In preparing the review, it was recognized that strengthening agricultural research and extension per se might not be sufficient to make the required contributions to agricultural development. In Sri Lanka as in other countries, the agricultural context has changed strikingly over the last 20 years. Six trends heighten the need to change the focus of research and extension services (World Bank 2006):

1. *Markets—not production—increasingly drive agricultural development.* For most of the 20th century, agricultural development was inextricably linked to improvements in the productivity of staple food crops, but this situation is changing. With falling staple food prices and rising urban incomes, the pay-off has shifted to strategies that enhance agricultural diversification and increase the value-added of agricultural production (Bhargouti et al. 2004).
2. *The production, trade, and consumption environment for agriculture and agricultural products is increasingly dynamic and evolving in unpredictable ways.* If farmers and companies are to cope, compete, and survive in contemporary agriculture, they need to innovate continuously.
3. *Knowledge, information, and technology are increasingly generated, diffused, and applied through the private sector.* Private businesses develop and supply a substantial number of the technologies that farmers use or introduce (examples include seed, fertilizer, pesticides, and machinery). The role of the private sector is expected to grow with the increasing intensification of agriculture.
4. *Exponential growth in information and communications technology (ICT), especially the Internet, has transformed the ability to take advantage of knowledge developed in other places or for other purposes.* The revolutions in both ICT and biotechnology have driven home the fact that many innovations within the agricultural sector—examples include geographic information systems, global positioning systems, and bioinformatics—are based on knowledge generated in other sectors.

5. *The knowledge structure of the agricultural sector in many countries is changing markedly.* Technical change and innovation have become much more interactive processes that can be led by many different types of actors (Janssen and Braunschweig 2003).
6. *Agricultural development increasingly occurs in a globalized setting.* Globalization raises the stakes in agricultural development: success (for example in the export of nontraditional products) may assume larger dimensions than in a more insular world, but failure to adapt to new conditions will also have larger consequences and may cause traditional production patterns to erode rapidly.

Given these trends, the review of Sri Lanka's research and extension system was designed to extend beyond the current situation and identify ways of fostering a more integrated agricultural innovation system that could be more consistent with the changing national and international context for agriculture. The review thus took stock of new or increasingly active players in agricultural innovation, such as universities, private consultants, national and international companies, and nongovernmental organizations (NGOs); assessed how Sri Lanka could take advantage of new ways to access and use knowledge; and explored whether Sri Lanka could benefit from new ways of organizing and coordinating the different efforts contributing to agricultural innovation.

Changing approaches for supporting agricultural innovation

In the 1980s, the concept of the “national agricultural research system” or NARS¹ was developed to guide investments in agricultural development. Development activities based on the NARS concept generally focused on strengthening research supply by providing infrastructure, capacity, management, and policy support at the national level. In the 1990s, the “agricultural knowledge and information system” (AKIS)² concept gained currency. The AKIS concept recognizes that research is not the only means of generating or gaining access to knowledge. Although the AKIS concept also focuses on research supply, it gives much more attention to the links between research, education, and extension and the identification of farmers' demand for new technologies.

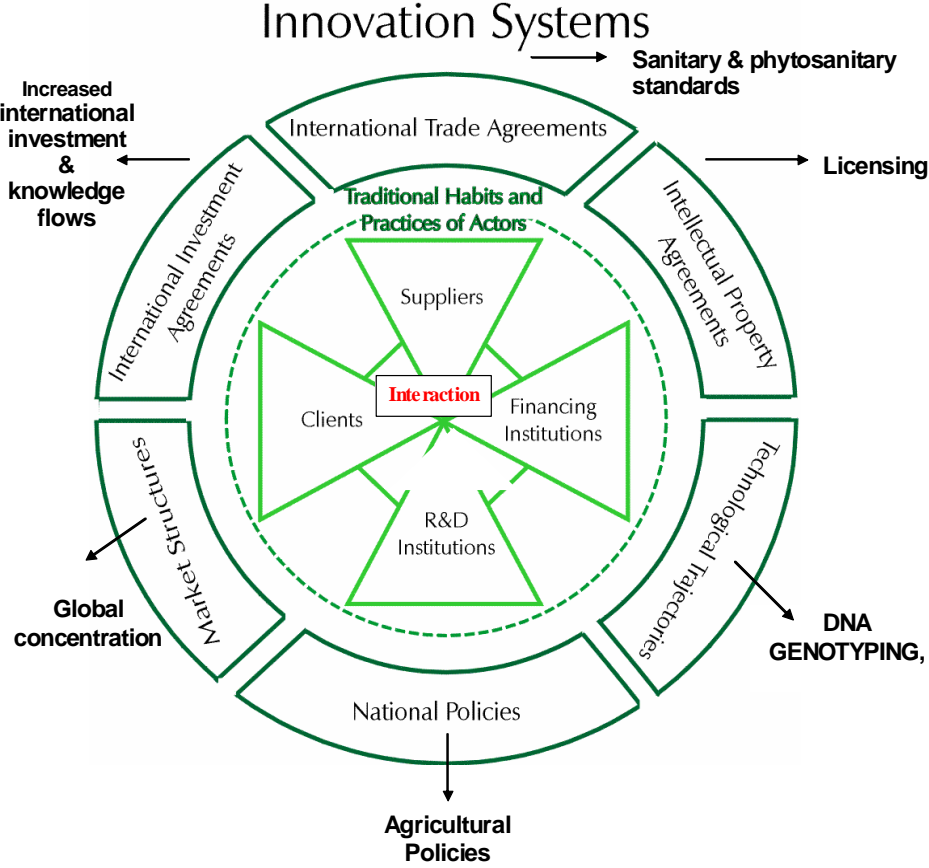
Stronger research systems may increase the *supply* of new knowledge and new technologies, but they may not necessarily improve the *capacity* for innovation throughout the agricultural sector (Rajalahti, Woelcke, and Pehu 2005). Recently more attention has been given to the demand for research and technology and to the development of wider competencies, linkages, enabling attitudes, practices, governance structures, and policies that allow this knowledge to be put into productive use. The concept of an innovation system has guided this more holistic approach to planning knowledge production and use.

¹ The NARS comprises all of the entities in a given country that are responsible for organizing, coordinating, or executing research that contributes explicitly to the development of its agriculture and the maintenance of its natural resource base (ISNAR 1992).

² The AKIS links people and institutions to promote mutual learning and to generate, share, and utilize agriculture-related technology, knowledge, and information. An AKIS integrates farmers, agricultural educators, researchers, and extension agents to harness knowledge and information from various sources for improved livelihoods. Farmers are at the heart of this knowledge triangle (World Bank 2004)

An innovation system may be defined as comprising the organizations, enterprises, and individuals that together demand and supply knowledge and technology, and the rules and mechanisms by which these different agents interact. The innovation systems concept focuses not merely on the science suppliers but on the totality and interaction of actors involved in innovation. It extends beyond the creation of knowledge to encompass the factors affecting

Figure 1.2: A stylized innovation system



Adapted from: Lynn K. Mytelka, "Local Systems of Innovation in a Globalized World Economy" in *Industry and Innovation*, Vol. 7. No. 1, June 2000

demand for and use of new and existing knowledge in novel and useful ways. Thus innovation is viewed in a social and economic sense and not purely as discovery and invention. Figure 1.2 is a stylized presentation of an innovation system and of the context in which it might operate. The innovation systems concept offers a holistic explanation of how knowledge is produced, diffused, and used and emphasizes the other actors and processes that have become important in agricultural development. Because markets for agricultural products and services emerge and change continuously, agricultural development depends more than ever on a process of continuous, incremental innovation. The scope of innovation includes not only technology and production but organizations, management, and marketing changes, therefore requiring new types of knowledge not usually associated with agricultural research and new ways of using this knowledge. Given that several recent successes in Sri Lankan agriculture arose as much through organizational as through technological change, the review was undertaken with an innovation system concept in mind.

2. Agriculture in Sri Lanka: An Overview

2.1 Introduction

The agro-ecological zones extending across Sri Lanka's 66,000 square kilometers are diverse. Elevations rise from sea level throughout the coastal lowlands to more than 1,500 meters in the central highlands. The climate is tropical, with little seasonal variation in temperature. Rainfall patterns are dictated by the Southwest monsoon, operating from May to September, and the Northeast monsoon, operating from November to February. The intensity of rainfall is influenced by the central highlands, which lie in the path of the rain-bearing winds.

The island is divided into two broad agro-climatic zones: the Wet Zone and the Dry Zone. The Wet Zone covers the southwest quadrant of the island, including the central highlands. Rainfall is well distributed throughout the year, ranging from 2,000 to 5,000 millimeters per annum. Though accounting for only 25 percent of the land area, the Wet Zone supports about 60 percent of the island's population, currently estimated at over 19 million. All of Sri Lanka's export crops, which are primarily perennial, are found in this zone.

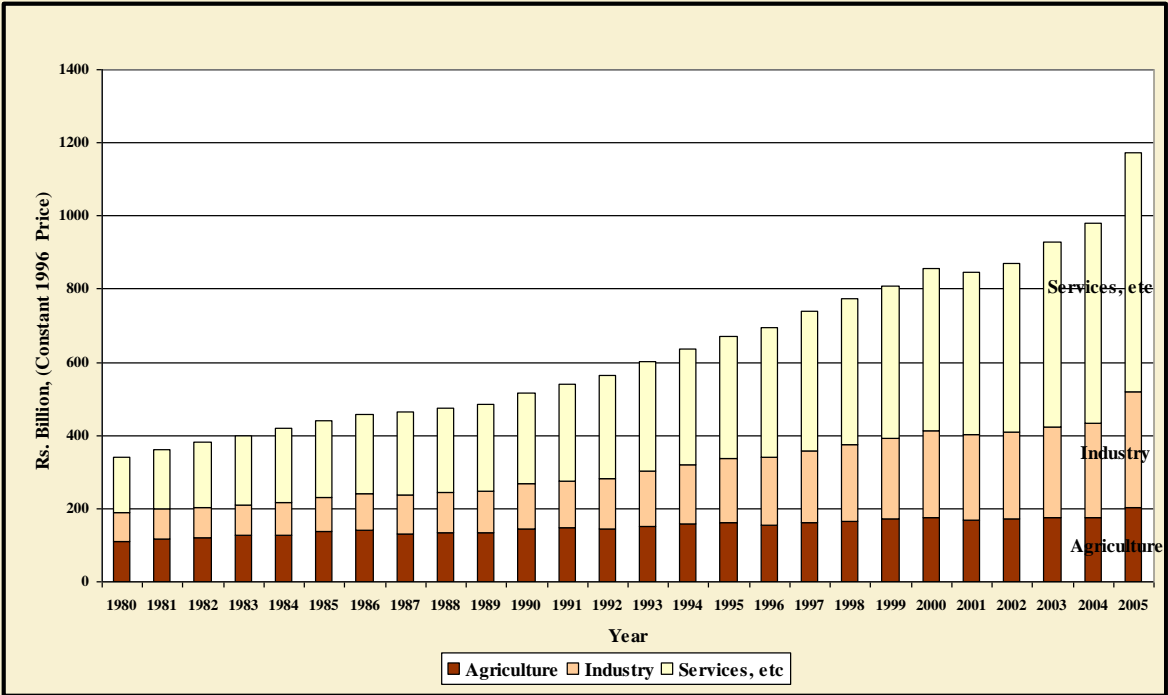
The Dry Zone is characterized by low and highly seasonal rainfall, which is heavily concentrated during the Northeast monsoon. The zone thus experiences a long dry period from about February to August when agriculture is impossible without irrigation. In ancient times, the Dry Zone was the base of a hydraulic civilization, and much development in the Dry Zone has been associated with renovating and rehabilitating the ancient tank systems and resettling or colonizing the zone. The zone remains sparsely populated except for these settlements. Even so, the rice and other annual crops produced in this zone help the island to meet its food requirements.

Twenty-five percent of the land in Sri Lanka is used for agriculture. Rice, coconut, tea, and rubber are the major crops, together accounting for more than 80 percent of agricultural land area and about 60 percent of the value added from agriculture. It is common to distinguish between food crops and export crops (also referred to as nonplantation and plantation crops). Nonplantation crops include, besides rice, other cereal grains such as maize, finger millet, and sorghum; pulses such as green gram and black gram; condiments such as chilies and onions; tubers such as manioc (cassava), potato, and sweet potato; oilseeds such as gingelly (sesame) and soybean; and fruits and vegetables. Apart from tea, rubber, and coconut, plantation crops include coffee, cocoa, cinnamon, and other spices such as pepper, cardamom, and nutmeg.

2.2 Agriculture within the overall economy

Sri Lanka's agricultural sector has grown slowly over the last 25 years, with an average rate of 1.5 percent in the last 10 years (figure 2.1). Much higher growth rates in the industrial and service sector have caused agriculture's relative role in the economy to fall quickly. Although the relative role of the agricultural sector is expected to diminish as the overall economy develops, higher agricultural growth on the order of 3–4 percent could have made major contributions to balanced economic development in Sri Lanka. For example, such growth could have helped reduce the bill for importing food and other agricultural products (dairy products, maize) and could have bolstered foreign exchange earnings. It could have reduced migration out of agriculture and provided a better raw material base for establishing rural agro-industries. Higher agricultural growth could also have prevented the cost of food from rising. Finally, it would have contributed to lower wage costs, thereby increasing the competitiveness of the Sri Lankan economy.

Figure 2.1: Sri Lanka: Long-term growth patterns in major sectors, 1980–2005



Source: Central Bank Annual Reports, various issues

Sri Lanka’s slow agricultural growth has several causes. Some general causes of poor economic performance per se have also affected agriculture. Macroeconomic policies, characterized by high fiscal deficits, have raised domestic interest rates, thereby increasing the cost of capital and reducing the incentive to invest. Labor regulations, very restrictive with respect to hiring and firing, have constrained the development of enterprise-based agricultural activities such as plantation agriculture or dairy processing plants, and the agricultural sector remains largely in the hands of many small-scale family farmers. Trade policies have been unpredictable. Import duties on commodities such as maize and rice have changed repeatedly and unexpectedly and have increased the risk of agricultural activities. The current civil conflict is another cause of slow agricultural growth. Box 2.1 outlines the relationship between this conflict and efforts in agricultural development, such as those occurring through the research and extension system.

Other factors more specific to agriculture have also contributed to slow growth in the sector. Agricultural policies with respect to imports and exports, as well as price and credit supports, have been notably unstable and ineffective. The land tenure policy discourages consolidation of agricultural property and leaves the land fragmented in many small, unproductive plots. Sri Lanka’s water policies and its investments in irrigation capacity have been irregular and have constrained the development of high-potential areas. Poor infrastructure in rural areas increases the cost of supplying inputs and marketing output and thus strongly influences the competitiveness of agriculture.

Box 2.1: Sri Lanka's conflict and the agricultural research and extension system

Sri Lanka's long-lasting civil conflict has particularly affected the North and the East. Since the Cease Fire Agreement broke down in 2005, an estimated 4,000 lives have been lost. More than 300,000 people have been displaced. The total number of internally displaced persons in Sri Lanka now surpasses half a million, including those displaced by the tsunami and earlier phases of the conflict.

The preservation of law and order in rural areas is an increasing concern. The Sri Lankan conflict is largely played out in rural areas and affects rural people most directly. The North and the East have high agricultural potential but have had little chance to realize it under current conditions. Given the conflict's rural nature, the need for agricultural development may be especially high. Agricultural development might help reduce rising inequities between rural and urban areas, which have often fuelled the fires of conflicts.

Undoubtedly the current conflict constrains efforts to strengthen agricultural research and extension. First, the large fiscal deficit, which approaches 8 percent of gross domestic product, is partly the result of military spending and creates pressure to limit other important public spending. Second, the conflict makes it very difficult to work in certain parts of the country. It would simply be unrealistic to expect effective agricultural extension in conflict-ridden regions. Third, the conflict leads many educated people to leave the country, thereby reducing the intellectual leadership available to the research and extension system.

How relevant is it to support agricultural research and extension in a country in conflict? An effective research system mostly produces public goods, often in the form of knowledge, which is freely accessible and transferable even in difficult situations. Ideally, research and extension are professional and politically neutral activities. In rural areas that are less affected by the conflict, investments in effective research and extension systems will forestall further marginalization. In rural areas where agricultural extension cannot be undertaken effectively at the moment, it is still useful to have an effective model at hand for when conditions improve. The rapid availability of promising agricultural opportunities for rural people might reduce levels of dissatisfaction, dampen the potential for continued conflict, and help to cement a peace process.

Source: Authors

A final factor is the low rate of technological change in the sector, caused by an ineffective agricultural innovation system and by constraints on the private sector's involvement in activities such as seed supply and the introduction of new varieties (for example, in horticulture). The low rate of technological change is illustrated by the change in agricultural labor productivity (table 2.1).

Table 2.1: Gross domestic product, employment, and average productivity per person, 1990–2005 (in constant 1996 prices)

Year	Annual AGDP (SLR millions)	Employment generated (millions of full-time jobs)	Share of national employment (%)	Average productivity (SLR/person/yr)
1990	144,000	2.362	46.8	60,965
1995	162,600	1.966	36.7	82,706
2000	175,100	2.269	37.3	77,171
2005	201,636	2.496	30.7	80,784

Source: Central Bank Annual Reports, various issues

Since 1995, labor productivity in agriculture has been falling rather than rising. At the same time, wages in the industrial and service sectors have increased substantially, by at least several percentage points each year. The income gap between agriculture and other parts of the economy has grown quickly and has contributed to rising rural–urban inequity. Poverty is increasingly a rural phenomenon. Several economically lagging districts, such as Badulla and Monaragala, are predominantly agricultural. For the young generation, agriculture has become at most a second-best option, characterized by physical drudgery and low and uncertain profits. While agriculture provides more than 30 percent of national employment, it has nevertheless been surpassed by the service sector as the biggest employer.

2.3 Structure and performance of agricultural production

Structure of production

Information on structural characteristics is available only for 1982. Information from the 2002 Census of Agriculture has not yet been processed. In 1982, it was estimated that nearly 65 percent of all agricultural holdings were under 2.0 acres (0.8 hectares) and that these small holdings covered about 16 percent of the agricultural land area. The total number of agricultural holdings increased by 90 percent between 1946 and 1982, and the increase in area cultivated increased by 25 percent. Preliminary data from the 2002 Census indicate that the number of holdings increased by another 80 percent, and that over 40 percent were less than one-quarter of an acre.

Rice is by far the single most important crop cultivated in Sri Lanka, contributing nearly 25 percent of AGDP. Vegetables are next in importance (20 percent of AGDP), followed by coconuts (13 percent), tea (12 percent), other food crops (10 percent), other export crops (5 percent), and animal husbandry (5 percent). The remaining 10 percent of AGDP comes from other crops, forestry, and fisheries.

Yield levels

Agricultural yields are low in Sri Lanka compared with neighboring countries (table 2.2). Data on selected commodities in 2003–05 from the United Nations Food and Agriculture Organization (FAO) indicate that Sri Lanka has the lowest average yield in all crops except rice (for which it has the second-highest yields) and the second lowest yield per animal for milk production. The low productivity levels across the different commodities suggest that production technologies (including varieties and breeds, seed quality, fertilizer use, cultivation practices, and pest and disease control) are rather rudimentary and that there is a lot of room for improving productivity and efficiency.

Table 2.2: Average yields in Sri Lanka and neighboring countries, 2003–05

	Rice (kg/ha)	Potatoes (kg/ha)	Maize (kg/ha)	Chilies (kg/ha)	Groundnuts (kg/ha)	Milk (kg/animal)
India	3,098	17,757	1,935	9,181	1,174	934
Indonesia	4,550	15,466	3,337	5,575	2,028	90
Malaysia	3,332	na	3,000	na	4,990	488
Sri Lanka	3,522	13,455	1,356	3,202	732	379
Thailand	2,996	14,566	3,777	14,000	1,624	2,892

Source: FAOSTAT (<http://faostat.fao.org/default.aspx>)

na = not available or not applicable.

Performance of selected commodity or commodity groups

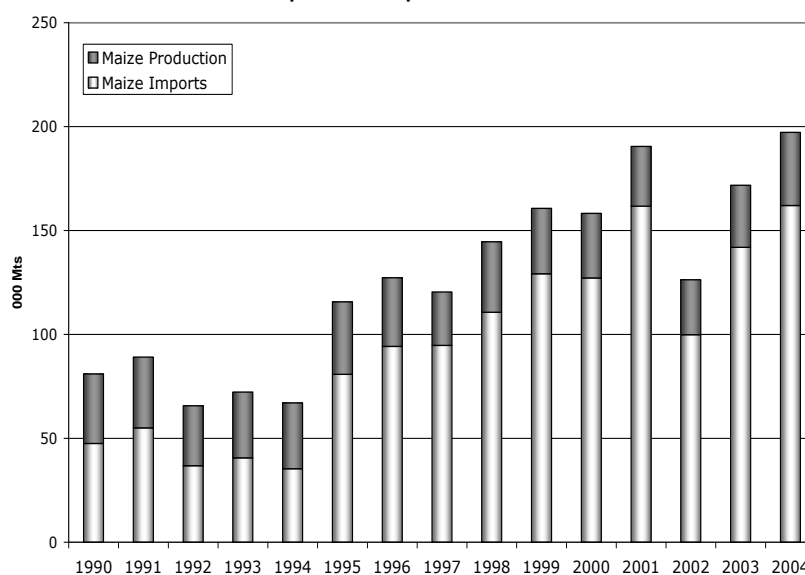
Rice. Rice is the single most important crop in terms of area cultivated, accounting for over 45 percent of the area under annual crops. It is double-cropped wherever sufficient water is available, and the area sown was estimated at over 510,000 hectares in 2002 and over 600,000 hectares in 2003. Cropping intensity ranges from over 150 percent in the major irrigation systems to under 100 percent in the rainfed areas. Other field crops account for about 200,000 hectares, and other export crops (that is, export crops excluding tea, rubber, and coconut) are estimated to occupy another 75,000–100,000 hectares.

The area planted to rice expanded from 450,000 hectares in 1952 to about 875,000 hectares in 2000. Much of this expansion occurred through the development of irrigation facilities in the Dry Zone. Rice area under rainfed cultivation decreased from about 285,000 to 235,000 hectares, whereas the area under minor irrigation systems grew from 67,000 to nearly 195,000 hectares. The increase in irrigated area has facilitated the spread of high-yielding seed–fertilizer technology. The new improved varieties, which started to replace traditional varieties in the early 1960s, covered more than 90 percent of the rice area by the 1990s. Average rice yields increased from about 1.5 metric tons per hectare³ in the 1960s to the current level of about 4.0 tons per hectare. Nearly 65 percent of the rice production is in the Maha or major season, from October to March. Rice production as a percentage of rice availability increased from 40 percent in the early 1950s to over 95 percent in the early 2000.

Other food crops. Maize accounts for about 20–25 percent of the area under other food crops. Large quantities of maize are imported to meet the requirements of the feed industry. In the early 1990s, about 40 percent of maize was locally produced. While the market since then has expanded by nearly 6 percent each year, the volumes produced locally have not. By the early 2000s, local production amounted to about 18 percent of supply (figure 2.2).

Figure 2.2:

Sri Lankan Imports and Local production of Maize in 000 Mts



Source: FAOSTAT (<http://faostat.fao.org/default.aspx>)

Chilies, green gram, and cowpeas follow in terms of area cultivated. No clear trends in yields can be discerned, given the highly weather-dependent nature of production. Maize yields have increased, however, probably reflecting the recent introduction of hybrid seed. The area under soybeans also showed a sharp increase from about 650 hectares in 2001 to about 3,000 hectares in 2005.

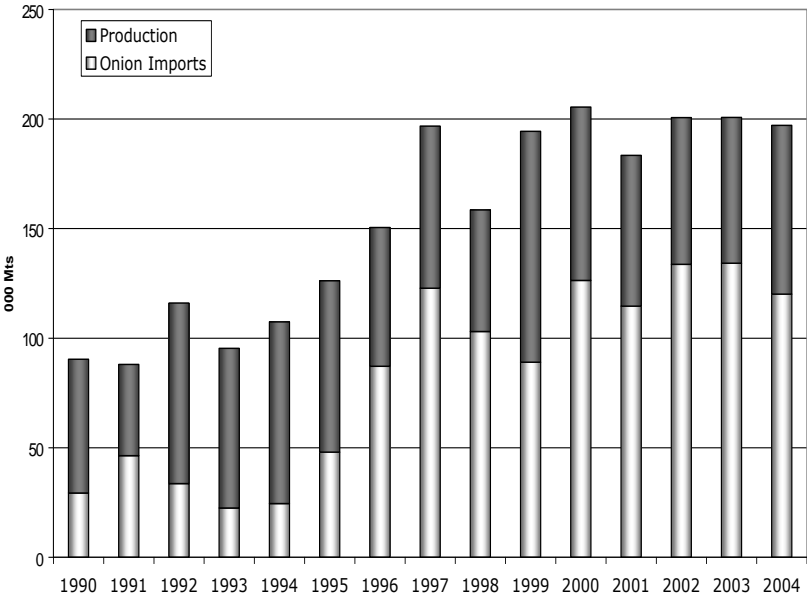
³ All figures reported in tons are metric tons.

Other export crops. Other export crops (those other than tea, rubber, or coconut) consist primarily of cinnamon and pepper, along with relatively small areas of other spice crops, such as cloves, cardamom, and nutmeg and mace. The Department of Export Agriculture (DEA) also handles coffee and cocoa, citronella, kithul, ginger, turmeric, betel, and arecanut. These are all largely confined to the Wet Zone. There is a marked increase in the areas under cinnamon and pepper, while the area under cocoa declined. Productivity as well as export volumes have increased over the years, but there is scope for value addition.

Fruits and vegetables. Fruits and vegetables are often seen as money-makers in domestic and export markets, but the data for Sri Lanka present a more mixed picture. Vegetable production rose sharply from 1980 to 1990 but slowed dramatically thereafter. For example, in the early 1990s demand for onions stood at some 90,000 tons, of which about 70 percent was produced domestically. By the early 2000s, demand had doubled to some 190,000 tons, but domestic production remained largely unaltered, and imports had grown by about 100,000 tons (figure 2.3; FAO Trade Statistics).

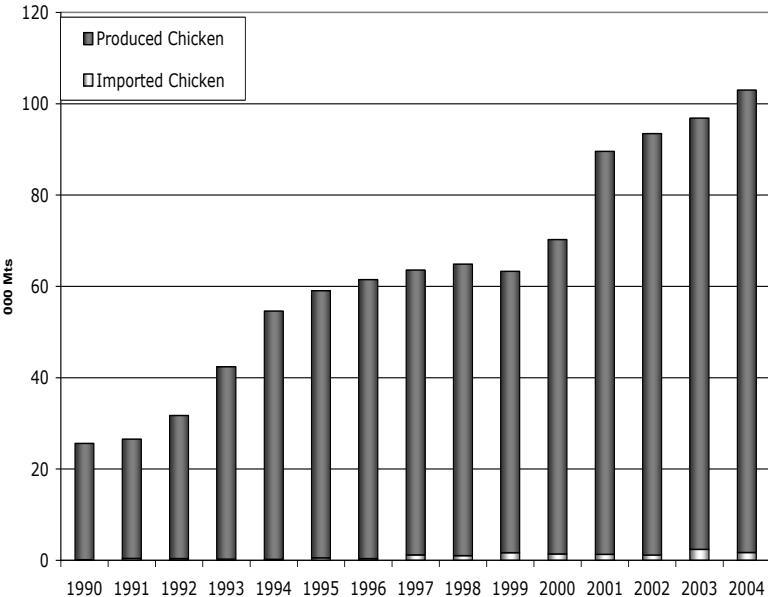
Fruit production declined dramatically, with per capita availability falling by more than half. Whether this can be attributed to liberalized imports is not clear. Per capita consumption is low in Sri Lanka compared to countries like Malaysia, and it is much lower than in the developed world. Small volumes of fruits and vegetables are both exported and imported, but there is evidence that domestic and foreign markets could accommodate considerable additional production from Sri Lanka. Owing to the small and scattered nature of fruit production, new technologies

Figure 2.3:
Sri Lankan Production & Imports of Onions in 000 Mts



Source: FAOSTAT (<http://faostat.fao.org/default.aspx>)

Figure 2.4:
Sri Lankan Production & Imports of Chicken Meat in 000 Mts

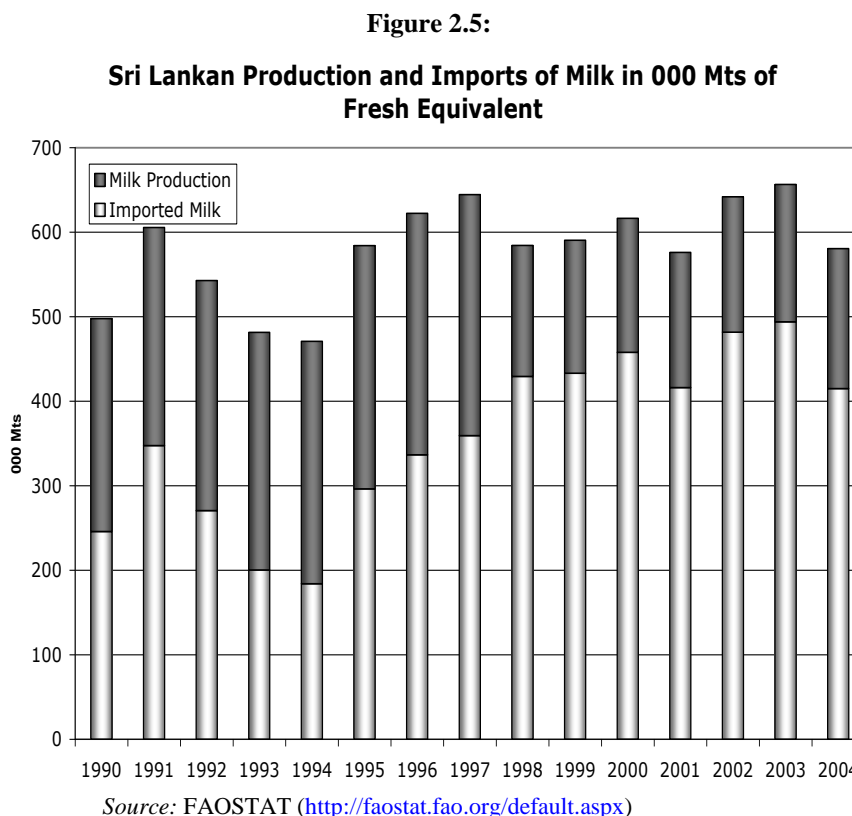


Source: FAOSTAT (<http://faostat.fao.org/default.aspx>)

do not appear to be widely diffused. As incomes increase, demand for fruits and vegetables will grow, and more research and extension funds should be assigned to these crops.

Livestock. Poultry production has surged dramatically, both from small-scale operators and from the entry of large-scale producers. The broiler sector experienced growth of some 10 percent per year during the 1990s, slowing to some 8 percent in the current decade. Domestic production is now sufficient to meet domestic demand (figure 2.4; FAO Trade Statistics).

The same cannot be said of milk production. In the early 1990s, the Sri Lankan milk market stood at the equivalent of some 500,000 tons, and national production met about 60 percent of that demand (that is, about 280,00 tons). By the early 2000s, however, domestic demand for milk had risen to about 600,000 tons, but domestic production had fallen to 160,000 tons (about 25 percent of demand). Sri Lanka now imports between 70 and 80 percent of its milk requirements in the form of milk powder



(figure 2.5; FAO Trade Statistics). The current policy seeks to upgrade the native dairy herd and increase the efficiency of domestic feed production. There is no beef industry as such. Attempts are being made to increase the production of goats for meat and milk and to serve as a source of income for smallholders. Considerable attention has been given to the development of farming systems that include livestock, but such attempts have made little headway.

This overview of production performance reveals a worrying trait in Sri Lankan agriculture: local production, with the exception of rice and poultry, is losing market share to imported products. It appears that the agricultural sector has largely lost its competitive edge.

2.4 Sri Lanka's agricultural economy and the poor

At independence in 1948, Sri Lanka was a classic example of a dual agricultural economy, with a largely subsistence-oriented food sector and a dynamic export-oriented plantation sector. In the early 1970s, agriculture's share of GDP was about 30 percent, down from more than 50 percent in the 1950s. Its share of exports and employment was over 90 percent and 50 percent, respectively. Agriculture currently accounts for about 18 percent of GDP and 35 percent of employment. This structural transformation has not been accompanied by any sharp increases in agricultural productivity per hectare, which has remained relatively stable

except for rice and possibly tea. Stagnating productivity at least partly explains why poverty—which affects 25–30 percent of the population and is largely a rural phenomenon—is proving so recalcitrant in Sri Lanka.

Rural poverty in Sri Lanka has been identified with the landless and with operators of mini-holdings (farms of less than two acres). A typical holding once consisted of three components: a paddy plot, a highland allotment, and a homestead. As the population has grown, a two-component system has emerged, consisting of a paddy plot and a homestead. In conjunction with the lack of productivity gains, the very small average farm size helps to explain why agriculture provides only about 23 percent of rural household income. Such small holdings cannot generate sufficient income to support a farm family at an acceptable standard of living. This is not to argue that all such holdings cannot become viable. Systems of diversified agriculture, encompassing not only rice but also vegetable, livestock, and fruit production, could provide a farm family with a decent living, yet they are more the exception than the rule. Important constraints to more intensive and diversified farming systems are the lack of working capital or access to credit, and poor access to markets and sources of knowledge.

Not surprisingly, then, agriculture has failed to absorb the unemployed. Between 1990 and 2000, employment outside agriculture grew at an average annual rate of 4.2 percent, whereas agricultural employment grew at 0.3 percent. It is estimated that agricultural employment must grow at about 1.4 percent (four times the current rate) to absorb the growing labor force. For good reason, agriculture in Sri Lanka has been characterized as “stagnant” or “in crisis.”

The incidence of poverty in Sri Lanka is relatively high compared to countries with similar income levels and has remained more or less stable over the last 10–15 years. Within Sri Lanka the local incidence of poverty varies widely, ranging from about 8 percent of the population in the Colombo District to over 30 percent in the Moneragala and Hambantota Districts in the Southeast. Whereas some districts (like Western Province) are moving out of poverty, others (like Southeast) are increasingly immersed in poverty. Rising poverty in some rural areas may also imperil the ability to manage Sri Lanka’s conflict. Little has been done to identify the determinants of poverty and the factors underlying the movements in poverty, but it is nevertheless clear that agricultural development must be accelerated to reduce rural poverty. In large measure, accelerating agricultural development depends on fostering a vigorous and dynamic agricultural innovation system.

2.5 Agricultural research and extension in the government system

Sri Lanka’s agricultural research and extension system is highly fragmented, reflecting a high level of fragmentation in government in general. Among the 53 Cabinet ministries and 33 non-Cabinet ministries, 9 deal with agriculture and rural development; of these, nearly all are involved in some type of agricultural research or extension (box 2.2). In addition, eight Provincial Councils run provincial extension services, the Ministry of Education deals with the university sector (including various faculties of agriculture), and the Ministry of Science and Technology establishes science and technology (S&T) policies and provides funds, some of which affect agriculture. This fragmented approach makes it very difficult to prioritize and pursue objectives effectively throughout the research and extension system.

The Council for Agricultural Research Policy (CARP) was established to coordinate this fragmented system, yet CARP is principally engaged with research and lacks a mandate for extension. In addition CARP, being positioned in one of the non-Cabinet ministries, lacks authority to lead the system effectively.

Box 2.2: Overview of public agencies involved in agricultural innovation in Sri Lanka

❖ Ministry of Agriculture, Irrigation and Mahaweli Development^a

- Mahaweli Authority of Sri Lanka
 - Extension Service

❖ Ministry of Agricultural Development

- Department of Agriculture
 - Field Crops Research and Development Institute
 - Horticultural Crop Research and Development Institute
 - Rice Research and Development Institute
 - Socio-Economics and Planning Centre
 - Extension and Training Centre
 - Seed Certification and Plant Protection Centre
 - Seed and Planting Material Development Centre
- Department of Export Agriculture
 - Research Division
 - Development Division
- Sri Lanka Council for Agricultural Research Policy
- Hector Kobbekaduwa Agrarian Research and Training Institute
- Institute of Post-Harvest Technology
- Pulses and Grain Research and Production Authority
- National Agricultural Diversification and Settlement Authority (Hadabima)

❖ Ministry of Estate Infrastructure and Livestock Development

- Department of Animal Production and Health
 - Division of Veterinary Research/Veterinary Research Institute
 - Division of Animal Breeding
 - Division of Livestock Planning and Economics
 - Division of Human Resource Development (training/extension).
- National Livestock Development Board

❖ Ministry of Fisheries and Aquatic Resources Development

- National Aquatic Resources Research and Development Agency

❖ Ministry of Plantation Industries^a

- Tea Research Institute
- Sri Lanka Sugarcane Research Institute
- Rubber Research Institute

❖ Ministry of Coconut Development

- Coconut Research Institute of Sri Lanka

❖ Ministry of Agrarian Services and Development of Farmer Communities

- Department of Agrarian Services
- Agricultural and Agrarian Insurance Board
- Sri Lanka National Freedom from Hunger Campaign Board

❖ Provincial Councils (nine, of which seven functional)

- Provincial Departments of Agriculture
 - Provincial Extension Services
- Provincial Departments of Animal Production and Health
 - Provincial Veterinary Services

...continued

Box 2.2: (Continued)

- ❖ Ministry of Science and Technology^a
 - National Science Foundation (funding and policy)
 - National Science and Technology Commission
 - Industrial Technology Institute
 - Natural Products Development Group
 - Post Harvest Technology Group
 - Environmental Technology Group

- ❖ Ministry of Education^a
 - University Grants Commission
 - University of Colombo
 - Faculty of Science
 - Department of Plant Science
 - Institute of Molecular Biology and Biotechnology
 - University of Peradeniya
 - Faculty of Agriculture (est. 1947)
 - Faculty of Veterinary Medicine and Animal Science (est. 1972)
 - Postgraduate Institute of Agriculture
 - Postgraduate Institute of Science
 - Ruhuna University
 - Faculty of Agriculture (est. 1981)
 - Eastern University
 - Faculty of Agriculture (est. 1986)
 - University of Jaffna
 - Faculty of Agriculture (est. 1990)
 - Rajarata University
 - Faculty of Agriculture (est. 1996)
 - Sabaragamuwa University
 - Faculty of Agriculture (est. 1997)
 - Uva Wellassa University
 - Faculty of Export Agriculture and Animal Husbandry (est. 2006)
 - Wayamba University
 - Faculty of Agriculture and Plantation Management (est. 1999)
 - Faculty of Livestock, Food, and Nutrition

Source: Authors

^a Ministries represented at Cabinet level.

2.6 Challenges for Sri Lanka's agricultural research and extension system

This report endorses the analysis presented in *Mahinda Chintana: Vision for a New Sri Lanka* (Department of National Planning 2006), which states that a successful future depends on recognizing and addressing a number of challenges, including emerging labor shortages; consumers' changing demands for safety, variety, and quality; rapid developments in transportation and communication technologies; on-going trade liberalization; and renewed environmental concerns. The increased agricultural productivity and profitability that an effective research and extension system can deliver will have a significant role in moving many of Sri Lanka's poor out of poverty, in strengthening the wider economy and the balance of trade, and in fostering sustainable use of natural resources.

Yet if positive change is to occur in the agricultural sector in the near term, greater support is needed to foster the adoption of available technologies (both locally generated and imported) through a more responsive extension system. Given that Sri Lanka is nearly self-sufficient in rice production, research and extension could turn their attention to import substitution for other products, such as dairy products, and to export markets for high-value crops. To sustain a dynamic agricultural sector over the longer term, however, Sri Lanka must recognize that agriculture is becoming a knowledge-intensive sector and that the nation must invest in mechanisms for generating and applying technologies in a user context.

Although technological innovation alone will not solve Sri Lanka's problems in agriculture, it will be essential for overcoming the problems limiting agricultural productivity and profitability. A more vibrant agricultural research and extension system can also foster an investment climate in which funds from the private sector as well as government flow more readily into agriculture. Finally, a more vibrant system will help articulate a more consistent long-term vision for agricultural development in general, another essential element for sustainable growth.

Global competition in agriculture is an inevitable challenge, but Sri Lanka has great opportunities in this arena. At a time when agricultural markets are increasingly driven by consumer preferences, Sri Lanka, with its well-educated labor force, diverse climate, and easy access to the expanding Asian economies, can become a preferred supplier of many agricultural products. This expectation is not unreasonable and has in fact already been realized for some agricultural products (gherkins are one example).

The challenges confronting agricultural research and extension in Sri Lanka are not unique. Experience from other developing countries shows that often research and extension systems are supply-driven rather than based on the needs of the market and the consumer. Research and extension then focus on agriculture as a production-based rather than a market-oriented activity. To improve the technological base of agriculture and to strengthen its market orientation, publicly funded efforts need to be dovetailed with private initiatives and investments, on a small and large scale. The potential of universities to contribute to agricultural innovation needs to be recognized. And in addition in Sri Lanka, the less common challenge of the present civil conflict needs to be recognized. A stronger agricultural research and extension system may help to overcome the conflict by reducing the economic marginalization of the rural poor.

3. Review of the Agricultural Research Component

3.1 Overview

The public system

Agricultural research in Sri Lanka started in the early twentieth century. Between 1910 and 1928, three plantation crop research institutes were established under British colonial rule, namely the Rubber Research Institute in 1910, the Tea Research Institute in 1925, and the Coconut Research Institute in 1928. A fourth plantation crop research institute, the Sugarcane Research Institute, was established only in 1984, when it took over from the R&D division of the Sri Lanka Sugar Corporation (Goonasekere 2006). While rubber, tea, and coconut remain important export crops, Sri Lanka imports most of its sugar.

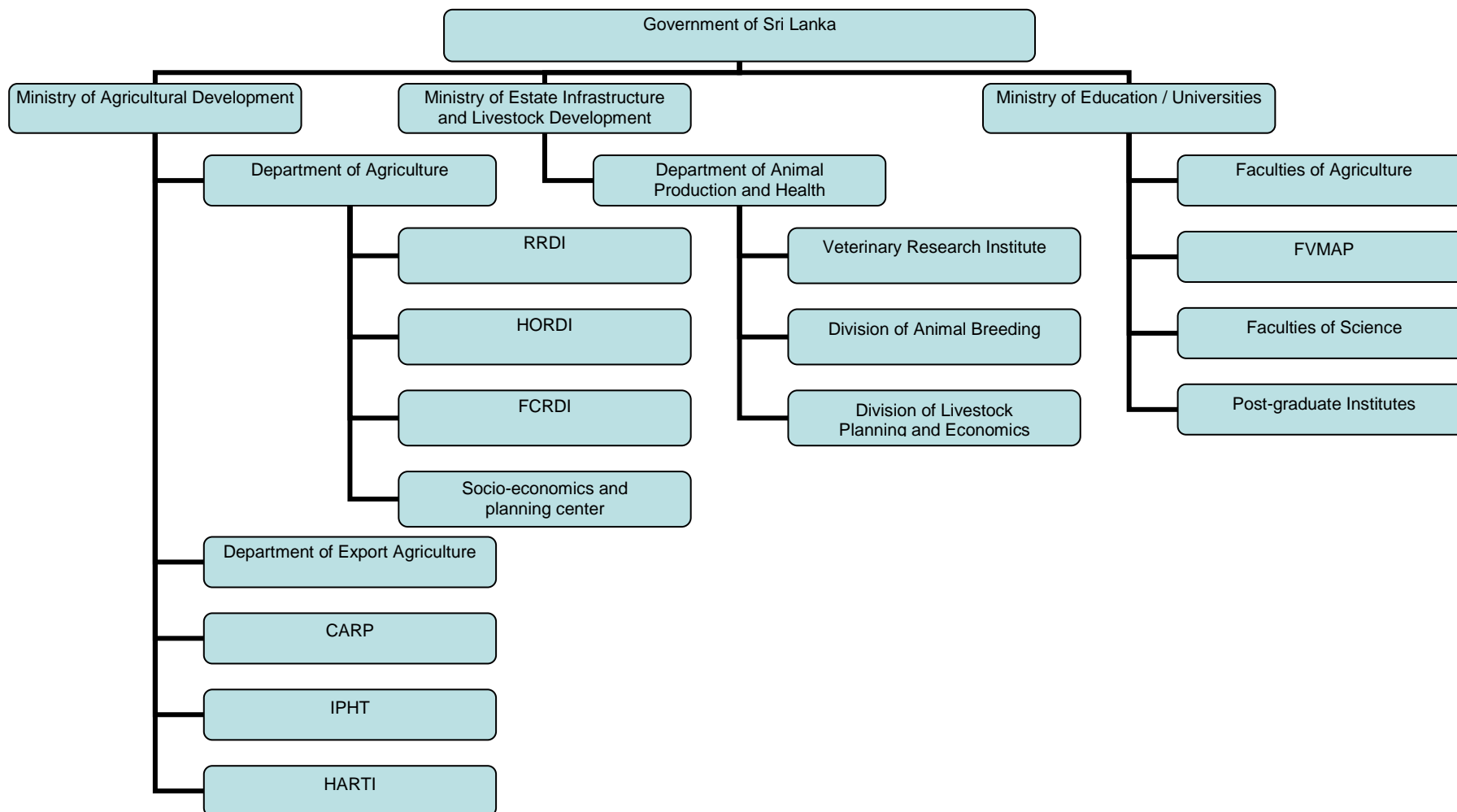
The DOA has been the main agency involved in nonplantation crop research and extension. Since its establishment in 1912, it has known frequent organizational changes but presently conducts crop research through three principal institutes: (1) the Rice Research and Development Institute (RRDI); (2) the Horticultural Crop Research and Development Institute (HORDI), and (3) the Field Crops Research and Development Institute (FCRDI). A Socio-Economics and Planning Division directly pertaining to DOA is responsible for socio-economic research related to nonplantation crops. In addition, DOA has an Extension and Training Division (about which more in Chapter 4). In 1972, all research and extension on minor export crops was handed over to the newly established Department of Export Agriculture (DEA) (Kudagamage 2006).

In addition to DOA and DEA, the MOA also oversees several other agencies dedicated to agricultural research: (1) the CARP, established in 1987 (Gunasena 2006); (2) the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI), established in 1972; (3) the Institute of Post-Harvest Technology (IPHT), established in 1999; and (4) the Pulses and Grain Research and Production Authority established around the same time. All these agencies have their own boards and operate relatively autonomously from the DOA.

Research in the livestock sector commenced when the Veterinary Laboratory was founded in Colombo in 1911. This laboratory was upgraded to Veterinary Research Laboratory in 1951 and moved to Peradeniya in 1959. In 1967, it became the Veterinary Research Institute (VRI), which operates under the Department of Animal Production and Health (DAPH). Other divisions of DAPH that conduct research are: (1) Animal Breeding and (2) Livestock Planning and Economics. There is little or no research on livestock production and management (Amarasekera 2006).

The two ministries dealing with agricultural and livestock development represent the bulk of Sri Lanka's agricultural research capacity in the nonplantation sector. In addition, eight faculties of agriculture, a faculty of veterinary medicine, and a postgraduate institute of agriculture conduct agricultural research. There are also some scattered agricultural research activities in science faculties. In terms of full-time equivalent (FTE) researchers, however, the contribution by the university sector to agricultural research is relatively modest. Figure 3.1 provides a partial overview (for three ministries) of where the various agricultural agencies sit within the present government structure and provides an indication of the extent to which agricultural research and extension are fragmented within the public sector.

Figure 3.1 Organizational chart of the agricultural research system, excluding plantation crops, forestry and fisheries
Source: Authors



New players and new initiatives

Some agricultural research (principally adaptive research) is done by companies such as Chemical Industries Colombo Ltd (CIC) and Hayleys Group, and to a lesser extent by private seed, fertilizer, agro-chemical, and equipment companies. Multinationals like Ceylon Tobacco Company engage in R&D to promote alternate, renewable energy sources. CIC is the most influential player in the private sector and has taken several steps to develop in-house R&D activities and programs. Utilizing farms at Hingurakgoda and Pelwehera, CIC has invested in R&D infrastructure, including laboratories for seed testing, soil and plant analysis, and tissue culture; plant nurseries; experimental fields; irrigation and water management systems; polyethylene tunnels; greenhouses; and modern processing equipment. CIC maintains a collaborative research program with public R&D institutes (Fernando 2006).

An interesting initiative concerns the cashew industry (Jayasekera 2006). In 1997 the Sri Lankan Cashew Corporation approached Wayamba University of Sri Lanka and sought assistance in developing a long-term research program to improve cashew cultivation. A project was developed to look into many aspects of cashew production, including crop improvement, agronomy, pest management, fertilizer application, post-harvest practices, processing, marketing, and socio-economic studies. Within a couple of years, two research centers were established, research and support staff was recruited, research plots were planted, mother plants were collected, a 200-acre mother plant nursery was established, and many training programs for farmers as well as extension workers were carried out. In 2005 three varieties of cashew were released for nationwide cultivation. New fertilizer recommendations were also delivered with the capability of increasing yields fivefold. A new protocol for tissue-cultured cashew was developed.

A third example of new and old partners coming together concerns the evaluation of imported vegetable varieties (Fernando 2006). Several countries in Asia have intensive vegetable research programs involving the public sector and private companies and market new varieties to other countries in the region. Companies from Thailand, South Korea, Taiwan, and India have established contacts with local seed companies. Many small, local seed companies lack the budget or resources to assess the suitability of newly introduced varieties. The DOA research station at Sita Eliya provides a valuable service to these companies by evaluating varieties. The research station obtains first-hand insight into the suitability of new varieties and is in a better position to advise growers. Costs of these trials are shared in innovative ways, through the provision of inputs, payment for associated labor, the provision of material for other research-related projects, or sponsoring training programs.

Human and financial resources of the public system

The most comprehensive overview on the availability and development of human and financial resources for agricultural research in Sri Lanka was recently published by the Agricultural Science and Technology Indicators (ASTI) project in the form of a country brief on Sri Lanka (Stads, Gunasena, and Herath 2005). The ASTI data are somewhat broader than the focus of the present review; they include data on research for plantation crops as well as forestry and fisheries (under other government agencies). Excluding these data, total investment in nonplantation crop and livestock research added up to about 600 million Sri Lankan rupees (SLR) and 400 FTE researchers in 2003 (table 3.1).

Table 3.2 provides an overview of the development of agricultural research staff (those holding a BSc or higher) over the past 20 years. What stands out is that the Sri Lankan agricultural research system has been growing at a very slow rate—more slowly than the population and more slowly than the agricultural sector.

The composition of the research staff by highest educational degree in selected research institutions is provided in table 3.3. Less than 25 percent of researchers hold PhD degrees, and roughly a third of them have a BSc degree only.

Table 3.1: Composition of agricultural R&D expenditures and researchers, 2003

	Total spending (SLR millions) ^a	Total researchers (FTEs)	Share in spending (%)	Share in research staff (%)
Public agencies				
Ministries of Agriculture and Livestock	455.8	338.0	38.1	58.4
Ministry of Plantation Industries	484.4	124.0	40.4	21.4
Other government	108.5	46.0	9.1	7.9
Higher education agencies	142.9	69.2	11.9	11.9
<i>Subtotal</i>	<i>1,191.6</i>	<i>577.2</i>	<i>99.5</i>	<i>99.7</i>
Business enterprises				
Business enterprises	6.2	2.0	0.5	0.3
<i>Total</i>	<i>1,197.8</i>	<i>579.2</i>	<i>100.0</i>	<i>100.0</i>

Source: Stads, Gunasena, and Herath 2005
^a Deflated to 2000 prices.

Table 3.2: Development of research staff over time

FTE researchers

	1983	1993	2003
Ministries of Agriculture and Livestock	321.4	315.9	338.0
Ministry of Plantation Industries	110.0	132.0	124.0
Other government	37.0	43.0	46.0
Higher education agencies	46.3	48.5	69.2
<i>Total research staff</i>	<i>514.7</i>	<i>539.3</i>	<i>577.2</i>

Source: Stads, Gunasena, and Herath 2005

Table 3.3: Research personnel in selected research institutions, 2003–2005

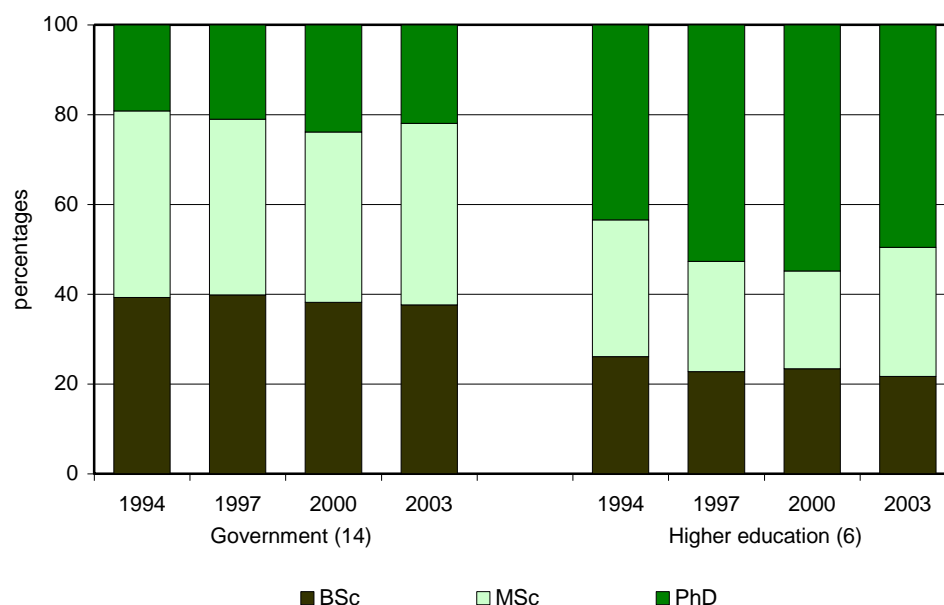
	BSc	MSc	MPhil	PhD	Total
Department of Agriculture					
FCRDI headquarters	11	5	2	3	21
FRCDI regional stations	17	10	3	2	32
HORDI headquarters	9	16	6	15	46
HORDI regional stations	9	6	10	5	30
RRDI headquarters	7	9	2	5	23
RRDI regional stations	5	4	3	4	16
Seed certification and plant protection units	1	4	0	2	7
Regional research stations	9	8	11	17	45
DEA	4	6	7	7	24
DAPH	14	15	0	4	33
<i>Total</i>	<i>86</i>	<i>83</i>	<i>44</i>	<i>64</i>	<i>277</i>

Source: Stads, Gunasena, and Herath 2005

Figure 3.2 shows the educational profile of research staff in government and the universities over time. The best-qualified researchers work in the universities, whereas a substantial number of researchers in government lack a postgraduate degree. What is also notable is that the education profile of the research staff at government establishments has not improved in any significant way over the past 10 years.

Nor has much progress been made in increasing the financial resources available to the research system (table 3.4). After a notable improvement in the late 1990s, spending contracted.

Figure 3.2: Educational profile of research staff over time



Source: Stads, Gunasena, and Herath 2005

Table 3.4: Research spending over time

SLR millions, 2000 prices

	1983	1993	2003
Ministries of Agriculture and Livestock	399.2	385.6	455.7
Ministry of Plantation Industries	397.9	381.9	484.3
Other government	51.0	99.1	108.5
Higher education agencies	83.8	85.6	142.8
<i>Total research spending</i>	<i>931.9</i>	<i>952.2</i>	<i>1,191.3</i>

Source: Stads, Gunasena, and Herath 2005

Perhaps the most revealing fact is that agricultural research expenditures as a percentage of AGDP dropped from 0.66 percent in 1981 to 0.36 percent in 2003, whereas relative investment levels rose in most other countries during the same period. The current figure is below the average for Asia (0.63 percent) as well as for developing countries in general (0.62 percent). This lack of investment implies that Sri Lanka has even farther to go than many other countries in moving towards an agricultural knowledge economy.

3.2 Structural issues in the research system

As mentioned, organizations within the research system for nonplantation crops fall under the purview of three ministries—the MOA, Ministry of Estate Infrastructure and Livestock Development (MEILD), and Ministry of Education—and CARP is meant to oversee the system. The various research departments and institutions within the system have well-defined mandates to cater for the technology needs of various agro-ecologies, consumers, and markets. Yet the system's efficiency and effectiveness suffer on account of three major structural issues:

1. Institutes are located under different ministries and departments.
2. There is no effective apex body with the authority and mandate to coordinate policy development, research planning, priority setting, monitoring and evaluation, and resource mobilization and allocation.
3. Formal linkages between research institutes and between research and extension are lacking (Sivayoganathan 2006).

Nor are there clear provisions or guidelines for integrating the rapidly growing private sector into the research and extension system and taking advantage of its growing strength (Fernando 2006).

CARP remains a relatively ineffective appendage of the MOA. Its operations are mainly limited to providing competitive grants from a fund of about SLR 100 million per annum. CARP is not involved in planning research or in implementing and monitoring the research programs of the national research system. It does maintain a database on activities within the system and has initiated a series of external reviews, however.

The fragmentation across ministries may be hard to overcome, but the lack of an effective and powerful apex body can certainly be addressed. A strong, forward-looking apex body must be put into place to plan, coordinate, and oversee research as part of a national agricultural innovation strategy. Ways of achieving this goal are discussed in chapter 5.

3.3 Funding sources and adequacy of support

The principal source of funding for agricultural research is the Government of Sri Lanka. More than 80 percent of the budget is provided directly by the state through the Treasury and indirectly through small, project-specific competitive grants from CARP and the National Science Foundation (NSF). The National Research Council (NRC) provides funds for strengthening cutting-edge science. Support from external sources was once substantial but is now very limited, inconsistent, and time-bound. When externally funded projects end, often there is no systematic follow-up, and project goals are not achieved (Senanayake 2006).

Treasury funds are inadequate to achieve the research agenda, partly because of the rising cost of research equipment and supplies but even more because of salaries and wages, which are said to consume over 80 percent of the budget. Very little funding is left over to conduct research and maintain facilities. Declining budgets are a major concern: annual budgets for many major institutes, including the DOA, DEA, and IPHT, are steadily decreasing. Overall funding for nonplantation crop research is stagnant at about SLR 400 million. Several actions are recommended to address these constraints:

- Increase the budget substantially, but impose conditions of accountability, so that funding shortages are not blamed for failing to achieve targets. Over the next 10 years, the agricultural research investment as a percentage of AGDP should increase from its present level of about 0.4 percent to at least 0.8 percent. Many other developed and developing countries are pursuing agricultural innovation far more rigorously at present than Sri Lanka. To remain competitive in the world market, Sri Lanka's agricultural sector needs to become more innovative.
- Encourage the individual institutes to generate their own funding through fees for services and through sales of the registered seeds or planting material they develop. A revolving fund approach may be put into place, as practiced among the institutes of the Indian Council for Agricultural Research (ICAR). The government provides start-up

money in the form of an interest-free loan that will be returned over five years. The start-up money is used to produce registered seed or any other products of value developed by the individual institute. The net profit accumulated over the years is used to improve research facilities in the institute. Staff involved in such ventures are entitled to receive 20 percent of the profit as an incentive. This scheme has proven to be a great success in India's agricultural research system.

- Identify and undertake research with the private sector on problems of mutual interest. Contracts may be drawn up to specify mechanisms for sharing costs and resources. This strategy brings public and private organizations closer and also helps to improve the research budget.
- Reduce the research system's land endowment. Land that becomes available in this way can be sold, leased to the private sector, or used in joint ventures to obtain a steady stream of income.
- The government may consider the introduction of a cess on exports or imports, as in the case of plantation crops.

A combination of cess funding, revenue generated by institutes for products and services, and greater reliance on private funding might substantially increase the funds available for public research. As promising as such a strategy appears, however, experience in other countries has shown that alternative funding sources should be pursued in a measured way to avoid shifting the mission away from public research goals and towards activities that are easily funded (Janssen 1998). It is hard to escape the conclusion that a stronger research system can be achieved only by a stronger reliance on public funds.

Stronger reliance on public funding can be realized through greater allocation of public funds to the agricultural sector (and to agricultural research and extension) or through a reallocation of funding within the sector. Although an overall fiscal analysis would extend far beyond the objectives of this study, some observations can be made. As in other South Asian countries, in Sri Lanka a large share of public funding is used to subsidize credit and fertilizer. These subsidies often create distortions in farmers' decision making. Projections by the Department of National Planning (2006) indicate that public spending on credit and fertilizer subsidies in the nonplantation sector from 2007 to 2016 will be roughly three times the amount spent on research and extension. This information suggests that it might be useful to evaluate the best way of using public funds to support sustainable agricultural development.

3.4 Human and physical resource constraints

Constraints

Adequate human resources (for example, sufficient staff with sufficient education), research infrastructure (laboratories, information and communications facilities, and research fields) and research support services (transport and library services) are essential for productive research. Current staff numbers are less than half of the actual number required to conduct the institutes' mandated research programs. Whereas the institutes at Kandy (Peradeniya) and Colombo have reasonable staff strength, institutes such as FCRDI at Maha Illupallama face large staff deficiencies. The FCRDI was one of the most productive and sought-after institutes in the 1970s and 1980s but is now in a deplorable state, with a highly inadequate number of generally poorly trained staff (most scientific staff at FCDRI have only a BSc degree). The poor professional environment and harsh living conditions are the major reasons that senior

and experienced scientists leave. Strengthening research and research facilities in key research institutes, especially in the Dry Zone, which accounts for two-thirds of the arable land area, should receive priority. Other recommendations include:

- The Government should more actively fill vacant professional positions within the research system and upgrade the minimum educational requirement for research positions to an MSc. In the process, care should be taken that there is an appropriate gender balance.
- Researchers' educational qualifications should be improved (BSc to MSc, and MSc to PhD) by in-service training programs in critical disciplines and through short-term training to increase exposure to new research and technology.
- Laboratory facilities should replace obsolete equipment and add new equipment.
- The number of research substations should be consolidated by merging or closing stations of secondary importance, especially in remote areas. Research staff from these stations may be assigned to other locations.
- The Agricultural Research Information System (ARIS) should be strengthened to cover all research institutes.

Human resources management

Unattractive compensation packages and poor career prospects in the public sector are major factors inducing otherwise competent and experienced scientists to leave the system. Salaries in the private sector are considerably better, even after taxes (table 3.5). In particular, salaries at the entry level are considerably lower in the public sector than in the private sector. At the top end the differences are more modest but still substantial.

Table 3.5: Salaries for agricultural R&D staff in the public and private sectors

Institute	Salary range (SLR/mo)^a
Public sector (research officer)	10,000–56,000
University (senior lecturer and above)	25,000–60,000
Private sector	40,000–120,000

Source: Fernando 2006

^a Salaries in the public sector are tax-free, while private sector salaries are taxed up to 35 percent.

Aside from the salary differences, the career prospects in the public sector are much more limited. A scientist with a postgraduate qualification begins his or her career as a Research Officer or Assistant Research Officer and retains this title for a long period, at times until retirement. There are no incentives to convince scientists to come to or remain in remote areas. Measures for overcoming these issues include:

- Review the salary structure to ensure parity with university scientists.
- After every 10 years of successful career progress, change the job titles to recognize the service/service period. For instance, job titles can advance from Scientist through Senior Scientist to Principal Scientist.
- Provide a special allowance/personal pay (at least 15 percent of the basic salary) and rent-free accommodation for scientists serving in remote areas.
- Provide bus service for children of staff to attend high school or college, if these educational facilities are far from the research centre.

- Develop a system in which a scientist can transfer to a place of his or her choosing after serving 10 years in a remote location.
- Recognize outstanding performance by way of: (1) out-of-turn promotion through a “fast-track” advancement system; (2) a system of awards or prizes for outstanding performance; and (3) opportunities for pursuing higher studies/special short-term training abroad.

3.5 Mechanisms for defining the research agenda

The success of any research program is strongly linked with the adoption of formal methodologies to: (1) identify and prioritize problems; (2) formulate and implement research projects; and (3) monitor and evaluate research project performance. In Sri Lanka, no clear system is in place to identify and prioritize problems, especially following devolution of the extension component, which provided feedback to researchers through regular research–extension contact. Current interaction through the Provincial Technical Working Groups (PTWGs) is not formal or mandatory, so feedback from the field and bottom-up identification of priority issues is weak. It is important to find ways of strengthening this process. At the same time, national-level analyses and scientific exchanges can continue to be used to identify some top-down priorities, such as issues related to food security or export market potential. Recommendations for strengthening research priority setting include:

- Develop a sustainable, consultative process that actively involves all stakeholders (such as research institutes, line departments, extension personnel, farmers, industry, and the private sector).
- Institutionalize regular contact between research and extension staff.
- Assess the likely socio-economic impact of successful research.
- Consider technical feasibility, commercial viability, and resource availability.
- Emphasize demand-driven research.

There is also scope to improve the process for formulating and implementing projects. Depending on the nature of the problem and objectives of the research, projects may be structured in different modes. For example, “mission-mode” programs may be established to make substantial progress in a subsector or specific region. At the national level, it may be decided that production of a certain crop or product should increase greatly, for example to reduce imports or take advantage of substantial export opportunities. Based on a detailed analysis, action plans can be determined to address the related constraints and opportunities. Building market information systems, developing and implementing quality standards, testing and adapting production and postharvest technologies, disseminating new technologies, reviewing policy constraints, and improving input supply systems are among the key activities involved in a mission-mode program. Such a program ideally is led by a stakeholder committee that represents the main actors in the subsector and coordinates the activities of the researchers and nonresearchers involved. A mission-mode program that is time-bound may be well suited to achieving specific goals in selected parts of the agricultural economy. For example, the mission-mode approach helped India rapidly become self-sufficient in edible oil.

A mission-mode approach will involve several institutes and scientists competent in different areas of research to make rapid progress towards the goal. It will also involve private agencies (for input supply and postharvest and marketing activities, for example).

Special partnerships may be developed to address other research issues. The development of hybrid rice in China and high-yielding basmati rice in India were made possible by networking among multidisciplinary groups in different institutes. Sri Lanka has been active in ecoregional programs organized by the International Rice Research Institute (IRRI) to remedy soil problems and unfavorable water regimes. Participation in many more international networks could be valuable.

Suggestions for strengthening the research agenda include:

- Develop and implement mission-mode programs for milk, maize, and other selected products and for some regions of the country that urgently require additional attention. For example, domestic supplies of milk and maize meet less than 20 percent of national requirements. Supplies of both commodities can increase to meet 40–50 percent of requirements in five years, if on-farm productivity can be improved and efficient forward and backward supply chains established. Possible objectives and activities that can be included in mission mode programs on dairy, maize and vegetables, are elaborated in another World Bank study on the “Growth Opportunities in Lagging Regions (World Bank, 2007c).
- These mission-mode programs will involve public and private organizations in their areas of mutual interest and comparative advantage. Partnerships can be by way of joint research on a problem of interest or by means of contracting. The production and supply of high-quality rice seed by CIC on land leased from the government is a good example of a productive partnership.
- Join—to the extent possible—regionally organized networks and ecoregional programs launched by the international institutes.

No standard mechanism is in place for project review and monitoring, beyond in-house reviews done at the institute level. It is important to have clearly defined, time-bound targets and precise performance indicators to monitor the progress of projects objectively and suggest on-course corrections. The suggestion is to:

- Organize periodic in-house reviews using appropriate performance indicators. Research Advisory Committees, comprising eminent scientists from other research institutes, universities, and the private sector, as well as retired scientists, could strengthen the review process. The recommendation is that such committees be constituted for every research institute.
- Commission external reviews for large, externally and/or nationally funded projects by involving eminent scientists and economists from countries in the region.

3.6 Introduction of new science areas and research topics

The paradigm shift from productivity-oriented growth to income and employment-oriented growth makes it essential to move from working within a traditional research system to working through “innovation platforms” that give importance to new areas of science. Some areas of research relevant to Sri Lanka are:

- High-tech floriculture/vegetable production.
- Milk production through genetic improvement of cattle and buffaloes and mass production of productive cross-bred animals.

- Self-sufficiency in animal feed through extensive cultivation of hybrid maize and soybeans.
- Development of animal-based or crop-based integrated farming systems for making livelihoods more secure in rainfed areas.
- Mechanization of agriculture through the development and introduction of affordable farm implements or machinery to reduce production costs and counteract declining labor availability in rural areas.
- Postharvest processing and value addition for perishable fruits and vegetables.
- Water harvesting and water management, emphasizing improved water-use efficiency through microirrigation and the development and cultivation of drought-tolerant varieties.
- Improved productivity and value addition of export crops such as cinnamon, cashews, and pepper, for which Sri Lanka has a market advantage.

Success in many of these areas will depend critically on the development of new modalities of operation. As indicated by Mendis (2006), postharvest processing, high-tech floriculture or vegetable production, and value addition of export crops are high-opportunity areas for partnerships between the public and private sector. Such partnerships may take different forms. For example, the public sector may develop and improve processing technologies and make them available for expanded use by the private sector. Depending on the contractual arrangements made at the start of such collaborations, the research results may be exclusively owned or licensed by the private sector partner, or they may be in the public domain. For high-tech floriculture or vegetable production, the private sector may use its outgrower network to identify technological issues that need attention. The public sector may then address these issues and provide results to private companies and their outgrowers. Other examples include the breeding of new plant varieties by the public sector and dissemination by the private sector.

Mechanization and water management often rely on new equipment, and here again the private sector is the player that will make research results available to the farm community through new or improved machinery and tools. Advances in milk production technologies and animal feed will be effective only if the dairy or meat value chain can absorb the increased volumes of production, which would again emphasize the need for intensive collaboration. In summary, whereas the public sector was able to pull off a “green revolution” very much on its own in the last century, public–private collaboration is critical for success in promising areas of agricultural research today. The proposed mission-mode programs make it possible to develop such partnerships by building on successful experiences within and outside Sri Lanka and by formalizing collaboration between the public and private sectors (for example, through subsector committees that develop subsector R&D plans (Mendis 2006; Fernando 2006).

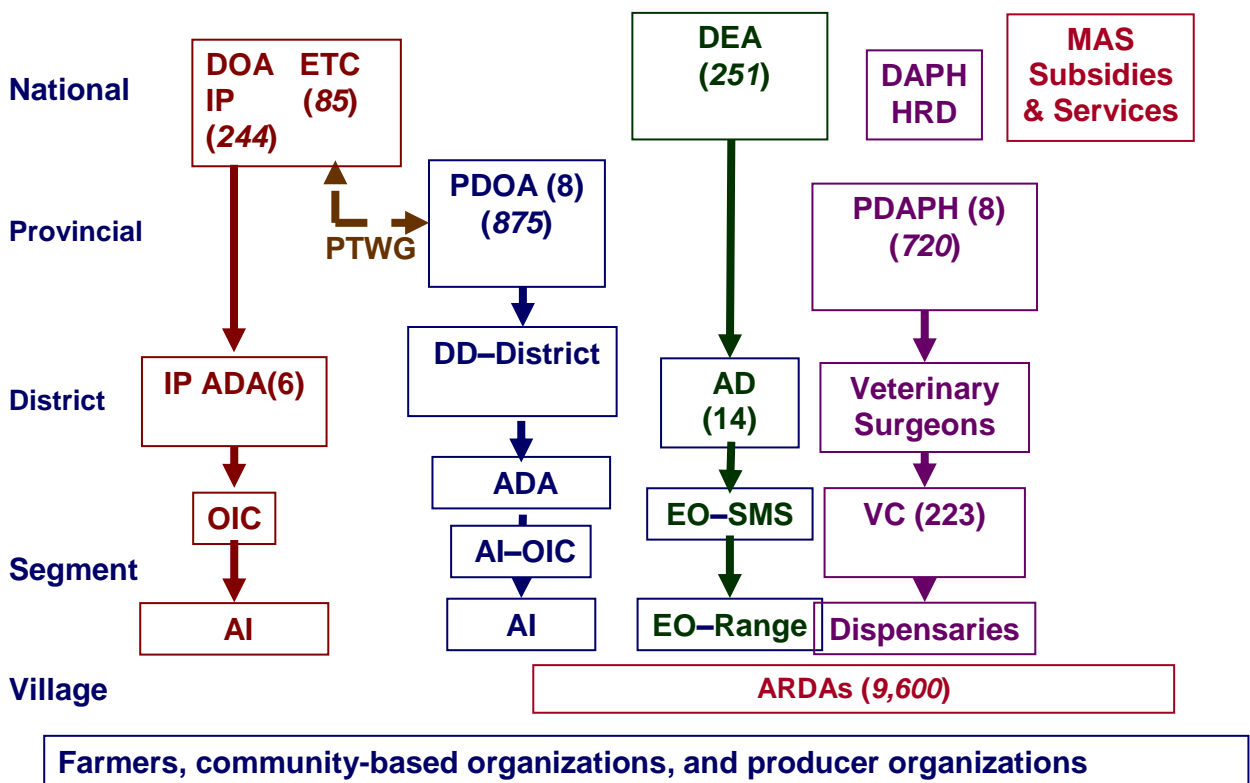
4. Review of the Extension System

4.1 Overview

The agricultural extension system in Sri Lanka originated early in the last century, along with efforts to improve plantation crops and food crops, described in the previous chapter. Since independence, Sri Lanka has undertaken numerous efforts to broaden and strengthen its extension system. Results have been mixed. In 1963, extension was formally established as a separate unit within the DOA. In 1980, with World Bank assistance, the Training and Visit (T&V) Extension System was adopted, resulting in a major but unsustainable expansion of human resources within the extension system. The government transferred 2,400 village-level extension workers (Krushikarma Viyapthi Sevakas, or KVSS) to the Ministry of Public Administration in 1988. When the government passed the 13th Amendment to the Constitution in 1989, it devolved primary responsibility for crop and livestock extension to the provinces. A second World Bank-financed extension project (SAEP), launched in 1993, was designed to integrate extension activities across key departments (food crops, livestock, export crops, and coconuts) and make the extension system more participatory. This project had limited success for several reasons but especially because of the lack of cooperation between departments. Sri Lanka thus retains a very complex extension system, in which most elements work independently and most units pursue a traditional, top-down, and supply-driven approach to programs and activities (Abeywardena 2006). Figure 4.1 provides an overview of the different extension agencies active in Sri Lanka through the different ministries, illustrating the high level of fragmentation.

Figure 4.1: Key components of the agricultural extension system in Sri Lanka
(regular numbers refer to units; italicized numbers to people)

Level

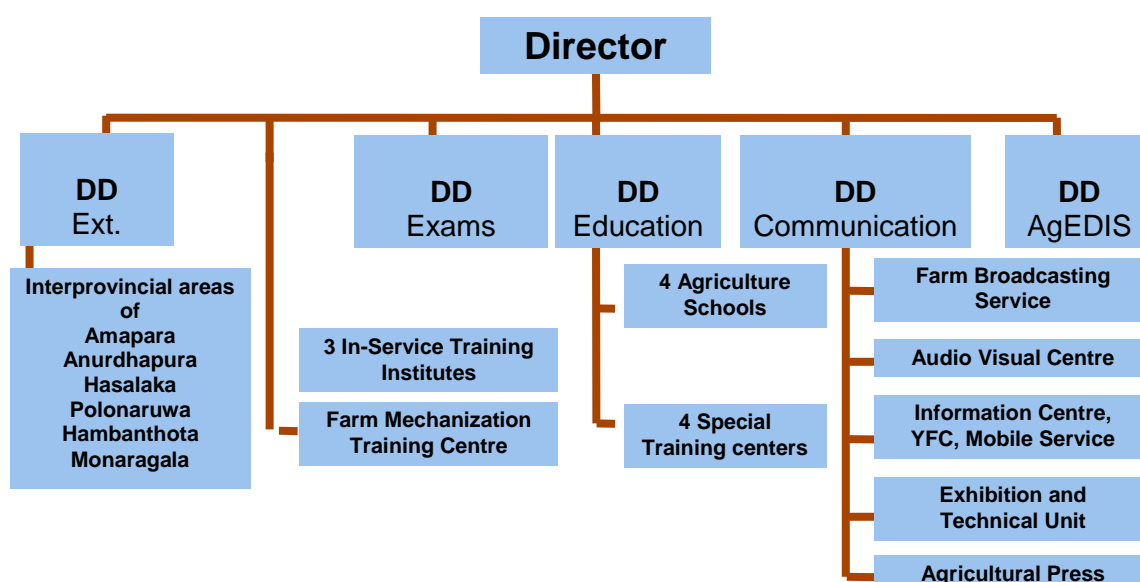


Source: Authors

Department of Agriculture

As part of the devolution of extension in 1989, the DOA was given control over extension in the interprovincial (IP) areas (usually extending across two or more provinces) covered by major irrigation schemes. About 244 extension directors, supervisors, and field extension staff assigned to these IP areas, which are primarily intensive rice-growing areas. The DOA also has an Extension and Training Centre (ETC) where 85 professional and technical staff operate four in-service training institutes, four agricultural schools, and four special training centers, plus a modern communications unit that engages in farm broadcasting, develops extension and training materials, and offers a unique toll-free call-in extension service. In addition, the ETC is establishing a Cyber Extension system for the online dissemination of technical information (Samarasinghe 2006). Figure 4.2 illustrates the structure of the ETC within the DOA.

Figure 4.2: Organizational structure of the Extension and Training Centre of the DOA



Source: Santha Siri Emitiyagoda, “Agriculture Extension in Sri Lanka,” presentation to the Agricultural Technology Review Panel, 2006.

Provincial Departments of Agriculture

With the exception of the IP areas, the eight Provincial Departments of Agriculture (PDOAs) have primary responsibility for implementing extension activities for the major food crops in Sri Lanka. Approximately 875 extension staff work in the eight provinces. The provinces commonly have three districts, each headed by a Deputy Director, and four divisions or segments per district, headed by an Assistant Director of Agriculture (ADA). Within each division or segment, Agricultural Instructors (AIs) have primary responsibility for extension at the field or village level. The current extension-to-farmer ratio is about 1 AI to 3,000 farm households, but reportedly the ratio can run as high as 1:7,000 in some areas, owing to a government hiring freeze.

Although the KVSS cadre was transferred to another ministry in 1988, during the 1990s a new Ministry of Agrarian Services and Development of Farming Communities (MAS) was established to provide subsidies and other development services to farmers. In the process, approximately 9,600 new field workers were employed on a permanent basis, most with a secondary education (although about 10 percent had agricultural diplomas). These new recruits were called Agricultural Research and Development Assistants (ARDAs) and were expected to dedicate three days each week to extension activities. Because they generally lack skills in agriculture and extension and are assigned to a separate ministry, most ARDAs have contributed very little to extension programs, although ARDAs with agricultural diplomas and/or an interest in agricultural development have had a positive impact in some villages.

Department of Export Agriculture

The DEA has a Development Division that provides extension services in 14 districts for several high-value export crops: (1) spices, including cinnamon, pepper, cardamom, nutmeg, cloves, and vanilla; (2) essential oils, including citronella, lemongrass, and oils from other spices; (3) beverages, including cocoa and coffee; and (4) other high-value crops, including betel, areca, ginger, turmeric, and kithul (fish leaf palm). The Development Division has about 250 staff members who are primarily responsible for extension activities, including the provision of planting materials to farmers in target areas (Wickramasinghe 2006).

Department of Agricultural Production and Health

The DAPH has several divisions, including Animal Health, Animal Breeding, Veterinary Research, Livestock Planning and Economics, and Human Resource Development (HRD). The HRD division is very small and primarily responsible for training central-level staff officers assigned to work in the Provincial Departments of Agricultural Production and Health (PDAPH). There appears to be minimal capacity to develop extension materials or to carry out training programs that would improve livestock management within the country.

Provincial Department of Agricultural Production and Health

The PDAPH parallels the PDOA within each province; the primary focus of these departments is to provide animal health and artificial insemination services. The PDAPH has about 720 staff members. The majority are veterinarians who provide animal health services and technicians who perform artificial insemination and vaccination services. These departments have very limited capacity to disseminate information to farmers about improving livestock management practices. This lack of capacity is a major reason why the livestock industry in Sri Lanka has not developed more rapidly.

Mahaweli Authority of Sri Lanka

The Mahaweli Authority of Sri Lanka (MASL) has sole responsibility for extension within the productive settlements under the Mahaweli River Diversion Scheme. The MASL has 57 extension officers and agricultural instructors. The DOA participates in the biannual technical working group meetings but, other than these meetings, MASL has no other linkages with any other research or extension program. Agricultural development within the Mahaweli Scheme is autonomous and largely disconnected from what happens in other parts of the country. Linkages may be improved with the current inclusion of the Mahaweli Scheme in the portfolio of the Minister of Agricultural Development and Agrarian Services Development.

Plantation agriculture development

Each of the three major plantation crops has its own research institute, with specialized extension staff who work with smallholders in the major production areas for each crop.

Extension within the private sector

Some large private firms are developing technical advisory and supervisory services for farmers. For input supply companies, such as those selling hybrid seed, it is important to provide technical advice to farmers to ensure that they obtain high yields and continue to buy the product. Some export companies hire agricultural graduates to provide technical advice to farmers working under buy-back contracts and to ensure that they follow the correct production practices to maintain product quality and uniformity. For export crops shipped to industrialized countries, it is essential to meet all required food safety standards, so advisory staff provide close technical supervision of producers to ensure, for example, that only approved agricultural chemicals are used (Fernando 2006).

One example of successful, privately organized extension is the outgrower system established by Hayleys Group for gherkins (Hayleys Group 2006). Hayleys Group, Sri Lanka's most diversified business conglomerate, initiated an outgrower scheme for gherkins with 100 farmers on 25 acres in 1989. The scheme has since expanded to 8,000 outgrowers on 2,000 acres each year and generates about 16,000 jobs. In addition to supplying inputs and guaranteeing a market outlet, Hayleys has invested in an extension system to ensure the quality of its produce. Its extension staff members are experienced agricultural graduates and diploma holders in agriculture. They further develop and maintain their competency through overseas visits and liaison programs with DOA and universities. Extension methods include computer-based presentations and videos. Since quality is the key to maintaining the position of Hayleys' gherkins in the market, the extension system fields one agent for every 100 farmers. Hayleys is considering moving into other horticultural products such as red bell peppers and Spanish peppers.

Nongovernmental organizations

A significant number of NGOs engage in agricultural development, especially in less developed areas of the county. These NGOs have their own mandates and frequently provide free inputs and other services in carrying out their activities. In a few cases, NGOs coordinate and work with PDOA extension staff. The NGOs support mostly short-term projects, and when they end, the NGO moves on to other areas or carries out different programs. Most NGO staff members are generalists with no technical training in conducting extension programs.

Universities

Universities have no clearly defined role in Sri Lanka's extension system, but they have engaged in several activities. The joint rural development project of the University of Colombo and the Japan International Cooperation Agency has developed improved production packages for the farming community in the North Western Province (Dissanayake 2003). The project is an example of an integrated approach to agricultural extension in villages. Efforts were coordinated with agricultural scientists, extension workers, social scientists, health workers, provincial council officers, traders, exporters, and others. Similarly,

the Universities of Peradeniya and Ruhuna have started extension programs for organic agriculture and cinnamon, in which input suppliers, growers, marketing agencies, and knowledge providers are brought together in a common forum (Jayasekera 2006).

4.2 Strengths of the agricultural extension system

A major strength of extension across all departments and provinces is the organization of farmers into groups. For farmers to shift to high-value crops or products, they must organize (and build social capital) so that they can work together in producing and marketing sufficient quantities of a product to achieve economies of scale. Groups also generally work together in procuring key inputs, such as seed and fertilizer, to reduce production costs. In carrying out this extension function and helping farmers to organize, Sri Lanka is ahead of every other country in South Asia.

One concern, however, is the precise function of these groups. Forming community-based organizations (CBOs) that lack a production function can ultimately create groups that become political in seeking subsidies and other inputs from government. On the other hand, when producer groups are organized around specific higher-value crops (such as maize, soybeans, fruits, vegetables, or spices), livestock (for example, dairy or backyard poultry production), or enterprises (such as mushrooms, value-added processing), extension activities can be targeted to men and women with similar prospects and interest in diversifying and/or intensifying their farming systems. Given the experience of other countries, such as China and India, the producer association model is the one that should be pursued throughout Sri Lanka. However, since many of the provincial extension systems are still largely supply-driven rather than market-driven, they have tended to follow the CBO model instead of organizing farmers into producer groups.

The Western PDOA is an example of a provincial extension system that is market-driven, well organized, and pursuing a five-year strategic plan validated by farmers (Ranasinghe 2006). This province is largely urbanized, because it surrounds Colombo, and the focus of its extension programs is vastly different from programs in the rural provinces. Looking beyond the program's content areas, however, it is clear that this is a well-run extension system. As noted, it has a five-year strategic plan that is validated annually, as well as medium-term and annual work plans. The program is largely market-driven, with a focus on high-value crops, especially export products (flowers and fruit), as well as fruits and vegetables for the Colombo market. When the extension system gets specific requests from farmers (for example, to learn how to propagate plants by tissue culture), the director sends the appropriate staff member for in-depth training, and the staff member then organizes a training program for farmers. The extension service routinely runs farmer training programs on agribusiness management as well as entrepreneurship. It has established programs for rural and urban women, such as Family Business Gardens, Landscape and Interior Design, as well as human nutrition. One of the extension staff members was partially responsible for the introduction of dragon fruit (pitaya), which is now produced for export. In short, this provincial extension system could be used as a model for transforming its counterparts.

In addition to these successes in the public sector, the private sector is beginning to play a larger role in extension. As mentioned, these efforts generally involve input supply companies, such as firms selling hybrid seed, or export companies that need to manage production with care to maintain product quality and food safety. The hybrid maize seed companies offer a good example of private extension on the input side. They provide free technical assistance to groups of farmers, as well as coordinating with feed manufacturers to

arrange buy-back contracts and sometimes arranging credit and crop insurance for farmers to mitigate their risk. An excellent example of a food processor and exporter that provides extension services to farmers is Hayleys Group, discussed earlier.

These examples demonstrate that it is possible and feasible to strengthen the extension system in Sri Lanka. What is needed are: (1) leaders who seek to build on opportunities to increase farm income and rural employment, rather than to perpetuate a supply-driven strategy that is not moving the agricultural economy forward; (2) effective managers who make the best use of existing resources in serving the needs of the farm households, including rural women; (3) up-to-date sources of technology that allow farmers to diversify parts of their farming systems into high-value crop and/or livestock enterprises; and (4) additional resources to first train field staff in implementing these new types of extension programs and then make it possible to implement them. For this proposed extension model to work effectively—as in Western Province—it must be accountable to farmers, so a bottom-up planning process is essential. The discussion that follows focuses on some of the major institutional and resource constraints to improved performance and provides suggestions for resolving or alleviating these problems.

4.3 Structural issues in the extension system

The devolution of agricultural extension to the provinces created two major linkage problems. The first linkage problem is the functional disconnect between the national ETC (within the DOA) and the PDOAs. Because there is no common strategy or approach for planning and implementing provincial extension programs, some PDOAs are forward-looking and make real progress toward national goals, while others pursue an outdated supply-driven extension strategy that has little or no impact on farm income and poverty alleviation. Since each provincial extension system operates independently, there is no reliable means of evaluating performance and/or assessing impact. Therefore, PDOAs with effective leadership and sufficient resources operate effectively, whereas others do not.

The other side of the leadership and management issue is that the DOA has considerable talent among its staff, both in the IP areas where it carries out field activities and within the ETC. In particular, the ETC could play an important role in supporting the PDOAs by providing in-service training, Cyber Extension services, and other services. This possibility appears to be limited by a continuing attitudinal problem about who should be in charge. The ETC and PDOAs have minimal contact, and budgets for the DOA and PDOAs come through different channels (MOA and the Provincial Council), which makes direct collaboration between the national and provincial institutions administratively complicated.

The second serious linkage problem is the disconnect between research departments and institutes that fall under the jurisdiction of MOA and MEILD at the national level, and the PDOAs and PDAPHs at the provincial level. Since agricultural research is funded and managed at the national level, and extension programs fall under the purview of provincial departments, there are some significant, built-in administrative hurdles to be overcome in bridging the research-extension linkage gap within the current system.

In the case of agriculture (crops), the primary mechanism for bridging this gap is the biannual PTWG meetings, which currently focus on immediate production problems and do not serve as a platform for planning and implementing a long-term agricultural development strategy for the province. In addition, since no resources are available to finance joint programs, national research and provincial extension operate independently. One option that could be

considered would be to provide funding from the proposed National Agricultural Innovations Council (NAIC) to a counterpart structure at the provincial level (for example, a Provincial Agricultural Innovations Council, or PAIC), based on the development and approval of a strategic research and extension plan. This funding mechanism could begin to overcome these linkage problems and at the same time move the research and extension system toward a more market-driven strategy.

Creation of a National Agricultural Extension Center (NAEC)

There is a clear need at the national level for:

- Creating a center of excellence in extension strategy, approaches, and methods, which would also act as a repository of technical and market information that would be directly useful to all agricultural research and extension workers throughout the country, as well as to farmers, agribusinesses, export agencies, and others.
- Conducting systematic monitoring and evaluation of all organizations conducting extension programs and activities, to assess their performance and contribution to national goals and objectives.
- Assisting provincial or other extension systems by providing essential support services that cannot be efficiently or effectively implemented by the individual PDOAs. For example, the National Agricultural Extension Center (NAEC) would develop and maintain a strong information technology (IT) system that would link to the provincial, district, and division levels and provide current technical and marketing information (that is, Cyber Extension). Such a system could also offer specific technical and management training through distance education programs, or offer other professional development opportunities through pre- and in-service education.

The proposed NAEC would not have management control over the PDOAs, but it could bring provincial extension leaders together periodically to discuss extension strategy, management problems, and ways in which the national center might play a more strategic role in supporting the work of the PDOAs. Since the NAEC could take on the role of monitoring and assessing the performance of each PDOA, this performance information could be shared at annual meetings. These periodic reviews would allow the provincial directors to assess their progress against that of other provinces and encourage the exchange of information about how specific management, resource, or program implementation problems have been overcome. In addition, if the National Agricultural Innovation Council (NAIC) is established, the NAEC could play an instrumental role in reviewing Strategic Research and Extension Plans (SREPs) and innovation proposals submitted by PAICs for funding. By working closely with the counterpart research center, these joint activities could help bridge the gap between research and extension on areas of strategic importance.

Development of a Provincial Agricultural Innovation Council (PAIC)

Given the current structure, the most feasible way of bringing research and extension together is to provide the necessary program funds to enable research and extension to work together in developing and then implementing a SREP for each province. The SREP would focus on crop and livestock diversification, consistent with the national goal of increasing farm income and rural employment (poverty alleviation). The preparation of a provincial SREP would take several months and involve participatory rural appraisal and strategic planning procedures. Once a SREP has been prepared by a joint research and extension team, it is submitted to the PAIC Governing Board for review, modification, and approval before being submitted to the NAIC (see chapter 5) for review and approval. Once the SREP is in place, the process of funding special projects and annual work plans can be implemented in a systematic manner, and the SREP can be modified periodically based on field experience.

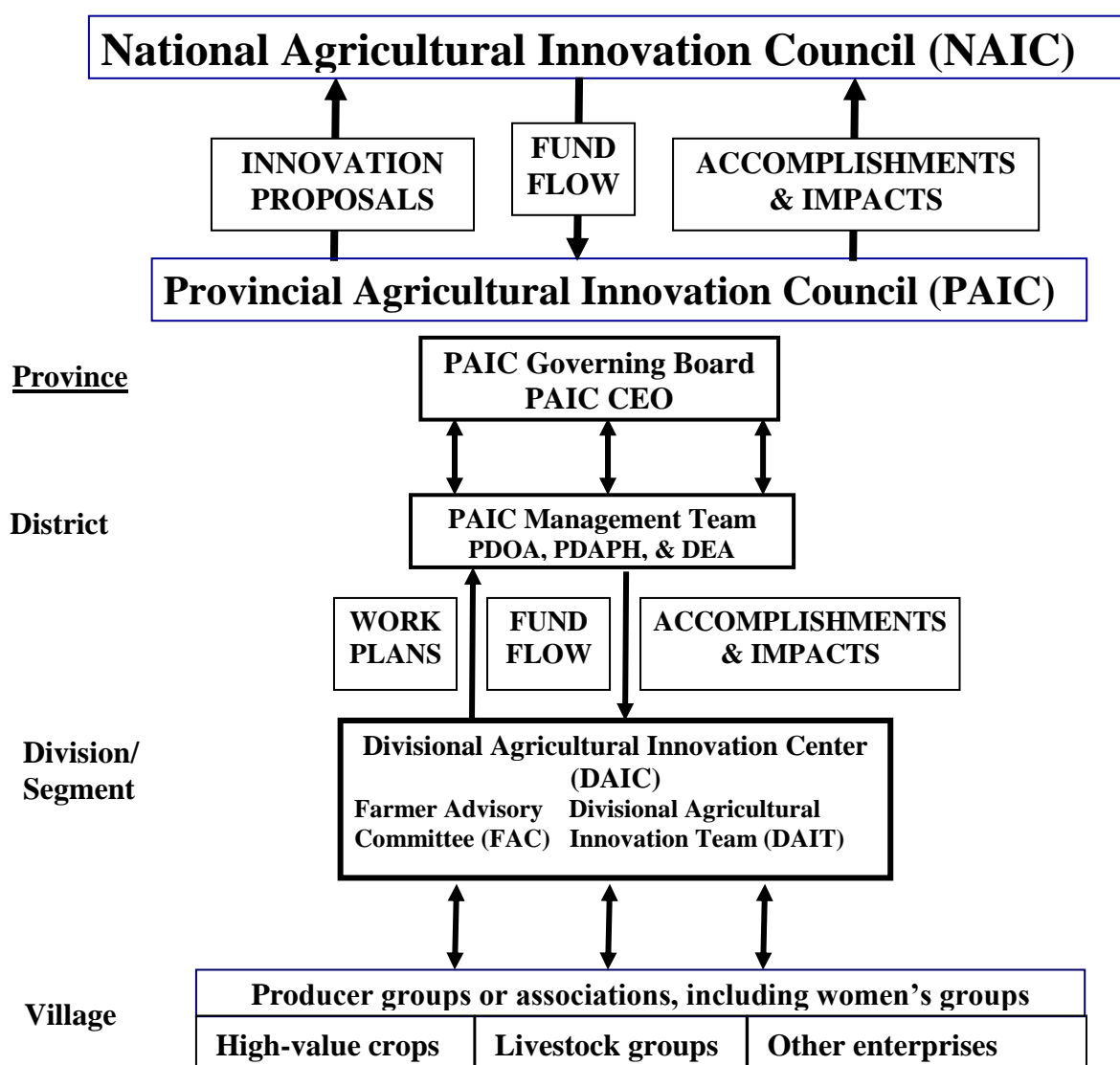
For such a funding mechanism to be successful, an appropriate management structure and procedures would need to be established and agreed upon to avoid the misallocation of funds and ensure full accountability by the different implementing agencies. Figure 4.3 suggests a possible organizational structure for this new PAIC.

Each PAIC would operate under the control and direction of a Governing Board (GB) composed of representative stakeholders within the province. The GB would have the authority to approve funding for a range of research, extension, training, and related activities that would support agricultural innovation within the province. Priority would be given to projects or programs that would link research with extension and/or link extension with private firms or NGOs. Funding would be provided only for program activities, for example adaptive research trials on onion cultivation, field testing a cheese processing unit that could be used by village women, training farmer leaders through an “exposure visit” to see how high-value crops or value addition is pursued in a different province, or training village women to establish home garden businesses or backyard poultry flocks. No salary costs would be funded from these grants; only supplies, equipment, travel, training, and related costs to field test or demonstrate new crop and livestock systems or other value-added enterprises.

The GB would include one elected producer or farmer association leader from each segment or division within the province; four or more private sector representatives; one or two bank representatives (representing sources of farmer credit); two or three NGOs with active programs within the province; and representatives of universities or organizations with a direct interest in supporting agricultural innovation in the province. The GB would be chaired by the Provincial Secretary of Agriculture.

With respect to the farmer members (approximately 12), they should be leaders of producer associations representing different commodities or enterprises that are important in increasing farm income and rural employment within the province. At least three of the farmer leaders should be women, representing women’s producer or enterprise groups. This composition of the GB would ensure that resources are not directed exclusively to one particular district, agro-ecological zone, commodity, or enterprise within the province. Also, private sector representatives must have significant business interests within the province. Such involvement could include selling inputs that support diversification, or trading, exporting, or processing (and thus engaging in buy-back arrangements from producer groups and strengthening the value chain for the particular commodities that are produced).

Figure 4.3: Proposed management structure for the PAIC



Source: Authors

At the provincial level, a Chief Executive Officer (CEO) would assume responsibility for all projects and programs approved by the GB and funded by the NAIC. The CEO would be assisted by a small administrative staff to monitor program activities, accomplishments, and impacts; provide financial oversight, including auditing accounts; and other activities. Primary responsibility for day-to-day management of most programs and activities funded by the PAIC would rest with the district (deputy) directors of the Departments of Agriculture and Animal Production and Health. For example, they would review all proposals or work plans submitted from each Division Agricultural Innovation Center (DAIC). In summary, they would provide monitoring and oversight for all funded projects or programs carried out within their respective districts.

It is expected that most proposals would be submitted by AIs or Livestock Extension Officers operating at the division or segment level. These proposals would be developed in direct consultation with producer groups within their target area and would focus on training, demonstration, and related activities that would introduce, test, or disseminate agricultural

innovations within their target area. Proposals could also be submitted by research institutes or universities operating within the province, but they would have to include direct involvement and participation of the extension staff and farmers (for example, through on-farm trials). Also, in districts where the DEA has field extension officers, they too could submit proposals in consultation with their farmer groups.

It is recommended that a Divisional Agricultural Innovation Center (DAIC) be created within each division or segment headquarters. This center would serve as the agricultural technology, market information, and training hub within each division. Where possible, existing DOA facilities might be upgraded to include a farmer training center and also serve as the Cyber Extension center for the division. In other cases, a new DAIC facility might have to be constructed. In any case, all agricultural instructors and other extension field staff would have access to this DAIC, but the training center and other facilities would have to be reserved in advance for individual or group use, and priority would be given to those research and extension staff members who are implementing PAIC grants.

The extension officers from each line department (PDOA, PDAPH, and DEA) would be responsible for consulting with producer groups about specific trials, demonstrations, and training activities they would like to implement during the coming year. In the process, these field officers for each program area would jointly develop an annual work plan that would outline the proposed activities; indicate where these demonstrations, trials, or training activities might be carried out; and develop a proposed budget to implement them.

Within each division, a Farmer Advisory Committee (FAC) would be established to provide input, oversight, and accountability for all project or program activities undertaken within each division. The FAC would be composed of farm leaders who are active in different producer groups within the division. It is important that the FACs represent all farmer groups that seek to diversify their farming systems, increase farm household income, and increase rural employment. There should be at least one representative from each high-value crop, livestock, or enterprise group already operating within each division. In addition, rural women should be represented on the FACs for enterprises that they might pursue (backyard poultry, home gardens, vermi-composting, mushrooms, dairy, and so forth). Each annual work plan (proposal) would need to be reviewed, discussed, and approved by the FAC before being submitted to the appropriate district director for review and then transmitted to the PAIC GB for review, approval, and funding. At the end of each season or year, the extension field staff would be accountable to the FAC for the successful implementation of the approved work plan. In addition, the implementation team would be accountable to their respective district director, to the GB of the PAIC and, ultimately, to the NAIC.

4.4 Funding sources and adequacy of support

To reduce costs or reallocate government funds to other priorities, extension budgets have been kept stable for many years by holding down salary costs and not filling vacant positions. As a result, about 85 percent of the recurrent budget goes for staff salaries and benefits, leaving very few resources for operational and program costs. Given the need to pay for electricity, telephone, and travel expenses, the remaining funds are spent on operational costs, with no funds available to fund programs such as an on-farm demonstration, field day, or farmer training course. The only activities that can be carried out by this virtually paralyzed extension system are the face-to-face interactions between extension workers and farmers or farmer groups. Given the poor linkages with research, extension field workers have little new information, technology, or production skills to transmit during their farm or village visits.

Research conducted on extension systems worldwide indicates that an extension system needs to allocate about 30 percent of its recurrent budget to program and operational costs to be effective in carrying out its functions and responsibilities. Any allocation below this level reduces program activities—which are the precise reason for having an extension system in the first place. An inherent difficulty in Sri Lanka is that if and when budgets do increase, the normal practice is to increase the number of staff, which locks in a larger budget, because new staff members have permanent appointments. Such a situation strengthens the case for providing program funds through the proposed PAICs. This process would allow funds to be shifted to the most important priorities within the province as determined by the stakeholders, including the need to get research and extension working more closely together.

Another long-term constraint is the lack of a capital budget for improving facilities, equipment, and mobility. The availability of in-service and farmer training centers differs from province to province, depending on what infrastructure was in place at the time of devolution. In some provinces, good training facilities are in place and are being used on a regular basis, while other provinces have no facilities. There is a need to rectify these imbalances in essential facilities across the different provinces. Finally, the lack of mobility for field staff is another major constraint. In a previous World Bank project, extension workers had the option of taking an interest-free loan to purchase a motorcycle. This loan was subsequently repaid through a reduction in travel fees. However, such a credit arrangement has not been available for more than a decade, and most field workers must walk or take public transport in traveling from village to village. Given the low salaries of extension staff, it is recommended that an interest-free credit scheme be established in the form of a revolving account, so that as loans are paid off, funds become available for new staff members to purchase motorcycles, thereby improving their efficiency and accessibility in delivering extension programs throughout their service area. Increased mobility will also reduce the number of field extension workers needed.

4.5 Human and physical resource constraints

Several human resource constraints affect the entire extension system. Each is addressed separately in the sections that follow, along with options to overcome the constraint.

Number of field extension workers

When 2,400 village-level (KVSS) extension workers were transferred from the DOA to the Ministry of Public Administration in 1988, the DOA extension system was reduced to one-third of its previous size (from 3,600 extension workers to 1,200). The extension worker-to-farm household ratio declined from about 1:1,000 to 1:3,000. To increase efficiency, the current field extension staff have been organizing farmers into CBOs.⁴

As noted, the MAS hired approximately 9,600 permanent field workers in the 1990s, who were assigned to spend three days each week conducting extension activities in their respective villages. Only about 10 percent of these ARDAs have a two-year, postsecondary agricultural diploma; the remainder are largely secondary school graduates. None of these ARDAs have training in planning and conducting extension programs, including farmer training and demonstration work. (Most diploma holders, however, engage in extension activities as time and resources permit.)

⁴ The previous chapter discussed the relative merits of CBOs and other kinds of farmer groups.

Given the shortage of trained field extension officers within the PDOAs and the fact that the ARDAs are expected to engage in extension activities, it is recommended that ARDAs with an agricultural diploma or sufficient training be transferred to the PDOA on a permanent basis. Transferring 1,000 MAS employees would more than double the size of PDOA field staff, reduce the extension agent-to-farmer ratio to less than 1:1,500, and double the level of extension activities carried out in each province.

Educational qualifications of field extension staff

The educational level of extension staff in the eight PDOAs is relatively low (table 4.1). Four staff members hold a PhD (0.4 percent), 29 have MSc degrees (3.1 percent), and 26 have BSc degrees (2.8 percent); the remainder (865 staff members, or 93.6 percent) have only diplomas in agriculture. In addition, most officers with postgraduate degrees occupy administrative positions, rather than serving as subject-matter specialists (SMS) offering training and technical support to field staff. The predominance of staff with such basic agricultural training is totally inadequate if Sri Lanka is going to survive, let alone compete, in the global economy. For example, in India nearly all front-line extension workers have BSc degrees, and an increasing number have MSc degrees.

Table 4.1: Educational qualifications of DOA/PDOA, DEA and DAPH extension staff

Province/agency	Agricultural Officers					AIs/SMSs	
	PhD	MSc	BSc	Diploma	Total	BSc	Diploma
Central	-	4	2	4	10	2	138
North East	1	7	4	5	17	-	151
North Central	1	3	4	-	08	-	44
North Western	-	4	1	4	09	-	128
Sabaragamuwa	-	1	3	4	08	2	116
Southern	-	3	3	8	14	-	134
Uva	1	3	1	3	08	-	54
Western	1	4	4	2	11	-	70
IP	-	8	6	2	16	-	228
ETC	1	22	9	3	35	-	50
<i>Total DOA/PDOA</i>	<i>5</i>	<i>59</i>	<i>37</i>	<i>35</i>	<i>136</i>	<i>4</i>	<i>1,113</i>
DEA	2	11	48	148	193	-	-
DAPH	2	140	211	400	726	-	-

Source: ETC

Several factors have contributed to this problem. The PDOAs have been unable to fill many Agricultural Officer positions in the past 10 years, and officers with a BSc or postgraduate degree are retiring or leaving. These posts are being filled with diploma holders who are currently in service. Second, very few in-service training activities and essentially no in-service education opportunities are available for staff. The Development Division of the DEA has a slightly higher share of staff with BSc and postgraduate degrees (5 percent with MSc degrees; 25 percent with BSc degrees), but given the specialized nature of these important export crops, the DEA extension staff also should be substantially upgraded.

Increasing the educational qualifications of current staff will be a long-term process that is not easy to accomplish. To the extent possible, the following actions should be taken:

- All current vacancies, especially for SMS positions, should be filled with candidates having at least a BSc in agriculture. Preference will be given to candidates with appropriate postgraduate degrees. Considering the increasing role of women in Sri Lankan agriculture, women should fill a substantial number of vacancies.

- Younger, junior staff that hold diplomas in agriculture and are performing well should be given a paid leave of absence to pursue a BSc.
- If the NAEC installs a suitable IT system, the University of Peradeniya should be consulted about collaborating with the NAEC to develop and deliver a special *distance education* degree program to allow interested extension officers to pursue BSc degrees on a part-time basis. They might take the bulk of their course work via distance education and then be given a one-year paid leave to complete their degrees on campus.

Lack of professional promotion and incentive schemes

To hold down salary costs in the research and extension systems, nearly all opportunities for promotion and career enhancement have been removed. Regardless of performance, most extension workers are frozen in their initial appointments (and thus have total job security), but they have no opportunity for career advancement (which thus has very negative impacts on job performance). Some or all of the following promotion and incentive schemes should be adopted to limit these counterproductive personnel practices and improve staff performance:

- Introduce different ranks within each employment cadre. A new hire might hold the title of Junior Agricultural Instructor, for example, with prospects for advancing to the rank of Agricultural Instructor and then to the rank of Senior Agricultural Instructor. These advancements in rank do not necessarily require significant increases in salary, but they offer public recognition of years of service and/or outstanding performance.
- Establish minimum qualifications for each cadre of extension employee, regardless of responsibilities. For example, all staff members with a BSc degree should hold the title of Agricultural Officer, even if they are field extension officers. Again, this is a way of encouraging staff to pursue BSc or postgraduate degrees.
- Develop and implement a recognition program for staff members who demonstrate outstanding performance. These award programs do not require a financial incentive but do offer public recognition of superior performance. There should be several categories of recognition, and these award programs should be conducted annually. It is also important to specify the criteria used in assessing performance (based on job responsibilities), and the review panel must be independent to ensure that politics and favoritism do not bias the outcome. For example, a review panel might include a university faculty member in extension education, a private sector representative, and a superior extension officer from a different province. As noted, given the need for the extension staff to improve their educational qualifications, one incentive that might be conferred on the top award recipients would be a one-year paid leave to pursue a degree or advanced study at the university.

To improve the performance of the extension system substantially and link field staff with up-to-date technical and market information, a Cyber Extension system should be established. As discussed earlier, the platform for compiling, loading, and updating this information could be assigned to NAEC, and Internet access could be provided down to the division level. For example, if a DAIC were developed at each division headquarters, then PDOA, PDAPH, and DEA extension staff would all have access to these facilities, and this center would serve as an innovation platform facilitating interactions between these groups.

Such a facility could also become a resource for producer groups or associations within the district as they seek market information and answers for specific technical problems. At

present, extension workers have no access to this information or to research officers who could respond to specific technical problems. By establishing a Cyber Extension facility in each DAIC, extension workers would have e-mail access to scientists and, as indicated earlier, the prospect of participating in in-service training courses or even pursuing a university degree through distance education. These facilities would motivate and enhance the capacity of extension staff to respond effectively to the technical and market information demands of different producer groups in their service areas.

Need for a market information system

Currently HARTI collects price information on vegetable, fruit, and other crops each day at 22 locations within the country and publishes it in the newspaper. HARTI also publishes a weekly market summary. Since markets are very dynamic, traders and large commercial growers with up-to-date market information have a distinct advantage over small-scale producers with very limited and delayed information on different markets. One reason for organizing small-scale producers into groups is to help them capture economies of scale and especially to help them market their products collectively in a wholesale market rather than selling to traders at the farm gate. If HARTI could upload market information on its own website or transmit it to the Cyber Extension system, producer groups could either ship their products to more profitable markets or be in a better position to negotiate fair prices for their products.

The same situation applies to export markets, but in this case there is little or no market information available except for proprietary information within export firms that already ship specific agricultural products to particular markets. There is an urgent need for a global market information system that would access different databases and provide information more readily to private firms, producer groups, and the research and extension system. If the goal is to develop a more market-driven research and extension system, it is critical that strategic market information be made available for guiding research and extension programs, along with tactical information for supporting production and marketing decisions by farmer groups.

5. Towards a More Integrated Agricultural Innovation System

The previous chapters have reviewed agricultural research and extension separately. This chapter adopts a somewhat different approach. It looks at research and extension from an innovation system perspective (see chapter 1, section 1.3) and addresses three overarching issues that are central to improving the performance of Sri Lanka's agricultural innovation system as a whole:

1. Greater emphasis on markets and economic impact, especially in terms of increasing farm income and rural employment.
2. Greater emphasis on technology application.
3. Strengthening linkages between actors and components within the system.

A proposal is made to create innovation platforms, first at the national and later at the provincial level. These platforms would serve at least three purposes. First, they would link research, extension, and the market much more closely, possibly in a value chain or from a regional development perspective. Second, innovation platforms would improve interaction between the actors in the agricultural sector and provide more room for "newer" actors, such as private firms and universities. Third, innovation platforms should enhance the potential for Sri Lanka to learn from its experiences. As illustrated in chapters 3 and 4, Sri Lanka's agricultural research and extension system is largely beset by underinvestment and suboptimal performance, even though several interesting initiatives show potential for scaling up or replication elsewhere in the country.

The chapter ends by reviewing the main conclusions.

5.1 Greater emphasis on markets and economic impact

Agricultural innovation is not only about introducing new technology; it is also about developing new markets and products and adding value (World Bank 2006). This latter dimension receives relatively little attention within Sri Lanka's agricultural research and extension system. The review encountered numerous examples of technology improvements that could not be realized because of market problems, including the lack of transport, poor storage capacity, poor market information, and market imbalances.⁵

Even so, the review encountered several positive examples of technology and markets working hand-in-hand. These examples illustrate the potential advantages of increasing the emphasis on markets and economic impact within research and extension. An outstanding instance is the export-oriented gherkin value chain, which produces and markets high-quality products for well-defined markets and has yielded profits for producers as well as industry. Innovations such as buy-back arrangements, credit facilities, and crop insurance have helped to reduce risk and increase working capital for farmers. The question is how to create more of these combinations of factors that lead to win-win outcomes for participants. Boosting output without a market will only depress prices and make farmers poorer rather than richer.

Most agricultural research and extension agencies in Sri Lanka have very little market and socio-economic expertise, and when questioned about possible export opportunities for

⁵ For example, at the time of the review newspapers were reporting that an oversupply of onions had reduced prices. Limited storage capacity means that there is no way to dampen such seasonal supply fluctuations.

agricultural commodities, they often had no idea. Socio-economic units at agricultural research institutes tend to be severely understaffed and do not focus on markets. Extension staff members (most of them diploma holders) have very little marketing and management expertise.

The entire research and extension system needs to shift its focus from productivity to profitability—that is, from an emphasis on technology only to an emphasis on technology and markets. Several actions are recommended to facilitate this shift:

- ***The public and private sectors need to interact more closely.*** As seen in the Hayleys Group outgrower scheme for gherkins, it is through the *market* and *market agents* that the technological requirements of high-value agriculture are understood. Joint technology forecasting studies should be undertaken to identify where Sri Lanka's potential to increase agricultural incomes is highest. These studies could be followed by specific action plans (such as the establishment of mission-mode programs) that clearly elaborate the roles and interactions for the different parties.
- ***Make all research and extension staff aware of the socio-economic, management, and market aspects of innovation.*** This heightened awareness requires, among other things, special training courses for staff. These subjects must also be covered sufficiently in the agricultural education curriculum. This deficiency is particularly acute in the education of diploma holders.
- ***Agricultural research and extension agencies should give high priority to improving capacity for socio-economics, marketing and business management.*** It is imperative that specialists in these areas do not isolate themselves in stand-alone research projects but become part of multidisciplinary research projects and extension programs.
- ***Agricultural research and extension project proposals should stringently follow a log-frame approach that specifies not only research and extension outputs but also outcomes and (economic) impacts.*** The selection of research and extension projects should focus more strongly on the expected economic impact rather than on expected outputs such as research papers, farmers visited, and so forth. Selection committees should not be composed of peers only but include ultimate clients. The latter are in a better position to validate the expected economic impact of project proposals.
- ***The agricultural sector needs better and more timely access to precise market information, not only for local but also for international markets.*** As discussed in chapter 4, an Internet-based system for agricultural market information could be developed.
- ***A competitive funding scheme should be established for projects that aim to develop new (export) markets for agricultural products.*** Such projects should involve the participation of various actors along the value chain, including farmer organizations and private sector companies.

5.2 Greater emphasis on technology application

Opening the innovation system

Many agricultural research systems concentrate more on generating knowledge and technology than on applying it. The traditional linear model extending from research to extension to farmers (still very influential, despite years of criticism) holds innovation hostage

to locally produced research solutions only. In reality, knowledge and technology increasingly spill in from many different sources. For example, private companies import seed and machinery from abroad. Technologies spill in from other sectors as well: for example, information technologies are used to access reliable market information.

One way to facilitate a more open mindset in the agricultural innovation system is to introduce a step between problem identification and research project formulation. That step would be to scan possible solutions that are available elsewhere, especially abroad. Resources should be allocated to conduct such explorations effectively and avoid reinventing the wheel. Access to the Internet should definitely be part of such a strategy, but study tours and participation in professional networks are also valuable for gleaning these insights.

Dealing with regulatory issues

When it comes to intellectual property rights, Sri Lanka is in the early stages of development. A new patent law in line with international standards has recently come into force. Public agricultural research agencies have submitted only a few patent applications, but none has been approved. Consequently there is no experience within the system about how to commercialize patents, about patent law and related legal processes, and on the use of royalty income as an incentive for publicly funded researchers.

A Plant Variety Act dealing with the protection of new plant varieties and breeder's rights was drafted several years ago and awaits discussion in Parliament. Meanwhile, private seed companies are still largely viewed as multipliers of varieties developed by government research institutes, which appear very reluctant to accept the fact that private companies also import seed (particularly for vegetable crops and maize) and sell it farmers. Government agencies consider this activity as infringing on their seed breeding "monopoly." The delay in adopting the Plant Variety Act also suggests that government may be disinclined to have private seed companies start their own breeding programs. Nevertheless, one local private seed company is already setting up a breeding program to develop hybrid rice (for hybrids, the legal protection under the Plant Variety Act is less relevant). Government policy in this area seems to be aimed at retaining tight control rather than stimulating greater private sector involvement in seed development and distribution.

With regard to the introduction of foreign seed, quarantine and seed registration legislation and procedures are in place, and most seed importers find them reasonable. When it comes to the actual implementation of these laws and regulations, however, seed importers frequently experience unnecessary delays in administrative procedures and the required testing. Certification procedures for agro-chemicals are in place and seem to run smoothly.

The introduction of modern biotechnology has triggered heated debate over biosafety the world over. Sri Lanka has not escaped this debate, but at the same time, the government realizes that it has to invest in biotechnology research capacity. Presently a few Sri Lankan researchers are involved in public biotechnology research on a limited number of laboratory-based projects. The necessary research protocols and safeguards are in place for these projects, but no biosafety legislation is in place for field trials, let alone commercialization of transgenic crops and animals.

The Sri Lankan government should adopt a more positive stance with regard to the private sector's role in distributing seed, selecting varieties, and breeding. Rather than frustrating

private efforts to develop a modern, competitive seed market, the government should seek ways to withdraw from the seed business and gradually hand full responsibility for seed multiplication and variety development to the private sector. For certain crops this can be done right away; for others, the process will be slower. Rather than competing with each other, it makes more sense for the public and private sector to complement each other and provide the best seed to farmers at an affordable price. As part of this strategy, the Plant Variety Act should be adopted and implemented, and quarantine and seed registration services should be streamlined. The government should develop biosafety legislation and build up the necessary capacity in this area, possibly within a regional framework.

5.3 Strengthening linkages

The internal cohesion of the agricultural innovation system in Sri Lanka is relatively weak because agricultural research and extension activities are highly fragmented and there is little consensus between public and private actors. The efficiency and effectiveness of the agricultural innovation system, however, will be determined largely by how well the various actors collaborate around a shared vision.

Linkages between research and extension

As discussed earlier, there is a major disconnect between research at the national level and extension at the provincial level. Repairing this link requires various interventions, including a change in attitude and a clarification of the respective roles of research and extension within the system.

A possible intervention for cementing the link between research and extension is to create a competitive funding facility for joint research–extension projects at the provincial level. Such projects require the development of clear joint objectives and effective modes of collaboration. Ultimately, this strategy should help to foster better relations between research and extension.

Integrating the universities into the agricultural innovation system

The total pool of academic staff in agricultural and related sciences in Sri Lanka is about 300. Half of this capacity is based in the Faculty of Agriculture and the Faculty of Veterinary Medicine and Animal Science at the University of Peradeniya. The other half is scattered across six smaller Faculties of Agriculture at regional universities and in some Faculties of Science. In addition there is a Postgraduate Institute of Agriculture, which depends almost completely on staff of the various faculties. Of the academic staff, 49 percent hold a PhD, 29 percent an MSc, and 22 percent a BSc. As in most other countries, in Sri Lanka the educational profile of academic staff in agricultural and related sciences considerably surpasses that of the research staff at agricultural institutes (where 22 percent have a PhD, 40 percent an MSc, and 38 percent a BSc) (Marambe 2006; Abeynayake 2006).

However, academic staff primarily teach and participate in service activities; they dedicate only about 20 percent of their time to research. Since about 90 percent of a university budget goes for salaries, universities are in no position to support research and the staff must find their own funding. Consequently university research is largely of an ad hoc nature. Priorities are determined by funding agencies, very often from abroad. In the absence of research funding, staff find themselves heavily engaged in consultancy assignments. In recent years there has been some change, with CARP and NSF actively engaged in supporting research at

the universities. Private sector support for university research is still meager, but possibilities exist and need to be pursued (Jayasekera 2006).

Given that universities also must provide instruction for higher degrees such as PhDs, it is important that they can offer research facilities and research opportunities with national organizations. The current public sector policy, which releases officers on fully paid study leaves for as many as three to five years abroad but not within Sri Lanka, discourages the development of local curricula for research-based degrees. One result is that many people pursue weekend-based courses for MSc degrees with very little exposure to research. Another is brain drain. For example, in a donor-funded training program abroad, of 30 doctoral-level trainees, only 15 returned after completing their programs. Given (1) the paucity of highly educated labor in the public and private sector, (2) the need to invest more heavily in research, and (3) the high cost of training abroad, it appears very attractive to strengthen research-based training opportunities at national universities.

It is recommended that the potential of the universities be used more actively within the national research system and that institutional arrangements be made to facilitate collaborative research between public, private, and university systems. Such arrangements exist informally, but they should be more open and transparent in the interests of wider collaboration. While public institutions appear hesitant to engage in collaborative research, institutions like CARP and NSF can promote not only collaborative but also interdisciplinary research, of which there is very little.

Another way of mobilizing more active participation by universities in agricultural research is to expand postgraduate programs and thus increase the participation of students and staff in agricultural research. At present, the priority of the Universities is strongly on the delivering students with first degrees (BSc) and attention to post graduate programs (e.g., for MSc and PhD degrees) is limited. To address this problem and also to differentiate the agricultural education landscape, the Faculty of Agriculture of the University of Peradeniya could be transformed from a “teaching” faculty to a “research” faculty.

Linkages with the ultimate clients of research and extension

As previous chapters have shown, the agricultural research and extension agenda in Sri Lanka remains largely supply-driven and is defined in a top-down manner. Consultation with farmers, input suppliers, processors, traders, exporters, and consumers in the selection of research and extension priorities is still very limited. Except for plantation crops, no financial contributions are requested from the user, so there is little feedback to indicate that research and extension are offering what clients want. Clients are not really critical about services they get for free. Although a financial contribution from the user could improve this linkage and reveal priorities more effectively, during the review various parties expressed considerable reservations about having farmers contribute to agricultural research and extension costs; most often farmers were considered too poor to contribute.

Agricultural research and extension could improve links to their ultimate clients by more strongly involving farmers and other clients in setting agricultural research and extension priorities through consultation and empowerment. Various instruments can be used, from consultation to giving farmers control over budget allocation. Mobilizing farmers into groups is an important prerequisite for facilitating their greater involvement, and the good work on building farmer groups should continue. Despite reservations in some circles, it would be

useful to experiment in the more developed, export-oriented segments of the agricultural sector to determine whether and how farmers and other actors along the value chain could contribute to the costs of research and extension. In addition to tapping an additional source of income, the advantage of asking for a contribution is that it will change the farmer from a passive receiver to a critical client.

Linkages between public and private actors

The overall impression emerging from the review is that linkages between public and private actors within the agricultural innovation system are rather tense. Much polarization is occurring and extreme caricatures are being entertained. Such perceptions negatively affect the willingness of both parties to work together in the national interest. Looking into the future, the role of the private sector in agriculture and agricultural innovation is bound to grow (World Bank 2005) and to provoke a shift in the distribution of activities. The government might adopt a dynamic vision and mobilize the private sector to develop the agricultural sector. For instance, the private sector could be invited to manage state farms on a leasehold or joint venture basis. The CIC farm visited in the course of the review is a promising example of how capital, technology, and knowledge about markets can combine to make a difference. This farm offers not only employment to local communities but also opportunities for nearby farmers to obtain outgrower contracts. The technological and economic spillovers of this farm are extremely promising.

5.4 New modalities of operation and coordination

To overcome the fragmentation, lack of coordination, and limited vision within the agricultural innovation system, several general structural suggestions are to the point:

1. ***Create a National Agricultural Innovation Council (NAIC)*** to provide a platform for the different innovation actors; to build a vision and consensus on the direction of the system; and to facilitate mission-oriented joint projects.
2. ***Create Provincial Agricultural Innovation Councils (PAICs)*** that bring together farmers, the private sector, NGOs, extension, and research.

It is important that the proposed changes overcome fragmentation and do not inadvertently worsen it. The review has therefore also tried to identify which organizations and mechanisms can be removed or used as the evolutionary basis for new ones. Table 5.1 summarizes the proposed changes.

The NAIC should bring research, extension, and market development together in one apex body. The NAIC can evolve from the current CARP, principally by widening its mandate, authority, and responsibility and by repositioning it in the public sector hierarchy. Whereas CARP currently forms part of the MOA, the proposal is for NAIC to be chaired by the President, as occurs with the Council of Scientific and Industrial Research in India.

The NAIC's main functions will be:

- To provide a platform for all innovation actors to come together.
- To develop a vision and consensus on the direction of the system.
- To ensure a legal framework that promotes the public–private partnerships required for successful innovation.

Table 5.1: Proposed evolution of Sri Lanka’s agricultural research and extension system

New organization	Functions	Organization from which it will evolve	Key changes
National Agricultural Innovation Council (NAIC)	<ul style="list-style-type: none"> - National platform for different innovation actors - Develop a national agricultural innovation strategy - Implement 8–10 sizable mission-oriented programs - Monitor the research system - Manage some focused competitive grant schemes - Oversee NAEC - Coordinate, fund, and oversee PAICs - Manage technology transfer and intellectual property rights 	Council for Agricultural Research Policy	<ul style="list-style-type: none"> - Change chairmanship - Widen mandate (research, extension, and market development activities) - Change board composition - Change legal position - Strengthen financial power - Strengthen operational capacity
Mission-mode programs	<ul style="list-style-type: none"> - Bring together principal stakeholders of a certain value chain or region - Develop and implement sizable innovation programs on issues of major importance to Sri Lankan agriculture 	Mission-mode programs will be managed by one of the key stakeholders	<ul style="list-style-type: none"> - Establish consortia to develop and implement mission-mode program - Establish legal relationships between consortia partners and with NAIC
National Agricultural Extension Center (NAEC)	<ul style="list-style-type: none"> - Center of excellence in extension strategy and approaches - Monitoring and evaluation of extension programs and activities - Support to provincial and other field extension staff for web-based information dissemination and training of extension staff 	ETC of the DOA	<ul style="list-style-type: none"> - Change reporting relationship from MOA to NAIC - Widen subject matter - Upgrade staff - Strengthen ICT management skills
Provincial Agricultural Innovation Councils (PAICs)	<ul style="list-style-type: none"> - Provincial platform for innovation actors - Elaborate demand-driven provincial research and extension strategies - Provide operational funding for implementing provincial extension strategies - Develop and implement additional resource mobilization strategies, including cost-sharing pilots 	PTWGs of the DOA and similar mechanisms in other ministries	<ul style="list-style-type: none"> - Establish organizational entities with a board and a chief executive officer - Develop reporting relationship with NAIC - Develop client-based governance and implementation structure (DAICs, FACs)

Source: Authors

- To develop a set of 8–10 mission-oriented, priority themes for innovation. Innovation priority themes should be formulated in terms of an economic accomplishment—for example, “development of the dairy industry” or “reduced postharvest losses in fruit and vegetable production.” Possible objectives for some of these mission mode programs can be found in World Bank (2007c).
- To assign the implementation of each national innovation priority theme to a consortium representing the major stakeholders around that particular theme. The lead agency of this consortium will be responsible for developing work plans and budgets and submitting them for approval to the Board.
- To allocate the necessary operating budgets to these consortia and monitor and evaluate the implementation of their innovation priority programs.
- To manage, in addition to the mission-oriented program, a few small competitive funds that will be used primarily to oil the wheels of the agricultural innovation system or remove certain blockages. For example, a special funding facility for the promotion of collaboration between research and extension (linkages fund) may be put in place. Similarly, a diversification fund for projects aiming at developing new exports might be developed.
- To develop a national extension strategy, coordinate the activities of the PAICs, and approve their user-based work plans and budgets.
- To oversee the operation of the NAEC.
- To manage a national monitoring and evaluation system.
- To mobilize resources, both from government and donors.
- To operate a business development unit to facilitate technology transfer and manage intellectual property rights and partnerships.

The NAIC will be governed by a Board consisting of key representatives of the public and private sectors. This Board will define NAIC’s overall policies, select the innovation priority themes, and monitor their implementation. In addition, the Board will play a coordinating and supervising role with regard to the PAICs. While the President would chair the NAIC Board, the organization itself may remain hosted in the MOA.

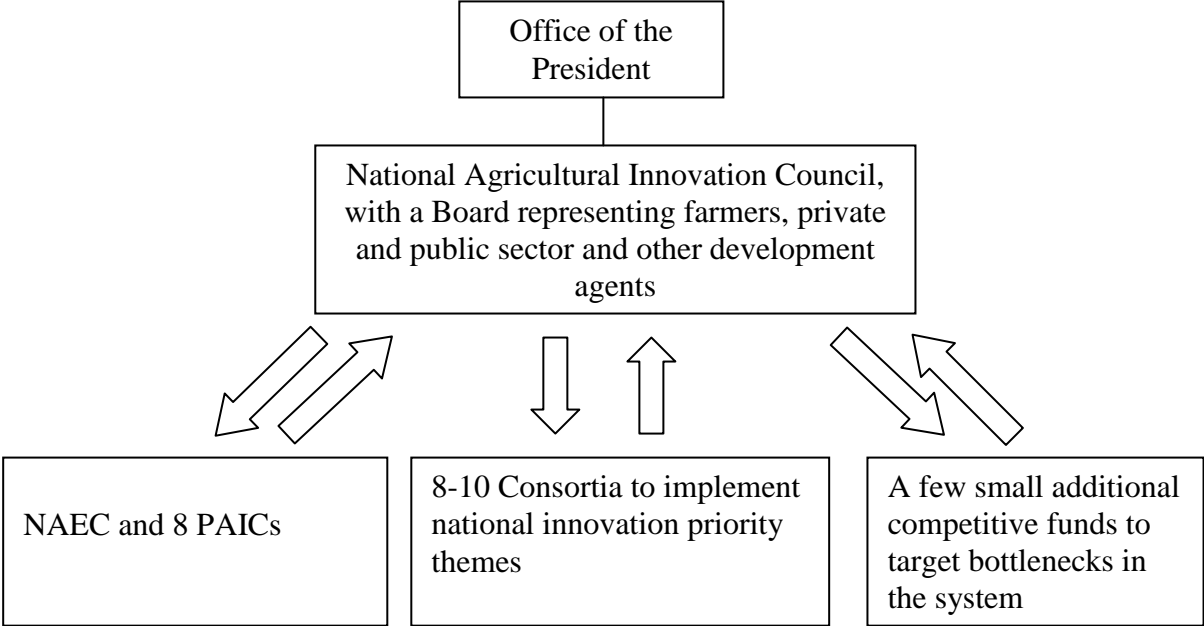
Figure 5.1 outlines how the NAIC could look. Funding will flow from the NAIC to the consortia, the PAICs, and a few small competitive funds on the basis of transparent work plans and budgets, with clear goals and objectives. In addition, a monitoring and evaluation system will be put into place. With regard to the government agencies participating in the consortia, NAIC will fund only the operating cost. Salaries and other costs will be channeled through the normal line budgets.

The PAICs will operate as described in chapter 4—relatively independently, driven mainly by farmer demand, but within a coordinated national framework through links with the NAIC. The development of PAICs in conflict-affected areas may require further consideration, to balance the possible benefits of extension activities with the risks of not being able to operate.

Priority themes for mission-mode programs should be selected through an open process of consultation and competition, backed up by solid analysis and a business case. The programs should have a strong focus on economic impact. Examples include:

- Livestock products, such as developing the dairy industry.
- Aquaculture.
- Fresh or processed horticultural crops, both for domestic use and export.
- Spices, plus medicinal and aromatic crops.
- Organic food products.
- Lagging regions or conflict-affected regions (when sufficiently stable to allow operations).

Figure 5.1: Suggested organization of the National Agricultural Innovation Council



Source: Authors

Investments in priority themes will add up to substantial sums, so themes should be selected carefully. About half of the national priority themes may be assigned to broadly supported, national priorities; the other half may be determined on the basis of an open competition. The level of ambition should be to attain projected results in 5–10 years, with a possible extension to 15 years. The implementation of innovation priority themes will be assigned to consortia (see below). Clear intermediate targets should signal whether the program is on track. The NAIC Board can decide to stop a priority theme if it fails to deliver.

Consortia will be formed to address technology and innovation problems of national importance. A consortium is a formal group of like-minded partners that will carry on a given task by sharing an innovation agenda and resources as specified in an agreed work plan. The success of the consortium depends on the active involvement of all of the major players in its field of agri-business and on harmonious coordination among the members, with a high degree of transparency. The consortium should be needs-based; accordingly, appropriate partners should be identified to manage a given task. The identification of the partners for the

consortium will be dependent on the target groups, socio-economic background of farmers and participants in the value chain, available infrastructure, and the problems they are currently working on.

Each of the consortia will have its own steering committee with representatives of the public and private sectors. As mentioned, these steering committees will have to approve the work plans and budgets before they are sent to the NAIC Board for approval. In addition, they will monitor the implementation of the program on a regular basis and report to the NAIC Board on an annual basis.

Activities undertaken by a consortium should focus on the constraints that limit the development of the particular value chain in question, such as:

- Searching for technologies that can be imported from elsewhere and testing their suitability for local use.
- Developing and/or testing production technologies that are suitable for the market.
- Building a safe and efficient value chain for each of the selected commodity areas (for example, the production and processing of dairy products).
- Improving supply chain management, including traceability.
- Establishing quality assurance standards and certification systems for key export markets.
- Organizing, training, and linking small-scale farmers to high-value markets.
- Making contract farming a “win-win” relationship between producers and buyers.

Other interrelated issues to be taken up by these consortia include:

- Capacity building and building public-private partnerships.
- Opportunities for further value-added processing.
- Increasing the role of rural women in producing and processing agricultural products for domestic and global markets.
- Training farmers to be reliable food-chain partners.

Consortium partners can be research institutes, universities, extension services, farmer organizations, financial institutes, private enterprises, and associations or federations of private enterprises, marketing boards, NGOs, and so forth. Each has its own role to play in the innovation agenda.

5.5 Conclusions

Sri Lanka’s highly fragmented agricultural research and extension system has been severely underfunded for more than a decade. Previously international donors provided financial support for research projects and extension programs, as well as opportunities for professional development, but presently only a few ad hoc projects of interest to donor agencies remain. Government personnel policies serve to restrict opportunities for career advancement, professional development, and/or incentive programs that recognize and/or reward superior service and performance. It should come as no surprise that, with a few noteworthy exceptions where funding has not been a constraint, the current research and extension system has limited economic impact on the agricultural sector.

Despite these constraints, it appears possible to revive the research and extension system and press it into action. If the research and extension system is to contribute directly to economic growth, however, the focus in research and extension must shift from a supply-driven model, which worked well for increasing rice productivity in the past century, to a more market-driven model that enables farmers to diversify towards high-value crops, livestock, and other products. Research and extension must direct their attention away from increasing productivity and towards increasing profitability. For extension in particular, it is essential that planning and implementation become more “bottom-up” to ensure that work concentrates on helping farmers to generate more income rather than to generate more output. Instances of these newer, more contemporary approaches have been observed, but they are not pursued at sufficient scale or with sufficient vigor.

For research and extension to overcome their current structural problems and resource constraints, as well as to focus on increasing profitability and creating economic growth within the agricultural sector, a new oversight system for agricultural research and extension is suggested. The Sri Lankan government should start with the creation of a National Agricultural Innovation Council (NAIC) that would primarily fund 8–10 strategic research and development areas (mission-mode programs), generate appropriate technologies, and help create value chains that would directly benefit farmers in supplying key domestic or export markets. For example, the lack of a dairy industry forces Sri Lanka to import about 80 percent of its milk and milk product requirements, and a mission-mode program to reduce imports could be undertaken with participation of all relevant actors. Key dairy production and supply chain issues would need to be identified and addressed by researchers, extension personnel, farmers, and the private sector, especially milk processors. This is just one example of a strategic research and development activity that might be funded by the proposed NAIC.

Once the NAIC is effective and has established a series of mission-mode programs, the second tier of the proposed system could be established. This second tier involves formation of eight Provincial Agricultural Innovation Councils (PAICs) that would link directly with the NAIC, be accountable to the NAIC, but would focus on implementing these strategic development initiatives at the provincial level, reflecting the different agro-ecological conditions within the country. In addition to helping link research to extension, the implementation mode for these new PAICs would involve bottom-up planning and full accountability to the stakeholders within each target area. The Governing Board (GB) for each PAIC would include a cross-section of stakeholder groups, dominated by farm leaders representing the different constituencies within the province, including women farmers. In addition, input suppliers, traders, processors, exporters, and banking representatives would sit on this GB so that all of the key players within the provincial agricultural sector would be represented and provide oversight of the activities proposed for funding under each PAIC.

The PAICs would be made operational at the division or segment level with the creation of Divisional Agricultural Innovation Centers (DAICs). Each year, annual work plans and budgets would be submitted by each division within the province, in consultation and with the approval of an elected Farmer Advisory Committee (FAC) for that division. This funding arrangement would bring agriculture and livestock departments together (also including the Department of Export Agriculture in 14 districts) as they work to diversify farming systems in their service area. Also, since there are effectively no livestock extension workers in the Provincial Departments of Animal Production and Health (PDAPH), this arrangement could

enable the current cadre of extension workers to take more of a farming systems approach in organizing and implementing these new extension programs.

In addition to providing strategic research and extension funding, the proposed NAIC would fund other strategic capacity-building activities. For example, a comprehensive market information system with information on domestic and export markets could be established. The market information currently collected and provided by HARTI is not made available quickly enough to producers and should be put online as soon as it is collected. Daily price and market data for products in export markets could also be made available online. Finally, an online service could be developed to provide up-to-date information on different high-value export products, as well as the capacity for on-line contracting.

Research and extension need to be linked by an information system through which technical and market information would be readily available to research and extension workers, farmers, private firms, and NGOs. The Cyber Extension component of this system could be housed within a National Agricultural Extension Center (NAEC) that would work with researchers, private firms, and other stakeholders to develop a comprehensive website where all types of technical and market information would be available. This information system would enable researchers at all stations around the country to communicate with each other and to search for useful findings and technologies from other countries. In addition, the Cyber Extension system would provide Internet connectivity to each DAIC. The technology information system could also deliver distance education and in-service training programs to improve the skills and knowledge of extension staff, as well as farmers and farm leaders.

The NAIC may then also support the institutional development of existing research and extension organizations so that they become more effective players in a reenergized Sri Lankan agricultural innovation system. The large majority of institutional support should be linked with the implementation of the mission-mode programs, thereby ensuring that new modalities of operation are being put in place and immediately made effective. Some institutional development activities (for example, institutional policies such as performance-based human resource management) should be implemented simultaneously across all research and extension organizations.

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