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Australian Centre for International Agricultural Research

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Scoping study:

Re-engagement in agricultural research for development partnerships in Sri Lanka

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Cover image: Tea pluckers in Sri Lanka's Western Province. Photo: Alan Dow

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Executive summary

Sri Lanka, a country with 20.5 million inhabitants, has faced many challenges. A 26-year civil war has scarred the nation, and a tsunami in 2004 left tens of thousands of people dead, injured or homeless. Despite these catastrophes growth over the past decades has been strong, resulting in significant poverty reduction across the country. Today, Sri Lanka has achieved most of the Millennium Development Goals and has middle income country status. However, growth has not been uniform and significant pockets of poverty exist in the former conflict districts of Mullaitivu, Manar and Kilinochchi in the Northern Province, as well as Batticaloa in the Eastern Province and Moneragala in the Uva Province.

From 1980 until 1992, the Australian Centre for International Agricultural Research (ACIAR) had a broad collaborative research program in Sri Lanka that covered fisheries, agriculture policy, forestry, animal health and crops. Since 1992, this collaborative program was gradually reduced until the last fisheries project terminated in 2005. Since then there have been no ACIAR-funded projects in Sri Lanka. Early in 2016, ACIAR's Commission requested an assessment to consider re-establishing a collaborative research program with Sri Lanka subject to funding availability. In response, ACIAR undertook a scoping study to assess the potential of such a partnership that aligned with Sri Lankan and Australian government priorities.

The scoping study was conducted in July 2016 and included three phases: (i) a desk review and interviews with Australia-based partners; (ii) a one-week visit to Sri Lanka for consultations with government officials, private sector representatives and university staff; and (iii) prioritisation of the demands and needs of potential partners with a focus on poverty alleviation for female and male smallholders farmers/fishers.

The wide ranging consultations with more than 80 representatives of government, universities and private sector resulted in a long list of potential collaborative research activities as well as requests for training and capacity building. They included, in no particular order: the development of mobile-based agriculture extension advice and market information; rehabilitation of forest degraded by the conflict; management of fish stocks; development of aquaculture for bivalves, shrimps and prawns; product quality in supply chains; transportation, packaging and processing losses; development of research outputs to inform policy; data aggregation and analysis; genetic studies into the unique biodiversity of the country to unlock potential for pre-breeding and breeding programs; and research on crops specific to Sri Lanka such as the Palmyra palm.

This list was diverse, however some key researchable issues were common to many proposals:

- A high percentage of post-harvest losses is occurring in most horticulture, crop and fish supply chains;
- There is a loss of or low-quality product and high inconsistency of supply in value chains;
- There is a lack of value addition for both domestic and export markets;
- There is a need for sustainable intensification of production (but taking into consideration the current policy on fertiliser subsidy for paddy production and climate changing patterns);

- Issues related to the current emphasis on organic agriculture; and
- Food safety issues related to the presence of residues and mycotoxins.

Currently these research areas are not effectively addressed and would benefit from enhanced technical knowledge and targeted co-investment. The scoping study team noted there is currently no national strategic plan to orient the efforts of research institutions towards key priorities to support development across the agriculture sector that is fragmented across numerous ministries and departments; the scoping study team was informed that research funding was dispensed to many and diverse projects that are not always linked to a broader objective.

The scoping study team used a matrix to prioritise and identify potential entry points to re-establish a collaborative research program in Sri Lanka. The three sets of criteria were as follows.

- The program should align with **strategic** considerations, including the priorities and policies of the Sri Lankan government, with its shift from a focus on food security to its current emphasis on increasing the competitiveness of the agriculture sector; and Australian government priorities on engaging the private sector, expanding economic opportunities for the poor, and empowering women and girls. From an ACIAR perspective, the proposed collaboration should benefit both Australia and Sri Lanka; it could be national in scope, but should in the short term benefit the geographic area where poverty is relatively high; and due to the middle income status of the country, there should be high potential for co-investment by country partners.
- The program should be consistent with a **research for development** approach, including addressing problems that are solvable through research; having a plausible pathway towards economic or social development; it should be linked to those who can use it; and should include strategies for the research results to be used and incorporated into development processes.
- The final set of criteria is related to research **partnerships**. The questions asked under this set of criteria are as follows: Is the necessary skillset and expertise available in Australia? Is relevant expertise available in the public or private sector in Sri Lanka? Is there potential for complementarity with investments from the public sector, the Australian aid program, or international agencies? Is the private sector willing and able to collaborate in the research initiatives? The development of MoUs between Australian and Sri Lankan universities, like the one between the University of Peradeniya and the University of Tasmania, would be encouraged.

The conclusion of the scoping study is that there is a conducive environment to re-establish a collaborative research program with Sri Lanka. The recommendation is to start the program with a Small Research Activity (SRA) to design a multidisciplinary project in aquaculture for freshwater shrimp, including a socio-economic component, focused on communities in the Northern Province. Regarding training, a masterclass on bio-informatics and data analysis could be organised in collaboration with the University of Peradeniya. In the medium term, and if funding allows, a program of research on policies, linked to the USD185 million loan from the World Bank to modernise the Sri Lankan agriculture sector, would be very relevant. Finally, depending on the funds available, ACIAR could support research in sustainable intensification and reduction of post-harvest losses in products with a high potential for the export market.

Introduction and objective of the study

The Australian Centre for International Agricultural Research (ACIAR) previously had a collaborative research program in Sri Lanka, which covered fisheries, forestry and crops. There have been no ACIAR-funded projects in the country since the program ended in 1992.

The objective of this scoping study is to examine the potential for ACIAR to re-engage in agricultural research for development partnerships in Sri Lanka. This scoping study will inform the ACIAR commission on:

- The current country context;
- Current key donors in the agriculture sector, and their priorities;
- Public and private sector priorities for agricultural research, including fisheries and forestry;
- Key partners for potential research partnerships;
- Relevant opportunities for ACIAR re-engagement in Sri Lanka.

During the discussions held under the framework of this scoping study, ACIAR clarified that one of the criteria for re-engagement would be the level of co-funding in any project from private and public partners. ACIAR also made it clear to all stakeholders that this scoping study would not necessarily result in investments.

Sri Lanka—an overview

Sri Lanka has a total population of 20.5 million and a per capita gross domestic product (GDP) of US$ 3,811 (World Bank 2016). The country has recently faced some enormous challenges—a 26-year civil war has scarred the nation, and a tsunami in 2004 left tens of thousands of people dead, injured or homeless. Despite these catastrophes growth over the past decade has been strong, averaging 6–7% per year and resulting in significant poverty reduction. Today, Sri Lanka has achieved most of the millennium development goals (World Bank 2015). However, "despite these gains, absolute poverty remains endemic in conflict-affected Northern and Eastern Provinces and in remote districts in Uva and Central Provinces" (DFAT 2015).

Sri Lanka has over 2 million hectares of agricultural land, of which 20% is occupied by plantations and the rest is used for food crops, including rice, maize, fruits, vegetables and other crops grown by smallholder farmers. The country has 1.6 million farms of average size 2 hectares, which contribute 80% of the total food production. Most food crops are grown under irrigated conditions. The country has more than 80

natural lagoons and a multitude of freshwater reservoirs that are used for irrigation and increasingly also for fish farming.

Agriculture is recognised as an important driver of poverty reduction. Agricultural wages grew annually by nearly 6% on average over the last decade resulting in rural poverty falling more rapidly than urban poverty (World Bank 2016). However, there are issues over environmental sustainability, and also whether income gains will be sustainable without serious attention paid to post-harvest issues, diversification, value addition (World Bank 2016) and sustainable intensification.

Sri Lanka lags behind other countries in the region on agriculture productivity measured as total productivity (World Bank 2016). Although agriculture policies (such as fertiliser subsidies) have encouraged import substitution of basic agricultural commodities, they have neglected the domestic fruit and vegetable sectors. Sri Lanka's agriculture trade policies are generally overly complex and not always predictable.

Sri Lanka landscape. Source: Sri Lanka Tourism Development Authority.

Socioeconomic overview

Sri Lanka is home to a diversity of people, including the ethnic majority Sinhala, the Sri Lankan Tamils in the North and East, Moors in the east, northwest and coastal areas of the south, and Indian origin Tamils, Burghers and Malays. This diversity contributes to the richness of the country; however it also creates an ongoing challenge for social inclusion and peaceful co-existence of communities.

The economic growth of the last decades is a development success. However, and unfortunately, the benefit of development has not been distributed equally across all groups and all locations. Moors, for example, have experienced the fastest decline in poverty, whereas Sri Lanka Tamils have the highest rate of poverty among the ethnic groups (World Bank 2015)

As can be seen in Figure 1, the poverty rate is below 15.3% for a large part of the country. The distribution of people living under the national poverty line is concentrated in three main areas: the former conflict districts Mullaitivu, Manar and to a lesser extent

Kilinochchi in the Northern Province; Batticaloa in the Eastern Province; and Moneragala in the Uva Province. Figure 1 also reveals significant geographical disparity for poverty distribution in some districts. Poverty rates in Batticaloa, for example, vary from 5.3% to 45.1%.

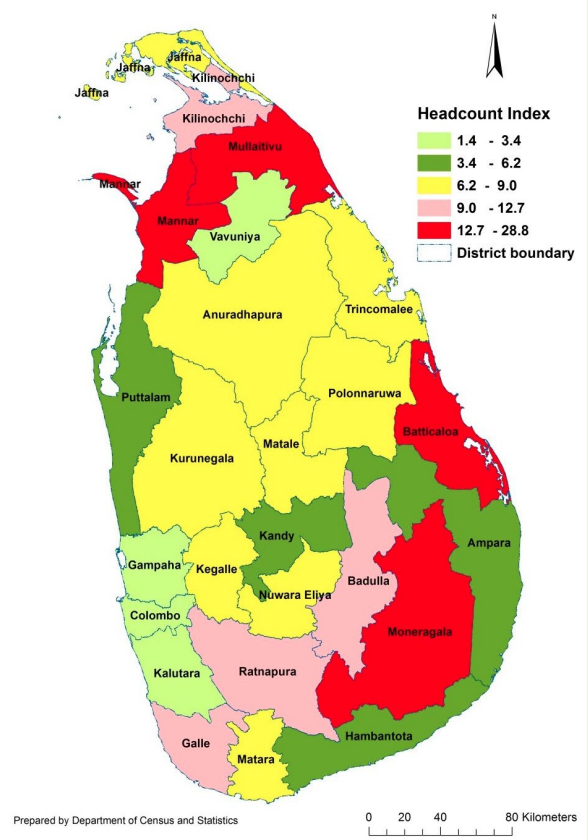

Figure 1. Distribution of poverty headcount index for 2012/2013. The headcount index is a percentage representing the proportion of the population with real per capita consumption expenditure below Rs. 3,624 (equivalent to US$1.50 in 2005 purchase power parity terms) line. (Source: DCS 2015.)

Climate and agro-ecological zones

Sri Lanka has a tropical climate with high humidity. Seasons are determined not by change of temperature, but by the rainfall distribution and two monsoons. The northeast monsoon in November– February is locally called 'Maha season' and the south-west monsoon from May–September 'Yala season'. Topography plays a major role in the pattern of rainfall distribution and variation in temperature. While the northeast monsoon rains are island- wide, the mountains intercept the southwest monsoon. Thus the country can be divided into three climatic zones, which also define three main agroecological zones (Figure 2):

a) The highlands and the southwest that receive both monsoons are the 'wet zone'. This is the most intensively exploited zone with 67% of the area under permanent agriculture.

b) The northern and eastern lowlands, which receive only the northeast monsoons, are the 'dry zone'. This zone covers two-thirds of the agricultural area of the country. It is the most favoured area with regard to radiation levels, but lack of rainfall during February–September is a major constraint to crop production. Most of the country's irrigation system is located in this zone, and with irrigation, yield potential for field crops is high in the zone. This area also has great potential for aquaculture.

c) A narrow strip of land fringing the highlands to the north and east lies between the two zones and is the 'intermediate zone'. This zone is dominated by coconuts along the western coastal region, and dairy production has a long tradition.

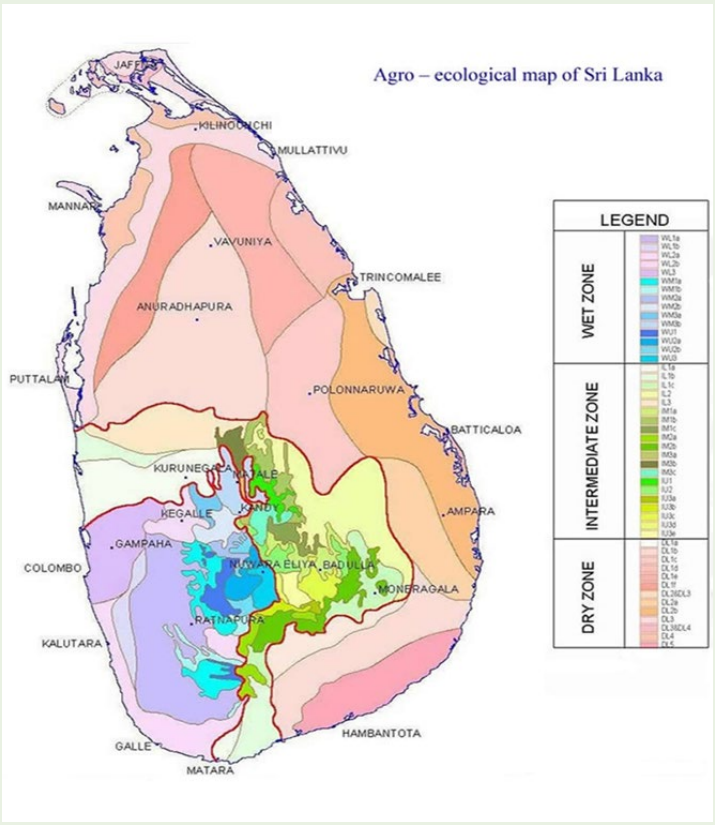

Figure 2. Agroecological map of Sri Lanka. (Source: Department of Agriculture, Sri Lanka; http://www.labour.gov.lk/web/images/srilanka/maps/ecological.jpg.)

Methodology

The scoping study was divided into three phases:

- A desk review of documents and face-to-face or phone interviews and discussions with stakeholders based in Australia.
- A 1-week country visit (18–22 July 2016) for consultations with stakeholders from the public and private sector, to gather proposals for partnerships.
- A post-visit period to analyse the data collected and write the scoping study report.

Annex 1 provides details of the 85 people interviewed during this study1. We interviewed people individually and in groups. We used semi-structured interview techniques, where we allowed interviewees to first present their priorities or ideas for collaboration. Then, after discarding infrastructure proposals, or areas where no skills or expertise were available in Australia, we discussed some proposals in more depth. The various proposals were then prioritised using a set of criteria presented later in this report.

Current investments in agriculture

Government of Sri Lanka

In 2015, government expenditure for the ministries of relevance to the ACIAR portfolio represented approximately 5% of the total expenditure, distributed as follows (Ministry of Finance 2015): Ministry of Agriculture, 53 billion Sri Lanka rupiah (LKR) (equivalent to A$ 485 million) or 3% of the total expenditure of the government; Ministry of Fisheries and Aquatic Resources Development, LKR 4.5 billion (this allocation has been increasing in the last 4 years); Ministry of Plantation Industries, LKR 4.2 billion; Ministry of Environment and Renewable Energy (which includes the Forest Department), LKR 1.6 billion; Ministry of Livestock and Rural Community Development, LKR 670 million.

The largest expenditure is handled by the Ministry of Agriculture, which has seen its relative share of investment decline from 4.7% in 1999 to 3% today. The bulk of the Ministry's budget is spent on implementing the rice fertiliser subsidy policy, which covers 95% of the cost of importing fertiliser (Wijethunga and Abeysekera 2010). The allocation to public agricultural research from this budget was LKR 1.3 billion (equivalent to A$ 11.7 million) in 2009 (IFPRI 2012), and this amount has not grown significantly since then. A significant proportion of the funds allocated to research—up to 80% according to Sri Lankan officials met with during the scoping study—is used for maintenance of infrastructure and salaries, leaving little investment for research operations.

Key donors and their priorities

Sri Lanka is a middle income country (World Bank 2016) and as such the concessional financing that the country received in the past several decades has ceased. Sri Lanka is also becoming a donor country and is starting to share its development experience through technical and grant assistance programs. For example, the country provided grant assistance of US$ 10 million to the Government of Maldives for construction of a 4.8 km road using Sri Lankan constructors (Ministry of Finance 2013).

Sri Lanka key donors are China, India, Japan and multilateral donors including the World Bank and the Asian Development Bank (ADB) (Figure 3). Donors of importance categorised under the Western Countries in Figure 3 are Australia, the United States, the European Union (EU), Germany, Korea and Norway.

From a sectoral perspective the majority of grants and loans are allocated to infrastructure development; road, bridges and the transport sector accounted for 70% of all funds in 2013. This allocation will improve connectivity and will benefit the development of more effective supply and value chains in agriculture. There are however only a handful of donors working specifically in the agriculture sector. These donors are listed below, with their main projects and priorities.

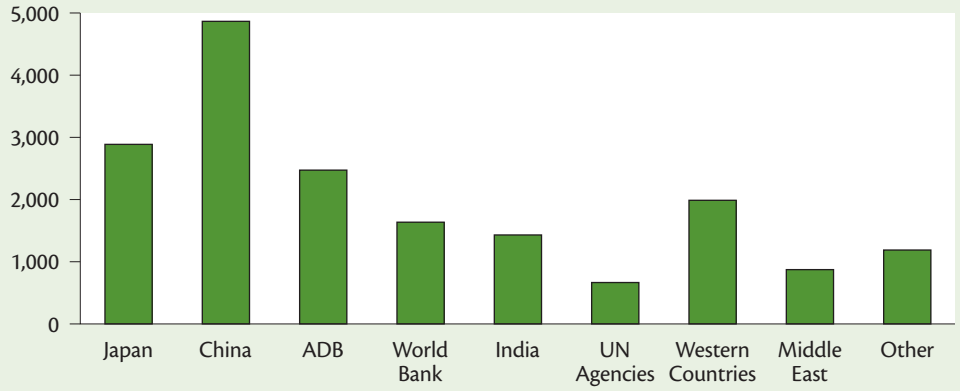

Figure 3. Total commitments from major development partners (2006 – September 2013). Source: Ministry of Finance 2013.

Japan is funding a diverse program that includes: the establishment of a research and training complex at the Faculty of Agriculture of the University of Jaffna in Kilinochi with a grant equivalent to A$ 21 million; support for irrigation in the dry zone; a rural community development program in Trincomalee and Hambantota; animal husbandry in the North and East Province; and the promotion of integrated plant nutrition.

The **World Bank** has just approved a US$ 185 million loan for an agriculture sector modernisation project, which will include a subcomponent costing US$ 4.2 million on analytical and policy advisory support that will support research for evidence-based policy. Other components of the project will provide grants and credit guarantees to foster the development of as-yet undefined supply and value chains (World Bank 2016). Other areas of investment include support to irrigated agriculture in the northeast, and a national community development and livelihood improvement project.

India is providing support to Sri Lanka in various areas of the agriculture sector. The existence of a memorandum of understanding (MoU) for Scientific and Technical Cooperation between the Indian Council for Agricultural Research (ICAR) and the Sri Lanka Council for Agriculture Research Policy (SLCARP) is of particular interest for ACIAR. One week prior to the visit of the scoping study team, the ICAR Director General and the Secretary from the Department of Agricultural Research and Education in India visited Colombo and identified the following areas of collaboration: (i) natural resource management with research on climate change impacts on productivity, waterlogging and strategies to mitigate the impacts, waste water use, and use of city compost in agriculture; (ii) animal sciences; and (iii) fisheries.

The **Food and Agriculture Organization** of the UN (FAO) has a portfolio of projects worth US$10 million covering two broad priority areas:

(i) Achieving sustainable food and nutrition security, working in three sub-sectors:

- Food crops, for example addressing increased production, post-harvest transport losses, packaging and food safety. Specifically, FAO is attempting to increase awareness on how to improve product quality and is focusing on beans and bananas.

- Livestock, with work supporting good practices for animal husbandry such as growing fodder crops and access to water and night feeding. FAO mentioned that they would like to do additional work in highly pathogenic Asian avian influenza.
- Fisheries, with work in sea bass broodstock improvement, seedlings production and feeds.

(ii) Preserving and rehabilitation of forestry and biodiversity of forests, with various small activities on capacity development in the north and east of the country.

The **World Food Programme** (WFP) is doing policy work with the Medical Research Institute (MRI) and the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI) on food security, nutrition and resilience. As part of an effort to increase resilience within supply chains, they are rehabilitating irrigation infrastructure and invest in school feeding program. Another very interesting program is the bio-fortification work where, using Chinese technology, micro-nutrients are added to rice flour, then rice kernels are reconstructed from the bio-fortified flour and the reconstructed kernels are added at a ratio of 1/1000 in packets of rice sold in the market.

The **International Fund for Agricultural Development** (IFAD) has been one of the main development partners of Sri Lanka. IFAD has extended concessional loans of US$ 400 million for 16 projects in the last two decades focusing on poverty reduction, benefiting more than 550,000 rural households. However, since Sri Lanka's graduation to middle income status the country is no longer eligible for highly concessionary loans. IFAD is focusing on irrigation rehabilitation and agribusiness development.

The **United Nations Development Programme** (UNDP) has a small investment in the country on control of alien species and is providing funding to a community forestry program.

Australia's total overseas development assistance (ODA) estimate for Sri Lanka is AU$ 27.5 million, this include AU$ 19.9 million in bilateral funding managed by the Department of Foreign Affairs and Trade (DFAT). DFAT is transitioning its aid program towards an economic partnership approach with three objectives (DFAT 2015): (a) expand economic opportunities for the poor; (b) support government to be more responsive to the needs of citizens and the private sector; and (c) increase gender equality. Specifically, DFAT is funding the Market Development Facility (MDF), a 6-year A$ 48 million private sector development project which uses the Market Development Framework/Making Markets Work for the Poor (M4P) approach. Even though the MDF focus is not agriculture, it has invested in the development of aquaculture value chains. ACIAR could also build on work done by the Local Empowerment through Economic Development (LEED) project, a DFAT investment that was implemented by the International Labour Organization and is now closed. LEED had successes in fruit and aquaculture value chain development.

The **United States Agency for International Development** (USAID) has a focus on economic growth and trade, and is funding a US$ 3.5 million agriculture project on increased competitiveness in the global market place.

Finally, the **EU** has a project to promote food security, rehabilitation of irrigation tanks and provision of agricultural inputs.

Key institutes and organisations involved in research

Government ministries and departments

The **Ministry of Agriculture** covers all aspects of domestic agriculture including policy, and crops including rice, fruits, vegetables, legumes, other field crops, spices and ornamental plants. The following research institutes fall under the Ministry of Agriculture: the Department of Agriculture (DoA), the Department of Export Agriculture (DEA), the Hector Kobbekaduwa Agrarian Research and Training Institute (HARTI), the Institute of Post-Harvest Technology (IPHT), the Veterinary Research Institute (VRI), and the National Botanical Gardens (NBG). A more complete list of public and private research institutions involved in agriculture in Sri Lanka can be found in annex 2.

The largest research institute is the DoA, which focuses on increasing productivity in the food crop sector. It also engages in a number of agricultural activities outside of research, such as seed distribution, the production of seed and planting materials, and education (DoA 2006). Surprisingly, during our consultation at the Ministry of Agriculture, the discussions focused mainly on issues related to competitiveness of supply chains in fruit, vegetables and aquaculture, but little on food crops. This illustrates the shift in government focus from food self-sufficiency to a broader agriculture competitiveness agenda.

The **Ministry of Fisheries and Aquatic Resources Development** includes the National Aquatic Resources Research and Development Agency (NARA) and the National Aquaculture Development Authority (NAQDA). NAQDA is responsible for the development of aquaculture and inland fisheries and NARA is responsible for carrying out research on all living and non-living aquatic resources in order to develop and manage fisheries and aquatic resources.

The **Ministry of Plantation Industries** has an important and relatively well funded research capacity and includes the following research institutes: the Tea Research Institute, the Rubber Research Institute, the Sugar Research Institute and the Coconut Research Institute (which also studies oil palm).

The Forest Department within the **Ministry of Environment** includes a forest research team and two regional forest research centres. The Veterinary Research Institute is administered by the Department of Animal Production under the **Ministry of Livestock and Rural Community Development**. Finally, the **Ministry of Primary industries** has recently been established and is becoming increasingly involved in in economic development in agriculture, however it does not have research capacity for the moment.

From an ACIAR engagement perspective, the **Sri Lanka Council for Agricultural Research Policy** (SLCARP) is the umbrella organisation that oversees the public national agricultural research system and a key discussion partner for the development of a collaborative research program. However, we concluded from discussions with government officials that there is a need to improve the strategic coordination of agricultural research in Sri Lanka. The research

system is very fragmented and has poor communication. There is funding available from SLCARP, but we were told that grants were provided to many small projects that were not always linked to a coherent strategic framework. As such, any ACIAR re-engagement should consider SLCARP capacity gaps and needs.

Universities

Eight Sri Lankan universities are engaged in agriculture research: Sabaragamuwa University of Sri Lanka, Wayamba University of Sri Lanka, the University of Jaffna, Eastern University, the University of Ruhuna**,** the University of Peradeniya (UoP), University of Colombo and Rajarata University of Sri Lanka. Their faculties of agriculture employed a total of 71 full-time equivalent (FTE) research staff in 2009 with UoP having the largest faculty. This number of FTE has steadily increased since 2009, and during our visit to Sri Lanka we were informed that Peradeniya now had 50 FTE researchers and Ruhuna 35 FTE researchers.

Private sector

There are no data available on private sector agricultural R&D investments in Sri Lanka. The information that we gathered during this scoping study is presented below, and names and details of the private sector representatives met are included in the contact database in Annex 2.

CGIAR

The International Water Management Institute (IWMI) is headquartered in Colombo and has a research program in Sri Lanka including projects on water policy, water security, water use in irrigation, water management in rainfed systems, early warning system development and waste management and recycling. Other CGIAR centres have projects in the country, the most important being the International Rice Research Institute (IRRI). Surprisingly, the CGIAR was not mentioned by government officials or university staff during the discussions.

Agricultural research priorities

Government agencies

The priorities for collaborative research presented below result from discussions held on the first day of the country visit. A meeting was organised at the Ministry of Agriculture, chaired by the Secretary of the Ministry of Agriculture Mr B. Wijataratne, and attended by 28 participants representing the majority of the public research institutions (see Annex 2).

The overarching theme of the **agriculture development policy** is to improve the productivity of the sector by increasing competitiveness on domestic and foreign markets. A presidential taskforce on national food production has developed the Food Production National Programme (2016–2018) that includes the following objectives:

- Self-sufficiency in traditional food and import substitution. Production targets have been set for rice, maize, groundnut, chili, ginger and turmeric.
- Sustainable intensification using environmentally friendly food production methods.
- Food safety.
- Management of food stocks and food reserves.
- A crop production program based on agro-ecological zones.
- Increasing coordination between all institutions involved in food production.
- Increasing women and youth entrepreneurship and employment in rural areas.
- Improving the extension system with investment in vocational training for extension.

The meeting at the Ministry of Agriculture.

The **DoA**'s main research focus is post-harvest losses across all supply chains. Losses of up to 40% are reported due to pest, storage and transport issues, and these add to relatively low yields and result in very low productivity. The key areas where the DoA sees opportunities to collaborate with ACIAR were post-harvest, value addition, soil and water management, and mitigation and adaptation to climate change. During the meeting in Colombo, DoA staff also presented their training needs in research management, plant quarantine, food safety residue analysis, advanced breeding technologies and crop management practices.

The **Department of Agrarian Development** (DAD) has a broad mandate including irrigation infrastructure and extension. The key area of collaboration with ACIAR that they identified was water management: mapping water resources using remote sensing and improvement of irrigation infrastructure. The improvement of irrigation links with the competitiveness policy of the government by improving the production environment. Once the scoping team explained that ACIAR would not fund solely infrastructure, the head of DAD then highlighted research needs in the development and use of organic fertiliser, and the modernisation of farming techniques to improve productivity.

The **Veterinary Research Institute** (VRI) has two research arms, one focused on animal production and one on animal health. VRI has a particular focus on highly pathogenic Asian avian influenza (HPAI), as importing countries are demanding HPAI-free certification. This was also highlighted during discussion with FAO. VRI also has a research focus on dairy to support the government objective to reduce its reliance on imported milk. They indicated that investment had been made in infrastructure to support the dairy industry, however there is a lack of trained personnel. The key opportunities identified by VRI to work with ACIAR were related to their current research project on anti-microbial resistance (AMR) in milk and eggs, the analysis of mycotoxins and chemical residues, and research to improve diagnostic

methods for tuberculosis, leptospirosis and rabies. Researchers from this institute recalled the successful work done with ACIAR in 1980s and 1990s to develop heat-resistant vaccine (HRV4) against Newcastle disease under projects 8334 and 8717, and also indicated a general interest in working with vaccines.

NARA has a focus on breeding and culture technology development. During our discussions with both NARA and **NAQDA**, we were favourably impressed by their expertise and their motivation. They submitted a list of potential research areas for collaboration as well as a list of short-term and long-term training requests (see Annex 3). Discussions highlighted the great potential for aquaculture in a country with a multitude of small freshwater reservoirs, as well as the development of the lagoons on the coast. We discussed the list in order to prioritise areas for collaboration, and arrived at the following:

- Support in sea bass production, complementing the work done with FAO.
- Sustainable intensification of shrimp farming (*Penaeus monodon*), including broodstock domestication, research into white spot disease, and support for the development of 'newcomers' such as *P. vannamei* and *Macrobrachium rosenbergii*.
- Research on production and marketing of bivalves including oysters.

Additional areas for collaboration were related to lobster and crab farming and restocking, coral reef rehabilitation and seaweed farming.

The **Forest Department** has a wide research agenda including: forest restoration, increasing forest cover, biodiversity, biomass and carbon estimation, climate change adaptation and mitigation measures, prevention of invasive plants, pests and diseases, watershed management and soil conservation and biotechnology. Unfortunately, it was not possible to have a prioritisation exercise with the forest department due to time constraints.

HARTI identified technical support for developing a market information system as well as research in price forecasting as two key area for collaborative research. They also presented a list of capacity development needs and identified difficulty in accessing resources as a key constraint for the institute.

Private sector

During the scoping study we had opportunities to discuss with the private sector on four separate occasions. Prior to the visit to Sri Lanka we had a discussion with Wellard in Canberra. During the country visit, a 2-hour meeting was organised by the Prime Minister's Office bringing together the main agribusiness players in Sri Lanka (see Annex 2). We then travelled to Negombo to meet with two private companies working in aquaculture—Taprobane Pty Ltd. and Divron Bioventures.

Wellard Rural Export and the **National Livestock Development Board** (NLDB) have formed a joint venture to supply dairy cattle, infrastructure, equipment and management to Sri Lankan dairy producers to increase Sri Lanka's dairy herd and increase the yield of milk per cow. Under this project, Wellard will import 22,500 Friesian–Jersey cross heifers to Sri Lanka. The heifers will be distributed between a commercial dairy farm in Hambantota and medium size dairy producers in the south of the country who will manage 50–100 cows. The key research issues identified by Wellard were related to fertility and feed.

During the meeting at the Prime Minister's Office, the scoping study team heard that Sri Lankan exporters need to penetrate global niche markets with specialised products. The successful tea value chain could be used as a model and research could analyse how it can be duplicated for mangosteen, rambutan, pineapple or mango. Research on post-harvest losses should be prioritised and recommendations to reduce those losses should be provided to producers and processers. The lack of value addition is a key concern as Sri Lanka exports a majority of its product in raw form. We heard that the development of processing capacity for niche health-oriented goods, such as coconut oil, has great potential.

In general, the agribusiness representatives felt that there is a need for increasing productivity for small-scale farmers and developing a market-oriented production pattern. This increase should however be done carefully, as there is at present overuse of fertilisers and pesticides resulting in high environmental costs that are not sustainable, as well as a quality issues due to the presence of chemical residues in the food chain.

The changing climate patterns have disrupted/shifted traditional crop cycles and there is a need to develop climate-smart recommendations for small farmers. Also, due to the lack of market signals and of good data on production and markets, production is timed poorly resulting in oversupply of products during part of the year and insufficient supply at other times.

The private sector representatives held the view that the current research system is inadequate; it is fragmented and does not respond well to demands from the private sector and traders. The system also suffers from a 'brain drain', as young and promising scientists are going overseas. They predicted that in 10 years the Sri Lankan agricultural research system will be obsolete as there is little recruitment of young scientists with PhDs and the current budget is only sufficient to pay salaries and maintain basic infrastructure, but not to invest in research and modern infrastructure.

Aside from these generic concerns, three key research opportunities were presented:

- Restoring the floriculture sector and using Sri Lanka's biodiversity to find new ornamental and cut flowers.
- Focus on one value chain—such as mangosteen for example—and develop a strategic plan from the field to the plate for its development linked with infrastructure and R&D investment.
- The use of mobile phone and other ICT methods to provide extension advice and information to farmers and allow aggregation of production data.

In aquaculture, we had a very fruitful discussion with Divron Bioventures who are establishing a freshwater prawn (*Macrobrachium rosenbergii*) value chain with poor communities in the north of the country that have been affected by the conflict. Because of the conflict, some areas of Sri Lanka have been neglected as they were considered too dangerous to visit. Therefore the natural and artificial ponds in these area are relatively untouched and provide an optimal grow-out environment for freshwater prawns. Divron Bioventures has been supported by the DFAT-funded MDF to develop this value chain. There are many issues that can be addressed by research, including improving production of seedlings using probiotics,

decreasing mortality rate in the ponds, reducing post-harvest losses, and marketing and socioeconomic studies to analyse the distribution of benefits along the value chain. Another interesting discussion was held with Taprobane, an established company employing up to

1,000 employees during peak working periods. Taprobane identified two key areas for collaborative research: research and development to support the establishment of a new prawn industry using *P. Vannamei* in the southeast of the country; and research on illegal, unreported and unregulated fisheries in the north of the country and its effect on coastal communities depending on crab and lobster fishing for their livelihoods.

Universities in Sri Lanka

It is difficult to generalise the research priorities of the three Sri Lankan universities met with during the scoping study due to their differences. They included the University of Peradeniya (UoP), a well-established institution and a national research leader in agriculture, and the University of Jaffna, a teaching university that is currently rebuilding its infrastructure and has a limited number of academic staff.

University of Peradeniya

We had a half-day meeting at UoP that was attended by all the heads of departments of the Faculty of Agriculture. The scoping study team met with the Vice Chancellor who was very positive and interested in collaboration with ACIAR. He highlighted a recent MoU that was signed between UoP and University of Tasmania (UTas) (see Annex 4). UoP is also collaborating with CSIRO (Dr Mark Howden) on a seasonal forecasting project that was funded by former AusAID, and is participating in a project with UTas on eco-efficiencies of rice systems with Prof. Holger Meinke. Ian Nuberg and Desmond Coleman from the University of Adelaide also have a collaborative research program with Prof. Janendra de Costa on effective irrigation of tea.

We summarise below the key point of the discussions by department.

The **Agribusiness Centre** identified post-harvest losses and cost–benefit analysis of the paddy fertiliser subsidy as two key areas for collaborative research. The **Agriculture Biotechnology Centre** highlighted its focus on utilisation of biodiversity and was interested in investigating and characterising the unique Sri Lankan gene pool for use in rice pre-breeding, for example. The director of the centre also indicated a need for bio-informatics training to better analyse the data they are collecting. A masterclass on the subject could be organised at UoP. The **Biology Department** was interested in collaboration in the area of environmental impact assessment and toxicology. The **Animal Science Department** and the **Soil Science Department** has interesting collaboration on anti-microbial resistance (AMR) funded by Sweden and with a grant from the National Research Council (NRC). It also has some research in fishmeal development and would be interested in doing more work in food safety.

The **Fisheries Department** is headed by Dr. Saman Athauda who received his PhD from James Cook University. The department is doing interesting research in both capture-based and culture-based aquaculture and is focusing on:

- Production improvement of tilapia, carp, *Macrobachium rosenbergii*, *P. Monodon* and *P. Vannamei* and Asian sea bass;
- Development of broodstock for freshwater fish and prawns;
- The use of microorganisms and their products in aquaculture.

The **Soil Science Department** works on sustainable intensification and the relationship between soil contamination and environmental and health issues. Some preliminary work on precision agriculture is also being done. The **Food Science Department** is concerned with food health safety, analysis of residues and accreditation issues. The **Agriculture Engineering Department** has research on agriculture water pollution and pollution management of wetland systems. A focus of research in the **Crop Science Department** is the uptake and distribution of heavy metal in plants. The **Agricultural Economics Department** has two staff who are studying in Queensland and New South Wales thanks to Australia Awards Scholarships. The department has a broad research program covering all areas from farm management to marketing and has developed a concept note in collaboration with Griffith University to research chronic kidney disease of uncertain origin (CKDu), of which there is a high incidence in rural areas, specifically the North Central province. The **Agricultural Extension Department** is a new department that was formerly attached to the Economics

Department. It focuses on education, communication, sociology and farm management and has some trials monitoring the use of technology and agrochemicals on farm. The **Forestry Department** is doing work in forest restoration and is trying to establish linkages with Australia to learn from the forest rehabilitation work being done in abandoned mining sites in Western Australia. It is also carrying out some research in ecosystem management and services.

University of Ruhuna and University of Jaffna

The Faculty of Agriculture of the University of Ruhuna has seven academic departments: Agricultural Biology, Agricultural Economics and Extension, Agricultural Engineering, Animal Science, Crop Science, Food Science & Technology and Soil Science. It has established a collaboration with the School of Computing, Engineering & Mathematics at Western Sydney University for the development of a mobile-based extension system for cinnamon. In fisheries, the university has links with several universities in Japan and the focus of its research is on cage aquaculture in brackish water in natural lagoons. We met four heads of departments from the University of Jaffna. They are rebuilding the university thanks to a grant from the Japanese Government. The academic staff at the university has little time for research as the focus is mainly on teaching, however they have established collaboration with UoP and provide sites for and manage experiments.

Universities in Australia

Prior to our visit to Sri Lanka, we had a meeting with Prof. Athula Ginige from the University of Western Sydney to discuss the collaborative research program they have with the University of Ruhuna and University of Colombo, aimed at improving the yield, quality and viability of some important agricultural crops through ICT-based interventions. This collaborative project has developed an app for android devices which is being tested with farmers using technical information developed by the Department of Agriculture. We also had a discussion with Dr Samanthi Gunawardana from Monash University about her project with Oxfam focusing on facilitating rural women's participation and recognition in sustainable livelihoods in post-war Sri Lanka.

Criteria to prioritise ACIAR potential investments

We propose three sets of criteria to prioritise ACIAR investments (Table 1):

- The program should align with **strategic** considerations, including the priorities and policies of the Sri Lankan government, with its shift from a focus on food security to its current emphasis on increasing the competitiveness of the agriculture sector; and Australian government priorities on engaging the private sector, expanding economic opportunities for the poor, and empowering women and girls. From an ACIAR perspective, the proposed collaboration should benefit both Australia and Sri Lanka; it could be national in scope, but should in the short term benefit the geographic area where poverty is relatively high; and due to the middle income status of the country, there should be high potential for co-investment by national partners.
- The program should be consistent with a **research for development** approach. Thus any potential investment needs to:
  - address constraints that are be solvable through research, as opposed to through investments;
  - define a plausible impact pathway towards economic or social development;
  - be 'future proof'—that is, the results of the investment (either its research products or its capacity development outcomes) have low likelihood of obsolescence, so that the results of the investment will be of value into the future;
  - be linked with those who can use it (either scientists or producers);
  - have strategies to ensure that the research results are used and incorporated into development processes;
  - be scalable, that is, the research outputs and outcomes can be taken to scale (as part of the prioritisation exercise the time to impact should be considered, and priority given to start with investments that have a short time to impact, to help ACIAR demonstrate success early and build confidence in its collaborative program).
- **Partnerships for delivery:** The final set of criteria refers to the various institutions and individuals who will participate in the collaborative research. The questions asked under this set of criteria are as follows: Is the necessary skillset and expertise available in Australia? Is relevant expertise available in the public or private sector in Sri Lanka? Is there potential for complementarity with investments from the public sector, the Australian aid program, or international agencies? Is the private sector willing and able to collaborate in the research initiatives? The development of MoUs between Australian and Sri Lankan universities, like the one between the University of Peradeniya and the University of Tasmania, would be encouraged.

Table 1. Criteria for prioritising ACIAR investments in Sri Lanka.

Strategic alignment	
Sri Lanka priorities	Does the proposed research address priority policy areas of the government (see p. 16—agriculture development policy)
Australian priorities	Are there opportunities to engage with the private sector?
	Will the research results have potential to increase gender equality?
	Will the research results lead to economic empowerment and/or expand economic opportunities for the poor?
Shared benefits	Is there a public or industry interest in both countries that could benefit from the research?

Research for development	
Researchable Issues	Are there specific research questions to be answered, including adaptive or applied research questions?
Solvable	Is the issue solvable by research in the current state of knowledge?
Sustainability	Is the research proposed 'future proof', i.e. has low likelihood of obsolescence
Pro-poor	Will the research have an impact or be conducted in the poorer area of the country (see Fig. 1)
Women's engagement	What is the potential to economically empower women and girls in this research in the short and long term?
Scalability	What is the feasibility of taking the research outcomes to scale? (Lag time to impact will also be considered in the selection)

Delivery partnerships	
Australian Partners	Is the necessary skillset and expertise available in Australia?
Sri Lankan Partners	Is the necessary skillset and expertise available in Sri Lanka, including institutes with a relevant mandate but low capacity that could be strengthened by the collaboration?
Complementarity	Is there potential for complementarity with investments by the public sector, Australian aid program, or international agencies?
Private sector	Is the private sector willing and able to collaborate in the research initiatives and co-invest?

Conclusions and recommendations

A common thread in all our discussions was the positive attitude towards establishing a new research collaboration, and the willingness of all potential partners to engage and co-invest in the proposed research program. The discussions with both Sri Lankan and Australian officials led us to conclude that there is a conducive environment to re-establish a partnership, and that renewed ACIAR presence in Sri Lanka will be welcome.

Annex 3 includes some of the proposals received. As would be expected from such an exercise, we received a long list of ideas ranging from strategic areas of engagement to some small personal projects and short-term training opportunities. However, we were impressed by the richness of the discussion and the quality of the proposals. Many proposals had common issues that could provide the basis for a collaborative program with Sri Lanka:

- Post-harvest losses are reported in most of the horticulture, crop and fish supply chains;
- There is a loss of or low-quality product and high inconsistency of supply in value chains;
- There is a lack of value addition for both domestic and export markets;
- There is a need for sustainable intensification of production (but taking into consideration the current policy on fertiliser subsidy for paddy production and climate changing patterns);
- Research issues related to the current emphasis on organic agriculture; and
- Food safety issues related, among other things, to the presence of residues and mycotoxins.

The first four generic issues are well aligned with the strategic priority of Sri Lanka to increase the competitiveness of the agriculture sector and, depending on the value chain chosen, would also align well with Australian priorities of economic empowerment, gender equality, on-farm and off-farm employment opportunities and engagement of the private sector.

One of the key decisions to start the engagement would be to choose a value chain that will benefit communities in the poorer parts of the country, have potential for economic empowerment for the poor, benefit women and girls, and have private sector engagement. The recommendation is to start with a small research activity (SRA) and design a 3- to 4-year collaborative project, accompanied by a short-term training activity in the country. The SRA and the training activity will give time to re-establish links between institutions and familiarise potential partners in Sri Lanka with ACIAR operations. We recommend to start with a multi-disciplinary project to broker national partnerships and incentive collaborative research. The most promising sector in Sri Lanka for ACIAR engagement is aquaculture, as it has great potential for short-term impact and is in dire need of research and development support.

Key research opportunities by order of priority

Livestock and fisheries

Among the various value chains discussed, support for the development of *Macrobrachium* or freshwater prawns has the most potential for economic empowerment of woman and the poor in areas with a high poverty level. There is good potential for engagement with the private sector, with a strong demand from Thailand for these prawns attracting traders and processers. A key private partner would be Divron Bioventures who are already active in this

chain. Regarding partnerships, skills and expertise exist in Australia, and within NAQDA and at the universities of Peradeniya and Rajarata. This investment would also be complementary to past DFAT investment in the LEED project, the current MDF and the DFAT blue economy aquaculture challenge initiative. There are key researchable and solvable issues in the supply chain, such as the use of probiotics for seedlings production, or mortality rates in ponds. ACIAR has past investment on *Macrobrachium rosenbergii* in India, PNG and the Pacific. An additional research issue that would link to the economic and social science portfolio is related to the distribution of benefits of this value chain to woman and the poor.

Other areas of research that were discussed but did not score as highly as the freshwater shrimps were related to residues and antimicrobial resistance in dairy and livestock, and the issue of Illegal, unreported and unregulated fisheries in the north of Sri Lanka. This last issue is important, and should be re-examined at a later date.

Economics and social science

Aside from the socioeconomics work mentioned in the aquaculture project above, there are opportunities for work on policy to support the competitiveness agenda of the government. An area of research that could link well with the World Bank loan is related to cost–benefit of the fertiliser subsidy for paddy.

In agribusiness, some research on value addition is needed, but this should be done in the future and after key issues of quality and consistency of supply in the chains have been addressed.

Natural resource management and crops

We discussed interesting research ideas to be pursued under two broad areas. They were related to the relationship between poverty level and underground water resources management, and a second area of work in community forestry and forest rehabilitation. There is also much work needed to improve fruit and vegetable value chains.

Option for trilateral engagement

We recommend that ACIAR discusses with ICAR and SLCARP their MoU and associated work plan. This MoU represents a good base for a trilateral research collaboration, building on the successful partnership between ACIAR and India.

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Annex 1—Contact database

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Additional contacts are included in the scanned documents attached to this report.

Annex 2—Public and private research institutions involved in agriculture in Sri Lanka

Head count and full time equivalent (FTE) TE is based on a 2009 census from ASTI

Supervising agency	Agency involved in agricultural R&D	Research Focus	Head Count	FTE
Department of Agriculture	Plant Genetic Resources Centre (PGRC)	Crops	16.0	14.4
Sri Lanka Council for Agricultural Research Policy (CARP)	Rubber Research Institute of Sri Lanka (RRISL)	Crops	35.0	35.0
Department of Agriculture	Plant Virus Indexing Centre (PVIC)	Crops	16.0	4.8
Sri Lanka Council for Agricultural Research Policy (CARP)	Sugarcane Research Institute (SRI)	Crops, agricultural engineering, natural resources, socioeconomics	19.0	13.3
Department of Agriculture	Rice Research and Development Institute (RRDI)		33.0	33.0
Sri Lanka Council for Agricultural Research Policy (CARP)	Tea Research Institute of Sri Lanka (TRI)	Crops	35.0	35.0
Department of Agriculture	National Plant Quarantine Service (NPQS)	Plant quarantine	18.0	5.4
Sri Lanka Council for Agricultural Research Policy (CARP)	Veterinary Research Institute (VRI)	Livestock	30.0	30.0
Department of Agriculture	Socio Economics and Planning Centre (SEPC)	Crops	14.0	11.5
Sri Lanka Council for Agricultural Research Policy (CARP)	Department of National Botanic Gardens	Crops	6.0	0.6

Supervising agency	Agency involved in agricultural R&D	Research Focus	Head Count	FTE
Department of Agriculture	Regional Agricultural Research & Development Centre—Angunakolapelessa—Grain Legumes & Oilcrops Research & Development Centre (GLORDC)	Crops	17.0	13.6
Sri Lanka Council for Agricultural Research Policy (CARP)	Coconut Research Institute of Sri Lanka (CRI)	Crops, socioeconomics	34.0	34.0
Department of Agriculture	Field Crops Research and Development Institute (FCRDI)	Crops, soil fertility	24.0	24.0
Department of Agriculture	Regional Agricultural Research & Development Centre—Aralaganwila	Crops	8.0	5.6
Sri Lanka Council for Agricultural Research Policy (CARP)	Department of Export Agriculture (DEA)	Crops, agricultural engineering	38.0	38.0
Department of Agriculture	Food Research Unit (FRU)	Crops	9.0	5.9
Department of Agriculture	Regional Agricultural Research & Development Centre—Bandarawela		19.0	19.0
Sri Lanka Council for Agricultural Research Policy (CARP)	Forest Department (FD)	Forestry	6.0	6.0
Department of Agriculture	Fruit Crops Research and Development Centre (FCRDC)		20.0	20.0
Department of Agriculture	Regional Agriculture Research and Devolopment Centre—Bombuwela		26.0	26.0
Sri Lanka Council for Agricultural Research Policy (CARP)	Hector Kobbe Kaduwa Agrarian Research and Training Institute (HARTI)	Socioeconomics	31.0	21.7

Supervising agency	Agency involved in agricultural R&D	Research Focus	Head Count	FTE
Department of Agriculture	Horticultural Crop Research and Development Institute (HORDI)	Crops, socioeconomics, natural resources	57.0	57.0
Department of Agriculture	Regional Agricultural Research & Development Centre—Makandura		16..0	16.0
Sri Lanka Council for Agricultural Research Policy (CARP)	Institute of Post Harvest Technology (IPHT)	Crops	19.0	19.0
Department of Agriculture	Natural Resources Management Center (NRMC)	Natural resources	8.0	5.6
Department of Agriculture	Regional Agricultural Research & Development Centre—Vavniya		7.0	7.0
Sri Lanka Council for Agricultural Research Policy (CARP)	National Aquatic Resources Research and Development Agency (NARA)	Fisheries	56.0	39.2
Sabaragamuwa University of Sri Lanka (SUSL)	Faculty of Agricultural Sciences	Socioeconomics		3.2
Wayamba University of Sri Lanka	Faculty of Agriculture & Plantation Management (FAPM)	Crops, socioeconomics, natural resources, landscaping	27.0	6.8
Eastern University of Sri Lanka	Faculty of Agricutlure (FAG)	Crops, socioeconomicsc, pathology, farm machinery, natural resources, landscaping, livestock	26.0	6.4
University of Jaffna	Faculty of Agriculture	Crops, livestock, forestry, fisheries, off-farm post-harvest		5.6
University of Ruhuna	Faculty of Agriculture	Agricultural engineering, livestock, natural resources, fisheries, off-farm post-harvest	64.0	16.0
University of Peradeniya (UOP)	Faculty of Agriculture	Crops, natural resources, off- farm post-harvest	102.0	30.6
Rajarata University of Sri Lanka	Faculty of Agriculture		26.0	2.6
CIC Agri Businesses (CICAGRI)		Crops	2.0	0.2
Serendib Horticulture Technologies (Pvt) Ltd		Crops	5.0	0.5

Annex 3—Scanned documents submitted by institutions during the field visit

Visit of Australian Center for International Agricultural Research (ACIAR) on Scoping Mission

on

18th July 2016

at

Ministry of Agriculture, Battaramulla, Sri Lanka.

Proposal for the

Research Collaboration, Human Resource Development, Infrastructure Development in the field of Agriculture, Livestock, Forestry, Fisheries and Aquaculture.

Agriculture sector in Sri Lanka

Sri Lanka has almost all favorable factors required for agriculture. We claim for fertile soil suitable for bringing under the plough. We have sufficient water resources coupled with timely raining and climatic conditions favourable for agriculture. So are the labour resources being familiarized with farming in the past even to the extent of having made use of every drop of water falling from the sky. We are proud of being a nation who asweddumized the land in environment friendly manner and won the war of cultivation to make the country self - sufficient in food.

At present 65% of the total land area of the country have been utilized for agriculture. 40% for paddy, 38% for plantation crops and 22% for other crops. More than 70% of the countries populations are living in rural area whose main livelihood being agriculture. Plantation crops, forest, fishery and livestock sector contribute to over 10% of the country's Gross National Production.(GNP)

Whereas Sri Lanka is surrounded by the sea, the present per capita fish consumption is only 43g per day. However consumption of 60g is needed to reach accepted minimum nutritional level. There is a possibility of increasing the daily consumption up to 100g if fully utilized the inland and sea water resources available.

We have to spend foreign exchange of over Rs. 40 billion to import milk and milk productions to meet the requirements of the population of over 22 million. In addition, a considerable amount of foreign exchange is required to import other animal production too. Food import bill is also higher. The objective of this national undertaking is to make the country self- sufficient totally putting an end to food imports.

Main objectives of agricultural development programmes

1. Make the country self-sufficient in traditional local foods and thereby save the colossal sum of foreign exchange spent on importation of food.
2. Ensure the availability of high quality food items through adopting environment friendly food production methods also minimizing the use of chemical fertilizer and pesticides.
3. Ensure food security by proper management of the available food stocks.
4. Introduce and implement a crop production programme based on agro ecological zones.

5. Increase productivity of promotion through adopting suitable methodologies in food crop production.
6. Maintain a proper coordination between all the institutions involving in local food production and join this programme with the normal daily routine of school community, civil society and the general public.
7. Provide high quality inputs in food production and create formal procedures for their production.
8. Building a healthy nation.

Priority areas of Departments/ Institutes for ACIAR assistance.

01.Department of Agriculture

1. Plant Genetic Improvement including molecular biology techniques, convention breeding and other related crop improvement research and training.

2. Soil and water management covering soil nutrition, onfarm water management, remote sensing, land management research and training.

3. Crop physiology and agro climatologyaddressing climate change, stress physiology, plant nutrition management, climate change predictions, adaptation and mitigation.

4. Plant protection including pest, disease and weed management especially using biological control.

5. Technology transfer and value chain development.

Long term training requirements

Subject area	No of PhDs	No of Mphills
Genetic improvement	8	8
Soil and water management	2	4
Crop physiology	2	2
Plant protection	4	4
Technology transfer	1	1

Short term training requirements

Need training on

1. Research management
2. Plant quarantine
3. Food safety-residue analysis
4. Marker assisted selection
5. Double haploid technology
6. Technology transfer
7. Efficient Crop management techniques
8. Value addition

02. Department of Agrarian Development

Project of Production and Promotion of Organic Fertilizer

Main Objective	:	**To immerge one large scale producers for the International market from each and every district**
Other Objectives	:	Increasing the usage of organic fertilizer. Encouraging farmers to produce compost and use for the crops. Increasing the technical knowledge from small scale to large scale producers.

Essential from the ACIAR

- Technical knowledge for producing compost within short period of time
- New methods and machineries of producing compost (Wormy composts, Liquid compost etc.)
- Methods of increasing the quality of compost when facing with international market
- Standards of high quality compost which is acceptable internationally
- Knowledge on Using compost and chemical fertilizer together for increasing productivity of crops

03.Department of Export Agriculture

Requirements for ACIAR scoping Mission

Component	Theme	Long Term (LT)/ Short term(ST)	Justification
i)Capacity Building ii)Research collaboration	Crop Modeling	LT ST	Yield parameters of spice and beverage crops are highly susceptible for extreme weather conditions. Therefore prediction of crop forecasting is very important.
i)Capacity Building ii)Research collaboration	Quality Assurance and food Safety	ST LT	Amount of foreign exchange earning of all spice and beverage crop products are highly dependent upon quality of the products. Therefore quality assurance is most important
i)Capacity Building ii)Research collaboration	Agricultural Machinery	ST LT	Mechanization of whole value chain of export agricultural crop sector is important
i)Capacity Building ii)Research collaboration	Post Harvest Technology and value addition	ST LT	The foreign exchange earning can be increased significantly through quality products exports
i)Capacity Building ii)Research collaboration	Pesticide Residual Analysis	ST LT	Maximum residual level (MRL) of spice & beverage products have drastically reduce up to 0.001mg/kg. Therefore the determination of trace amounts of residues is important.
Up grading of Laboratory Infrastructure	Quality Testing Laboratory	Short term training on equipment	Quality testing and pre-testing of export products are important for the export for superior markets

04. Institute of Post Harvest Technology

1. Improved Technologies for fresh produce handing.

2.Technology on safety and quality of agricultural produce

Non-thermal processing of fruit and vegetable

Shelf life extension of horticultural produce

Application of nanotechnology

Food fortification Technology.

Analysis of chemical residues and contaminants

3. mechanization of agricultural commodities

Freshly Harvested Paddy Drying for enhancing storability of rice

Novel Technology adoption for edible oil extraction

Emerging technology for spice grinding

Grain/Pulse Processing Technology

Shelf life extension of Onion

4. Human Resource Development

Post graduate (MSc/ PhD) and short and long term training programs.

The fields of training required such as,

1. Post harvest loss reduction methods for all crops
2. Postharvest Machinery for cleaning and de-husking sesame, finger miller, other millets
3. Post harvest machinery for all field crops other than millet and sesame
4. Post harvest physiology of horticultural crops,
5. Postharvest disease management of horticultural crops.
6. Insect pest management of durable crops

7 nondestructive methods for quality evaluation of fresh produce

8 Flavor and aroma biology of fresh produce and sensory evaluation methods

9. Fruit ripening and ethylene management

10. Cooling methods of fresh produce

11. Maturation and maturity indices of agricultural commodities.

12. Research management Training

05.Hector Kobbakaduwaa Agrarian Research and Training Institute (IPHT)

1. Technical support for Developing Price collection and dissemination programme of the institute and initiating a price forecasting system

2. Capacity development of the Research and Training Staff of the institute

Level of Training			Field of Training
M.Sc.	Ph.D	Short Term Training	
01	06	30	• Agri. Resource Management • Farming System • Production Economics • Marketing • Development Project, Programme& Policy Evaluation • Planning of Rural Development Project • Evaluation Tools for Rural Development Projects • Development Research Communication • Advance Economics • Dynamic Modeling • Mathematical Programming • GIS,IT • Human Resource Management • Organizational Management • Training Methodology • Participatory Planning & Management • Environmental Economics • Environmental Sociology • Agriculture Economics • Water Resources Management

06. National Aquatic Resources Research and Development Agency (NARA)

A. Possible areas for research collaboration

Breeding and culture Technology Development

High value fish breeding and culture technology development

Nontraditional aquaculture

1. Development bivalve breeding, farming, processing, value addition and safety certification
2. Development of seaweed culture, processing and value addition .
3. Development of sea cucumber breeding, farming and natural stock enhancement
4. Lobster and crab breeding and restocking
5. Shrimp and ornamental fish Health management
6. Impact on climate change on fisheries and aquaculture

Other areas

Conservation and Resource Management

B. Human Resource Development

1. Short term training

Area	Justification
Fish/ shell fish Breeding and culture	
Bivalve breeding technology (oysters and mussels)	Cannot totally depend on the wild. Essential to fulfill the spat requirements through breeding in future
Lobster and crab breeding technology	Provide lobster and crab for aquaculture and natural stock enhancement
Sea cucumber breeding and larval rearing technology	Well-developed breeding technology to achieve high larval survival and to enhance the natural stocks
Grouper and sea bass fish breeding	Ideal candidature species for brackish water aquaculture especially for abandoned shrimp

	farms
Fish genetics	Essential for improving genetic quality of fish breeds
Fish feed development	High quality low cost feed is essential for sustainable aquaculture development
Sea weed tissue culture	Important for maintaining the genetic quality of the seed stock
Food security and safety	
Bivalve bio security development (safety certification)	To address the quality and safety issues for local and export markets
Quality assurance	To cater to the fishery export industry
Molecular biology, bio technology and health management	
Fish biotechnology	Fish stocks identification
Fish health management	Fish disease diagnosis and treatment
Shrimp health management	For sustainable shrimp farming industry
Post harvest technology	
Processing and value addition of fish and fishery products including bivalves	To produce high quality value added products for the market
Minimize post harvest losses	30% fish quality lost at present. This should be minimized
Fishery related product development	Using excess fish stocks and by products
Chemical and heavy metal analysis	To carry out research and analysis of samples provided by fish export industry
Environmental management and Conservation	
Coral reef restoration	To conserve corals for future
Eco system valuation methods	Eco system valuation is essential to conduct feasibility studies
Eco- toxicology	To study toxicity levels and Pollution minimization
Fish resource management	
Fish stock assessment	To assess and maintain the fish stocks in Sri Lankan waters

Fishery data analysis	To proper data handling and analysis
Fishing gear technology	Develop eco friendly alternative fishing gears for banned destructive gears
Socio economics and marketing	Study the socio economic status of fisher communities and make recommendations
Fish larval identification	Essential for fish stock management
Habitat mapping	Mapping habitats for fisheries and aquaculture project
Fisheries sector value chain analysis	Important for commercial fisheries sector development
Fisheries forecasting	Forecast accurate fishing grounds for harvesting fish with minimum cost
Ecosystem modeling with climatic changes	Climate change has to be considered for marine resources management
Research methods for underwater resource surveys	These methods are necessary for underwater resource assessments and conservation of sensitive habitats.
Reefs and reef associated fauna identification	Needed for stock assessments, conservation and management of reef habitats
Zoning for aquaculture using GIS	For preparation of zonal plan for aquaculture
Research and Development	
Research Projects design and project Management	Essential for annual research projects design and management
Research project monitoring and Evaluation	Research progress monitoring is essential to achieve the targets
Information Dissemination	
Web based GIS system	Dissemination of spatial information for management and development of aquaculture

2. Study Tours

Area	**Justification**
Aquaculture farms and processing factories	To get ideas about aquaculture and processing technology development
Fisheries and aquaculture related research institutes	To observe the research and development capacities and upgrade our systems

3. Long Term Training (Ph.D.)

Area	Justification
Shrimp health management	Expertise required to address issues related to shrimp diseases
Fish stock assessment	To assess the fish stocks in the Sri Lankan marine waters and maintain the fish data base
Fish biotechnology	Fish stocks identification and disease diagnosis
Fish breeding	High value fish breeding expert is essential for sustainable aquaculture development
Eco-toxicology	Environmental monitoring and pollution mitigation
Pesticide analysis	Essential for the analysis of pesticide in fish and other aquatic organisms
Fish value chain analysis	Expert required for analysis of fish market value chain
Fish post harvest technology	Minimizing post harvest losses and value addition
Food toxicology	Food safety &biotoxin issues related in bivalves aquaculture
Geological and geo physical application for Habitat mapping (Acoustic mapping)	Systematic exploration of valuable habitats
Modeling of marine ecosystems with climatic changes	Understanding the effects of climatic changes on marine ecosystems and need to incorporate these in marine management
Integrated management of coastal ecosystems	Coastal ecosystems are highly utilized and integrated management is needed for long term management
Application of geo informatics for the development of aquaculture	Required for sustainable aquaculture development
Fishing gear technology development	Preparation of alternative fishing gears

C. Infrastructure Development

1. Establishment of Central Laboratory System at NARA to enhance the capacity of fisheries and aquaculture sector, Sri Lanka

2. Development of RRC Trincomalee as the Marine Resources Research and Development Centre

07. Department of Forest (FD)

Funding for research, and long term and short term training and study visits for research, training and management staff of the FD are highly needed and relevant areas for research and training would be as follows.

- Forest restoration
- Biodiversity, Biomass and Carbon estimation
- Climate change adaptation and mitigation measures
- Prevention of invasive plants, pest and diseases
- Watershed management, soil conservation
- Biotechnology

08. Board of Export Development

	Theme & Area	Sector	Title	Requirement
1	Post-Harvest& Value Addition	Rice	Value Added Products for export	It is accepted only some varieties of the rice in the international market and therefore value added products are need to be developed to compete in the export market. Technical assistance for developing value added products for export market.
2	Training	Floriculture	Training on Production/ Profitability and Lowering pre & Post Harvest Losses	Training for this sector for the upgrade of floriculture nurseries are lacking in Sri Lanka Training for floriculture producers/exports on production, profitability upgrade of the floriculture industry and minimize the pre and post-harvest losses.
3	Quality Assurance, Food Safety	Fruits & Vegetables	Export of Fresh Fruits & Vegetables to Australia	Currently Sri Lanka in not permitted to export fresh fruit & vegetables to Australia Negotiate with the relevant authorities in Australia to initiate fruit & vegetable export to Australia
4	Quality Assurance and Food Safety	Spices	Mechanizing of spice processing and sterilization of spice crop	Technical assistance is required for mechanization of spice processing and sterilization of spice crop

Annex 4—MoU between University of Peradeniya and University of Tasmania

Memorandum of Understanding
between
University of Peradeniya, Sri Lanka
and
the University of Tasmania

UNIVERSITY *of* TASMANIA
AUSTRALIA

This MOU entered into this 2"d May 2016 between University of Peradeniya and the University of Tasmania is to foster international cooperation in education and research.

I.

The agreements between University of Peradeniya and the University of Tasmania may include but not be limited to the areas:

- Professional development
- Joint research activities
- Joint scholarly and teaching activities
- Exchange of faculty members
- Exchange of students
- Joint supervision of research candidates or cotutelle arrangements

II.

This MOU will be identified as the parent document of any abovementioned future agreement(s) executed between the parties. Future agreements concerning any program will provide details concerning the specific commitments made by each party and will not become effective until they have been reduced to writing and executed by the duly authorised representatives of both parties. The scope of the activities under this MOU and any under any specific agreements executed between the parties shall be determined by the funds regularly available at both institutions for the types of collaboration undertaken. Except as may be stipulated in any specific agreement, each institution shall be responsible for expenses incurred by its employees under this MOU and any other agreements executed between the parties.

III.

University of Peradeniya and the University of Tasmania agree to designate the following individuals or such other persons notified by that party to oversee and facilitate implementation of this MOU.

University of Tasmania	Prof Peter Frappell Pro Vice-Chancellor (Global Engagement)
University of Peradeniya	Prof. Upul B. Dissanayake Vice Chancellor

The parties agree to ensure that the above-named will:

- promote academic collaboration at faculty levels for research and study;
- act as principal contacts and coordinate all activities within their institutions;
- distribute to each institution information about the faculty, facilities, research, publications, library materials and educational resources of the other institution; and
- periodically review and evaluate past activities and to explore new ideas for future agreements.

Memorandum of Understanding
between
University of Peradeniya, Sri Lanka
and
the University of Tasmania

UNIVERSITY *of* TASMANIA
AUSTRALIA

IV.

Upon signature by each institution, this MOU shall remain in effect for three years from final signature or until terminated by either institution. Such termination by one institution shall be effected by giving the other institution at least six (6) months advance written notice of its intention to terminate. Termination shall be without penalty. If this MOU is validly terminated, neither institution shall be liable to reimburse each other for any monetary or other losses that may result.

The intention of the parties is that the terms of this MOU are not enforceable in a court of law. Further, nothing in this MOU binds either of the parties to enter into any future agreements in relation to its subject matter, if they consider that entering into such agreements would be detrimental to their interests.

Nothing in this MOU constitutes the parties as partners, agents or employees of the other and they expressly deny the existence of such a relationship.

FOR UNIVERSITY OF PERADENIYA

Professor Upul B. Dissanayake
Vice Chancellor

FOR THE UNIVERSITY OF TASMANIA

Professor Peter Frappell
Pro Vice-Chancellor (Global Engagement)

CONTACT PERSON FOR UNIVERSITY OF PERADENIYA

Professor B Marambe

Annex 5—Scoring matrix for proposed investment ideas using criteria for prioritising ACIAR investments in Sri Lanka

The scoping study team used a matrix to prioritise and identify potential entry points to re-establish a collaborative research program in Sri Lanka. The three sets of criteria used to prioritise investments were as follows:

- The first set of 5 criteria represent **strategic** considerations including: Sri Lanka priority policy areas, private sector engagement, empowerment of women and girls, economic empowerment, shared benefits for public and/or Industry in both countries. The proposed investments were scored against these criteria on a scale from 1 to 3: 1) high strategic alignment, 2) moderate alignment and a 3) low alignment. In table 1 below, green represent the highest strategic alignment and red the lowest strategic alignment.
- The second set of 6 criteria represent the **research for development** approach including: researchable issues, solvability, sustainability, pro-poor, women's engagement and scalability. The proposed investments were scored against these criteria using a scale from 1 to 5: 5) very high confidence that the proposal was researchable, solvable, sustainable etc... 4) high confidence 3) neutral 2) low confidence and 1) very low confidence.
- The final set of 4 criteria are related to research **partnerships** including that potential Australian partners exist and have the necessary skills and expertise, potential Sri Lankan partners exist and have the skills and expertise, there a good potential for complementarity of investments by Government or donors, and there is good potential that the private sector will be engaged. The proposed investments were scored against these criteria on a scale from 1 to 5: 5) strongly agree, 4) agree, 3) do not agree nor disagree, 2) disagree and 1) strongly disagree.

A rapid assessment of some of the proposed investment ideas is presented in Table 1 below. The investments in aquaculture achieved the highest priority and scored the highest for delivery partnerships and strategic alignments. This result aligns well with the observation of the scoping mission team: ACIAR and its Australian partners have extensive experience in this sector in the region, both NAQDA and NARA have good skills and expertise and investment in aquaculture and such investment would complement past Australian investment and align well with objective 1 and objective 3 of the Australian Investment Plan (AIP) for Sri Lanka. The proposed investments in post-harvest losses and value chain efficiencies for horticulture and fresh produces did not score as high as aquaculture. This as well was consistent with the observations of the scoping mission: post-harvest loss was a common issue discussed during the mission, however the skills and expertise present in Sri Lanka were not as strong as the one in the aquaculture sector and in the short time allocated to the scoping mission, Sri Lankan stakeholders could not always identify specific constraints that were researchable and solvable.

Table 1: Proposed investment ideas scored against criteria for prioritising ACIAR investments in Sri Lanka. Criteria under strategic alignment were score from 1 to 3, were a 1 represented a high strategic alignment, a 2 for moderate alignment and a 3 for low alignment. Criteria under Research for development were scored from 1 to 5 where a score of 5 represented a high confidence that the proposal was researchable, solvable, sustainable etc... and a 1 represent a very low confidence for the same criteria. Criteria under delivery partnership were score from 1 to 5: 5) strongly agree, 4) agree, 3) do not agree nor disagree, 2) disagree and 1) strongly disagree. The score against each criterion is colour coded from green to red, with green representing the highest score and red the lowest.

	Strategic Alignment					Research for development						Delivery partnerships			
Proposal	Sri Lanka priority policy areas	Australian priorities: Private sector engagement	Empowerment of Women and Girls	Economic empowerment	Shared benefits for public, and/or Industry in both countries	Researchable Issues	Solvable	Sustainability	Pro-poor	Women's engagement	Scalability	Australian Partners have skills and expertise ?	Sri Lankan Partners have potential skills and expertise	Complementarity of investments by Gov. or donors	Private sector potential engagement
Support for the development of *P. vannamei* and *Macrobrachium rosenbergii*.	1	1	1	1	1	5	5	5	5	5	3	5	5	5	5
Production improvement of tilapia, carp, *Macrobachium rosenbergii*, *P. Monodon* and *P. Vannamei* and Asian sea bass;	1	1	1	1	1	5	5	5	5	5	3	5	5	5	5
Support in sea bass production, complementing the work done with FAO.	1	1	2	1	1	5	5	5	5	3	3	5	5	5	5
Development bivalve breeding, farming, processing, value addition and safety certification	1	1	2	1	1	5	5	5	5	3	3	5	4	3	5
Development of broodstock for freshwater fish and prawns;	1	1	2	1	1	4	5	5	5	3	3	5	4	4	5
Shelf life extension of horticultural products	1	1	2	1	1	5	4	5	5	3	3	5	3	3	5
Development of seaweed culture, processing and value addition .	1	1	2	1	1	3	5	5	5	3	3	5	3	3	5
Improved Technologies for fresh produce handling.	1	1	1	2	1	4	4	5	3	5	3	5	4	3	5
Post harvest losses across all supply chains	1	1	2	1	1	4	1	5	5	3	3	5	3	4	5
Post Harvest technology and value addtion of quality export crops	1	1	2	1	1	4	1	5	5	3	3	5	3	4	5
Technology transfer and value chain development	1	1	2	1	1	3	1	5	5	3	3	5	3	4	5
Research on production and marketing of bivalves including oysters.	1	1	2	1	2	4	5	5	5	3	3	5	4	3	5
Restoring the floriculture sector and using Sri Lanka's biodiversity to find new ornamental and cut flowers.	1	1	2	1	2	5	4	5	5	3	3	5	3	3	5
Shelf life extension of Onion	1	1	2	1	2	5	4	5	5	3	3	5	3	3	5
Sustainable intensification of shrimp farming (*Penaeus monodon*), including broodstock domestication, research into white spot disease	1	1	2	2	1	5	5	5	3	3	3	5	4	4	5
Development of sea cucumber breeding, farming and natural stock enhancement	1	1	2	1	2	3	5	5	5	3	3	5	3	3	5

Key:

Proposal	Strategic Alignment					Research for development						Delivery partnerships			
	Sri Lanka priority policy areas	Australian priorities: Private sector engagement	Empowerment of Women and Girls	Economic empowerment	Shared benefits for public, and/or Industry in both countries	Researchable Issues	Solvable	Sustainability	Pro-poor	Women's engagement	Scalability	Australian Partners have skills and expertise ?	Sri Lankan Partners have potential skills and expertise	Complementarity of investments by Gov. or donors	Private sector potential engagement
Shrimp and ornamental fish Health management	1	1	2	2	1	5	4	5	3	3	3	5	4	4	5
The use of microorganisms and their products in aquaculture.	1	1	2	2	1	4	5	5	3	3	3	5	4	4	5
Soil and water management covering soil nutrition, onfarm water management, remote sensing, land management research and training	1	1	2	2	1	5	4	5	3	3	3	5	3	3	5
Use of mobile phone and other ICT methods to provide extension advice and information to farmers and allow aggregation of production data.	1	1	2	1	2	2	4	5	5	3	3	5	4	5	5
Quality assurance and food safety for spice and beverage crops	1	1	2	2	1	4	4	5	3	3	3	5	4	4	5
High value fish breeding and culture technology development	1	1	2	2	1	4	4	5	3	3	3	5	4	3	5
Impact on climate change on fisheries and aquaculture	1	1	2	2	1	4	4	5	3	3	3	5	4	3	5
Lobster and crab breeding and restocking	1	1	2	2	1	4	4	5	3	3	3	5	4	3	5
Mechanization of agricultural commodities	1	1	1	2	2	2	4	5	3	5	3	5	4	3	5
Mechanization of whole value chain of export agricultural crop	1	1	1	2	2	2	4	5	3	5	3	5	4	3	5
Watershed management, soil conservation	1	1	2	2	1	4	4	5	3	3	3	5	3	4	5
Crop physiology and agro climatology addressing climate change, stress physiology, plant nutrition management, climate change predictions, adpatation and mitigation	1	1	2	2	1	3	5	5	3	3	3	5	3	3	5
Research to improve diagnostic methods for tuberculosis, leptospirosis and rabies	2	1	2	1	2	5	4	5	5	3	3	5	3	3	5
Post-Harvest & Value Addition in Rice	2	1	2	1	2	4	4	5	5	3	3	5	4	4	5
Climate change adaptation and mitigation measures	1	2	2	2	1	4	5	5	3	3	3	5	3	3	3
Grain/Pulse Processing Technology	2	1	2	2	1	4	4	5	3	3	3	5	4	4	5
Quality assurance, food safety, fruit, vegetables ans spice to reach the standard to reach the Australian market	1	1	2	2	2	4	4	5	3	3	3	5	3	4	5
Research on mycotoxins and chemical residues	1	1	2	2	2	4	4	5	3	3	3	5	3	4	5
Crop Modeling for yield parameters of spice and beverage crops	1	1	2	2	2	3	5	5	3	3	3	5	3	3	5
Novel Technology adoption for edible oil extraction	1	1	2	2	2	4	4	5	3	3	3	5	3	3	5

Key:

1 2 3 — High alignment — Low alignment

5 4 3 2 1 — High confidence — Low confidence

5 4 3 2 1 — Strongly agree — Stongly disagree

Proposal	Strategic Alignment					Research for development						Delivery partnerships			
	Sri Lanka priority policy areas	Australian priorities: Private sector engagement	Empowerment of Women and Girls	Economic empowerment	Shared benefits for public, and/or Industry in both countries	Researchable Issues	Solvable	Sustainability	Pro-poor	Women's engagement	Scalability	Australian Partners have skills and expertise ?	Sri Lankan Partners have potential skills and expertise	Complementarity of investments by Gov. or donors	Private sector potential engagement
Standards of high quality compost which is acceptable internationally	2	1	2	2	1	5	4	4	3	3	3	5	3	3	5
Prevention of invasive plants, pest and diseases	1	2	2	2	1	4	4	5	3	3	3	5	4	3	3
Conservation and Resource Management	1	2	2	2	1	3	5	5	3	3	3	5	3	3	3
Forest restoration	1	2	2	2	1	4	4	5	3	3	3	5	3	3	3
Non-thermal processing of fruit and vegetable	1	1	2	2	2	3	4	5	3	3	3	5	3	4	5
Pesticide residual analysis, Maximum residual level of spice and beverage crops	1	1	2	2	2	3	4	5	3	3	3	5	3	3	5
Research on Palmyra	1	1	2	1	3	4	4	4	3	3	3	3	4	4	5
Plant Genetic Improvement including molecular biology techniques, convention breeding and other related crop improvement research and training	1	2	2	2	1	3	4	5	3	3	3	5	3	3	3
Plant protection including pest, disease and weed management especially using biological control	1	2	2	2	1	3	4	5	3	3	3	5	3	3	3
Emerging technology for spice grinding	1	1	2	2	2	2	4	5	3	3	3	5	3	3	5
Focus on one value chain to develop a strategic plan for its development	1	1	2	2	2	2	4	5	3	3	3	5	3	3	5
Technology on safety and quality of agricultural products	2	1	2	2	1	3	1	5	3	3	3	5	3	4	5
Biotechnology in Forestry	2	2	2	2	1	3	5	5	3	3	3	5	2	3	3
Anti-microbial resistance (AMR) in milk and eggs,	2	1	2	2	2	2	5	5	3	3	3	5	3	3	5
Application of nanotechnology for horticulture	2	1	2	2	2	2	5	5	3	3	3	5	3	3	5
Food fortification Technology.	2	1	2	2	2	3	4	5	3	3	3	5	3	3	5
Analysis of chemical residues and contaminants in agriculture products	2	1	2	2	2	0	3	5	3	3	3	5	3	3	5
Mapping water resources using remote sensing and improvement of irrigation infrastructure	2	2	2	2	2	4	4	5	3	3	3	5	4	4	3
Forest Biodiversity, Biomass and Carbon estimation	2	2	2	2	2	4	4	5	3	3	3	5	3	3	3
Freshly Harvested Paddy Drying for enhancing storability of rice	2	2	2	2	2	3	4	5	3	3	3	5	5	3	3
Knowledge on Using compost and chemical fertilizer together for increasing productivity in crops	1	3	2	2	2	2	2	5	3	3	3	5	3	3	3

Key:

1 2 3 — High alignment — Low alignment

5 4 3 2 1 — High confidence — Low confidence

5 4 3 2 1 — Strongly agree — Stongly disagree

Proposal	Strategic Alignment					Research for development						Delivery partnerships			
	Sri Lanka priority policy areas	Australian priorities: Private sector engagement	Empowerment of Women and Girls	Economic empowerment	Shared benefits for public, and/ or Industry in both countries	Researchable Issues	Solvable	Sustainability	Pro-poor	Women's engagement	Scalability	Australian Partners have skills and expertise ?	Sri Lankan Partners have potential skills and expertise	Complementarity of investments by Gov. or donors	Private sector potential engagement
Technical knowledge for producing compost within short period of time	2	2	2	2	2	2	3	4	3	3	3	5	3	3	3
Methods of increasing the quality of compost when facing with international markets	2	2	2	2	3	3	4	5	3	3	3	5	4	3	3
New methods and machineries of producing compost (Wormy composts, Liquid composts)	2	2	2	2	3	3	4	5	3	3	3	5	3	3	3
Development of quality testing laboratory	1	3	2	2	3	0	5	5	3	3	3	5	3	3	3
Post graduate (MSc/ PhD) and short and longterm training programs.	2	3	2	2	2	2	2	5	3	3	3	5	5	3	3

Key:

1 2 3
High alignment — Low alignment

5 4 3 2 1
High confidence — Low confidence

5 4 3 2 1
Strongly agree — Stongly disagree

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