High Level Policy Dialogue on Investment in Agricultural Research for Sustainable Development in Asia and the Pacific

Rama Gardens Hotel, Bangkok, Thailand
8-9 December, 2015

Abstracts of Presentations

Organizers

Asia-Pacific Association of Agricultural Research Institutions (APAARI)
Australian Centre for International Agricultural Research (ACIAR)
Department of Agriculture (DoA), Thailand
Food and Agriculture Organization of the United Nations - Regional Office for Asia and the Pacific (FAO - RAP)
Global Forum on Agricultural Research (GFAR)
International Food Policy Research Institute (IFPRI)

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**Presenter*

Session I: Status and Outlook for Investment in Agricultural Research and Innovation

SI.1 Long-Term Agricultural Research and Innovation for Development – An ACIAR Perspective in the Asia-Pacific Region

N.R. Austin* and D. Shearer

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The Australian Centre for International Agricultural Research (ACIAR) has for more than three decades been brokering agricultural research partnerships in the Asia Pacific region and beyond, to promote prosperity, reduce poverty and enhance stability. ACIAR brings together Australian and international experts with developing country counterparts to find solutions to problems faced by smallholder farmers, fishers and foresters.

Innovation is the key to agricultural development and economic growth, and ACIAR seeks and promotes innovation through research partnership. The diversity and creativity of the selected partners serves to generate new ideas, new technologies and new approaches. Innovation, along with adaptability and flexibility, are essential requirements in today's context of rapid change, and ACIAR has built these features into its ways of working.

An analysis[1] of economic returns on 103 bilateral ACIAR research projects – which accounted for only 6 per cent of ACIAR's investments since operations began in 1982 – concluded that, in present value terms, the realised benefits attributable to ACIAR from the 'convincing' benefit streams alone (so the most conservative estimate) equated to A$2.4 billion. The evaluation did not consider the difficult-to-quantify benefits from, for example, capacity building, new knowledge, or social, human health and environmental benefits — which are all likely to be highly significant.

ACIAR's long-term engagement within the region has generated important insights about agricultural research and innovation for development (ARI4D), namely that: relationships must be nurtured, which takes time and resources; there is a need for flexibility and adaptability within partnerships and their management to deliver research outputs and development outcomes; there is no prescribed set of partners, each is unique; interactions take place on many levels, some formal and many informal; partnerships at a fundamental level involve people-to-people interactions, and ACIAR's success as a research partnership broker relies on a high level of engagement with project partners.

[1]Returns to ACIAR's investment in bilateral agricultural research, ACIAR Impact Assessment Series No. 86

SI.2 Agricultural R&D in Asia: Recent Investment and Capacity Trends

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During the 20th century, the implementation of research-based agricultural methods and new technologies enhanced the quantity and quality of agricultural outputs, and led to rapid economic growth and poverty reduction throughout Asia. Despite these tremendous advances, Asia is still home to more than half of the world's poor, most of whom live in rural areas where agriculture remains the main source of employment and income. The United Nations forecast that Asia's population will increase by 700 million people by 2050. In order to feed these additional people and to address other pressing challenges - including adaptation to climate change, volatile food prices, and tackling the widening rural-urban gap - agricultural productivity will need to be further accelerated.

Despite the well-documented evidence that investments in agricultural research and development (R&D) have greatly contributed to economic growth, agricultural development, and poverty reduction in developing countries over the past decades, many Asian countries continue to underinvest in agricultural R&D. Given the substantial time lag between investing in research and reaping its rewards - which is typically decades, not just years - agricultural R&D requires a long-term commitment in terms of sufficient levels of sustained funding and well-staffed research agencies.

The International Food Policy Research Institute's (IFPRI's) Agricultural Science and Technology Indicators (ASTI) program is the leading program globally that collects, analyzes, and reports on trends in agricultural R&D capacity, investments, and outputs in developing countries worldwide. This ASTI paper assesses long-term trends and challenges in agricultural R&D investment and human capacity in twelve Asian countries: Bangladesh, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam. The available data for South Asian countries are most detailed and complete as ASTI recently finalized first-hand data collection rounds from a complete set of agricultural R&D agencies operating in this subregion. Funding constraints prevented ASTI from collecting recent data with a similar level of detail from other Asian countries. Yet, ASTI managed to compile comprehensive long-term time series datasets for the remaining countries based on detailed data from the principal agricultural R&D agencies as well as external sources.

Most of the Asian countries for which detailed time series data were available have made tremendous progress in terms of agricultural R&D investment and capacity since the turn of the millennium.

Data are the lifeblood of decision making. They are an essential input for policymakers, donors, R&D managers, and other stakeholders to be able to analyze trends in agricultural R&D investments and capacity; identify gaps; set future investment priorities; and better coordinate agricultural R&D across institutes, regions, and commodities. Nonetheless, many Asian countries lack comprehensive quantitative data systems on the status and direction of agricultural R&D investment and capacity. Governments and donors, therefore, need to urgently invest in sustainable agricultural R&D data systems today as a shared resource that will enable the innovations required to meet the challenges of tomorrow.

SI.3 A Synthesis of the Status of Agricultural Research and Investment to Support Sustainable Development in Countries of Asia and the Pacific

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The pace of advances in agricultural research and innovation is commensurate to the investment made in this area. It is, therefore, crucially important to assess the current capacities, disparities as well as levels and trends of investment in agricultural research and innovation to support sustainable agricultural development in the countries of Asia and the Pacific.

Apparently these levels and capacities vary drastically between the sub-regions (South Asia, Southeast Asia and the Pacific) and also between well developed, developing and least developed countries of the region. Such variations are considerable and do occur due to a number of reasons, including man-land ratio, advancement of technologies, development goals, focus of trade and trading partners, industrial development, and socioeconomic considerations and policy objectives in various countries and economies.

In order to assess and understand these variations and underlying causes so as to further assess future needs and directions for investments in agricultural research and innovation for sustainable development in individual countries, and the region as a whole, efforts were made to have detailed information and systematic assessment on capacities and level of investment through appropriately structured status reports from 25 countries in the Asia-Pacific region. The status reports were received from 22 countries, and these primarily covered aspects such as current policies and strategies on agricultural research for development; priorities for agricultural research and innovation; institutional roles, responsibilities and partnerships; infrastructure and financial investment; major challenges and opportunities ahead; and short to medium-term plans. A synthesis of key findings including current scenario, gaps and constraints and future prospects is presented in this paper as contribution to the dialogue and to further discuss and identify priority areas of actions to promote and improve investment, policy support and institution building in agricultural research and innovations for sustainable development at both the national levels and the Asia-Pacific region as a whole.

SI.4 Agricultural Research Raises Productivity and Reduces Rural Poverty: Empirical Evidence from Indonesia and Thailand

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It is often said that raising agricultural productivity is important for reducing poverty in developing countries, especially among people living in rural areas. Propositions of this kind seem reasonable but they are seldom backed by solid empirical evidence. The present study examines this issue empirically, in the context of Indonesia and Thailand, where reduction of poverty incidence in both rural and urban areas has been an extraordinary success story. The present study compiles data on rural and urban poverty incidence at a provincial level and relates it to data on productivity growth in agriculture and also data on food relative to non-food prices, all at a provincial level, over time. It is found that both higher rates of productivity growth in agriculture and lower prices of food contribute significantly to poverty reduction in rural areas. The study also examines the effect of agricultural productivity growth on economic inequality in rural Indonesia and again finds the effects to be highly significant.

Session II: Scoping Investments in Agricultural Research and Innovation – Addressing Current and Emerging Challenges

SII.1 Patterns and Trends in Agricultural Investment – Leveraging Whole-System Impacts

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Current policies for agricultural investment harbour a lexicon of euphemisms, clichés, dubious assumptions, conflicting beliefs and a façade of political correctness used to reinforce thinking that is best described, from my own perspective as a foresight practitioner, as highly conservative if not bordering on the obsolete. Moreover many of the assumptions informing this thinking, invariably presented as innovative and strategic, are nothing of the kind.

The world is awash with money if you know where to look and who to ask. But philanthropy of all kinds, private equity, government funding and the allocation of capital for so-called "essential projects" from non-government entities are all shifting their emphasis and expectations quite dramatically in response to unprecedented and volatile global socio-economic conditions. If the organizers of the policy dialogue are serious about attracting additional investment into agricultural research, or even sustaining current levels of investment, orthodox thinking will simply not suffice. But is more money the only answer?

Our species has reached a crossroads – largely as a result of our achievements and ingenuity. The issue of whether we can survive such success or whether, ironically, hubris might lead to our own extinction, is as yet unknown. Certainly the major problems of our time are impacting humanity's most life-critical systems – food production and water security among them – in ways we failed to anticipate.

As participants at this high level policy dialogue will attest, those regions of the world where hunger and poverty are most widespread are trapped in dormant or decreasing rates of agricultural investment and production. And so the real issues we must face are concerned with how we provision for the impossible. *How can we rapidly redesign our systems, cooperatively, in ways that benefit all of humanity, without further damage to each other or to the environment? What changes will we need to make to our most fundamental belief systems in order for us to be able to*

see possibilities that have eluded us thus far? And, even more significantly given today's burgeoning global population of 7.2 billion people, *What does it mean to be human*?

This paper explores the differences between much orthodox thinking underpinning investment in agricultural research and alternative beliefs and practices that hold the clue to future enduring success.

SII.2 Investing in Agri-Biotechnology: Research for Entrepreneurship

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Many factors and trends influence the growing demand for agri-biotech products originating from both public and private sectors. These demands are fuelled, *inter alia*, by the increased need for quality and safe food and feed, improved stability of food security, for technologies to increase agricultural productivity with less fertilizer, less arable land and reduced water resources, for climate-adapted agricultural technologies (including climate-smart crop varieties) and for sustainable food production systems. Demographic trends such as population growth to nine billion by 2050, and a predominantly urban, middle-class Asia by 2030, further lead to an increased demand for diverse and high protein diets. All these needs are to be fulfilled by a greatly reduced and aged farming population. As a group of technologies, agri-biotechnology offers much scope to meet these demands.Agri-biotechnology includes conventional biotechnology (such as tissue culture, fermentation-based technologies, mushroom culture, improved crop varieties and animal breeds) and novel biotechnologies (genetically engineered organisms, marker aided selections of plants and animals, biodiagnostic tools, new vaccines and synthetic food). The global biotechnology industry is valued at over US$ 300 billion, of which biotechnology seeds are estimated to contribute US$ 15 billion on 2014, approximately 35 per cent of the global market for improved seeds. Generation of agri-biotech products commonly emanates from lab-based research to prove a concept. However, the "lab to farm to consumer" pathway requires appropriate investment in R&D and the development of a new paradigm of "farmers as entrepreneurs". To enable this pathway requires supportive policies for investment, infrastructure for conventional and novel biotechnologies, public sector financial support or investment funding by the private sector, the development of human resources (especially in science), regulatory frameworks to guide the development and deployment of new agri-biotechnologies, intellectual property regimes, and finally, consumer education and public awareness of the safety of new products. Many Asia-Pacific countries have developed modern "state of the art" capacity to tap into science for supporting economic development. Examples are the Biotechnology Research Institute, Chinese Academy of Agricultural Science in China, BIOPOLIS in Singapore, National Center for Genetic Engineering and Biotechnology in Thailand, and the Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development

(*ICABIOGRAD*). Research resource allocation is a challenging process in both the public and private sectors. Generally, the public sector tends to adopt a "science/technology – push" approach while the private sector is predominantly "demand-pull". Investment in research is, however, only one element of a complex, multi-step system that eventually leads to useful products for farmers and consumers.

SII.3 Five Necessary Policy Changes to Help Achieve Improved Nutrition and Sustainable Agriculture Through Smallholder Vegetable Horticulture

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The potential of vegetable horticulture to contribute to improved nutrition and sustainable agriculture is largely unexploited because of a chronic lack of investment in vegetable research and development. Five policy changes are necessary to correct this scenario. First, reorient food policies from having a focus on staple food production towards the promotion of healthier, better-balanced diets and collection of better statistics to monitor the outcomes of such new practices. Second, invest more in horticultural research and focus on overcoming long-term priority constraints to production including the generation of sufficient well-trained human resources. Third, strengthen market opportunities for smallholder farmers through better market integration and the adoption of improved pre- and post-harvest technologies. Fourth, strengthen policy and monitoring frameworks to ensure safer pesticide use that helps protect the environment and both smallholder farm families and consumers alike. Fifth, reconsider the need for appropriate investment in vegetable germplasm development to safeguard long-term improvement in the horticultural sector and to better align new emerging varieties with the need for better nutrition in the face of climate change in a warming world. Policy change in these directions will help to unleash the substantial potential of smallholder vegetable farmers to improve the income of the poor and to provide better nutrition for all.

SII.4 The Opportunities and Challenges for Livestock and Aquaculture Research for Development in Asia

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The livestock revolution continues unabated, and is centred in Asia. This explosion in demand for livestock and fish products is driven by rising incomes and urbanisation, and is expected to double by 2030 for many commodities in Asia. In terms of value, four of the five top commodities globally are now livestock products, the fifth being rice, with the dairy most valuable commodity globally. South Asia is now the world largest dairy producer and beef exporter, and East Asia is the fast growing region for livestock product imports. Approximately 60 per cent of the world supply of fish comes from this region where a large proportion is consumed domestically. In spite of increased supply of animal-sourced foods (ASFs) the region houses the majority of the world under-nourished population. ASFs provide the best source for dense and available high-quality protein and micro-nutrients, and in children, contribute to cognitive as well as physical development. Even though the region is now the centre for much of the world's livestock and fish supply, in most of the region the production, especially of ruminants, is dependent on smallholder producers, who typically operate using traditional technologies and experience low yields. Similarly, in large parts of the region, the link between livestock and fish producers and consumers is provided mostly by informal or wet markets, offering raw or traditionally processed products that do not meet modern standards. Finally, the threat to human health from zoonotic disease and other food safety risks potentially associated with livestock and fish products remains. In this paper, we review these trends and identify the opportunities they create for rural producers in Asia, as well as the challenges they pose, and the potential risks. We then lay out the potential priorities for regional research to address these issues, led by Asian nations supported by the international agricultural research community.

Session III (A): Scoping Investments in Agricultural Research and Innovation – Climate-Smart and Sustainable Agriculture

SIII (A).1 Innovation in Agriculture in Response to Climate Change: Towards a Global Action Plan for Agricultural Diversification

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Current global agriculture practices must be reassessed in the light of two pressing factors of differing nature: climate change and the United Nations 2030 Sustainable Development Agenda (SDA 2030) Goals (SDGs). The former will affect crop yields, nutritional value and production distribution although the nature of agriculture in a hotter world is not known and may be catastrophic for the major crops. The latter will impact on agriculture as several of the seventeen SDGs must be addressed through agriculture to be achievable. A Global Action Plan for Agricultural Diversification (GAPAD) is proposed to tackle these two factors simultaneously and so must be ambitious, global, inclusive and evidence-based. This paper gives the justification for GAPAD and calls for support for the Paris Declaration on agricultural diversification which will be presented at the UN Conference on Climate Change (UNFCCC COP 21) in Paris in December 2015.

SIII (A).2 Achieving National and Global Climate Objectives in Asia and the Pacific Through Investment in Climate-Smart Agriculture

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The agriculture sector remains crucial to the livelihoods and food security in Asia and the Pacific and is both increasingly vulnerable to changes in climate and a significant source of emissions. It is widely anticipated that the next Conference of Parties to the UNFCCC (COP21) and associated negotiations in Paris in December 2015 will mark a key turning point for future global action to tackle climate change and deliver an agreement to limit greenhouse gas emissions and set the world on a more sustainable development pathway. While it is not possible to predict the outcome of negotiations, it is clear that the agriculture sector, comprising crops, livestock, forestry, fisheries and aquaculture, will be a key focus area for future action under the UNFCCC framework to foster climate-resilient, low emissions development. Agriculture is a key element of the immediate future work program of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) that will guide future advice to the COP. Countries are also identifying agriculture and forestry as key targets for future actions to strengthen climate resilience under their Intended Nationally Determined Contributions (INDCs). As INDCs are expected to transform into Nationally Determined Contributions (NDCs) following the negotiations in December 2015, they will be an important roadmap for directing future investment and technical support. From a developing country perspective, the UNFCCC negotiation process and the INDCs also highlight where the global financing mechanisms that underpin the UNFCCC – most notably the Green Climate Fund (GCF) – should focus investment. These developments represent a unique opportunity to leverage countries existing agriculture sector development and investment plans and to drive climate-smart development in the agriculture sector leading to real benefits for agricultural communities and the environment. This presentation will summarize these developments and identify potential strategies that developing countries in Asia and the Pacific can employ to use these processes to drive investment in climate-smart agriculture.

SIII (A).3 Potential Areas of Investment in Climate-Smart Agriculture in South Asia

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Agriculture is the major land use across South Asia which contributes about 15 per cent of total gross domestic products (GDP) and employs more than 50 per cent population in the region. In some countries, such as in Bangladesh and Nepal, more than 65 per cent population is engaged in agriculture sector. This sector would be significantly impacted due to increase in temperature, changes in rainfall patterns and changes in the frequency and intensity of extreme climatic events such as floods and droughts. The estimated impacts of both historical and future climate change on crop yields in different regions of South Asia indicate that the yield loss can be from 10 per cent to 60 per cent depending on location, future climate scenario and projected year. Thus, the agricultural production system requires adaptation to climate change and variability in order to ensure food and livelihood security of millions of people in the region.

Climate-Smart Agriculture (CSA) is being promoted for adaptation and mitigation of climate change and variability in many places. CSA aims to improve farm productivity and income, increase resilience to weather extremes and decrease greenhouse gas emissions wherever possible. Farmers require to make several adjustments in crop management practices (e.g. changes in sowing time, application of water and fertilizers, tillage practices and inter-cultural operations) to transformation of agricultural production systems (e.g. change in cropping systems and land uses) to adjust with new climatic conditions in a particular location. Despite several options available for adaptation to climate change in agriculture, the uptake of many CSA practices and technologies by farm communities is not adequate to achieve their full potential effect in South Asian regions. There could be many adoption barriers including lack of investments, policy and institutional bottlenecks, and lack of coordinated actions by different stakeholders. Therefore, maximizing the impacts and scaling out the adoption of CSA requires bringing together a number of pieces- including investment in R&D and enabling policy environment.

This paper highlights potential areas and investment mechanisms for scaling out CSA in South Asia. Broadly, we categorize investment areas into followings: (i) Research: identification, prioritization, and development of portfolios of CSA interventions based on farming systems in different agro-ecological zones; (ii) Development:

Tools and models for investment planning and decision support system; (iii) Capacity building: project designing, implementation and M&E; and (iv) Scaling out: horizontal (farmers-to-farmers) and vertical (integration into existing policies and programs). This paper presents a Climate-Smart Village (CSV) model as a participatory approach of scaling out CSA which converges research, development and capacity building activities at the local level. This approach provides strategic and technical decision supports to the local communities and other key stakeholders for investment in climate change adaptation. The paper also highlights some potential investment opportunities for private sectors such as agro-industries, ICT companies and agriculture input suppliers, and new research needed to attract investment to CSA.

Session III (B): Scoping Investments in Agricultural Research and Innovation – Knowledge Management for Sustainable Agriculture

S.III (B).1 Land Resource Inventory of India for Development of Sustainable Agricultural Land Use Plans Using Geospatial Techniques – Avenues for Investment

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In India, investment in agriculture is growing at the rate of 9 per cent annually. Fertilizer consumption is increasing exponentially; however, productivity is stagnant even with best available management resources. Blanket application of technologies in absence of site-specific soil (land) resources data, and of situation-specific recommendations is one of the reasons for yield plateauing. The ICAR–National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), India has taken initiatives through its Land Resource Inventory (LRI) at country level programme on 1:10000 scales to fill the vital gap by generating data on site-specific soil and land resources. The present paper discusses the conceptual approach to LRI and expected outputs. It involves systematic surveys of soils (cultivable land) on 1:10000 scales and collection of other collateral data needed for scientific land use planning in GIS environment. This is a priority programme of the ICAR-NBSS&LUP and investments thereon are expected to generate rich dividends. The project is being executed (NBSS&LUP) in a consortium mode by involving State Governments/State Departments of Agriculture, State Agricultural Universities, National Remote Sensing Centre, Hyderabad, India, State Remote Sensing Applications Centres and Soil and Land Use Survey of India. The NBSS&LUP has responsibility to provide required scientific/technical back-up and facilitate establishment of the National Portal on soil and other land resources for effective dissemination of information. In the wake of several initiatives announced by Indian government, use of geospatial technologies is becoming undisputedly very important across Natural Resource Management Institutions. The said programme uses the latest time efficient and cost effective geospatial technologies and thereby ensures accuracy of the methodology.

The nationwide survey will categorize the agricultural and non-agricultural areas in terms of their strengths, limitations and opportunities for appropriate use and threats from misuse/abuse. This will help in developing perspective land use plans and monitoring

their impact at macro (district/state) and micro levels (village level). Special agricultural zones (present and potential) are planned to be delineated for giving focused support and services for major agricultural and horticultural production systems across the country and simultaneously delineating non-arable areas for other land uses. The importance of such land use planning is further enhanced if it is disseminated through well designed geo-portal. Efforts have also been initiated to develop a web-based platform, NBSS Geo-portal, deployed in a simple architecture with database server and application server to manage soil resource database. Depending on the authorizations, the user is able to visualize, analyse and download the soil information, upload maps, create new maps and merge them with other maps. Besides the legacy datasets, the land resources database developed under LRI project will be integrated with agro-technologies developed by other institutions in the geo-portal. The so developed NBSS Geo-portal with an estimated cost of about 1800 million US dollars will help to acquire, process, store, distribute and improve the utilization and dissemination of geospatial data through Web Map Services (WMS) and Web Future Services (WFS).

S.III (B).2 The Case for Investment in Knowledge Management to Support the Sustainable Development Goals in Asia-Pacific Region – Some Lessons Learned from CABI's Experiences

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The ambitions set out in the Sustainable Development Goals (SDGs) demand unprecedented levels of global cooperation and integration, calling for all countries and stakeholders to act in collaborative partnership to implement this new universal agenda. In contrast to the Millennium Development Goals (MDGs), the new goals emphasize the importance of monitoring and measuring progress and the development of appropriate indicators to facilitate this process. The statement calls for quality, accessible, timely and reliable disaggregated data, stressing that "such data is key to decision-making". Elsewhere, there is a call to enhance knowledge sharing and the use of enabling technology, in particular information and communications technology. Such calls are easy to make, but require considerable investment in technology, knowledge management skills, communication expertise and analytical capabilities, which should not be underestimated when planning SDG implementation programs. With a 100 year history of serving the information needs of the agricultural research and development sectors, and through the creation of innovative knowledge management platforms such as the Plantwise Knowledge Bank and the Direct2Farm mobile agri-advisory service, CABI has made major investments in its own knowledge management capabilities and as a result is uniquely placed to provide the underpinning data collection, sharing and reporting tools called for in the SDGs. Equally, putting know-how into the hands of smallholder farmers and bringing science from the lab to the field in order to achieve impact at scale requires investment in capacity building at the regional and local level to ensure long-term sustainability and stakeholder empowerment. This paper uses some of CABI's recent knowledge management initiatives to illustrate the scale and type of investment required. It also explains the need for all AR4D stakeholders to embrace the Global Open Data for Agriculture and Nutrition (GODAN) initiative and to embark on the journey towards data-driven and evidence-based programs.

S.III (B).3 The Rice Bowl Index: Using Open Data to Help Drive Sustainable and Robust Food Security Across Asia-Pacific

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Food security continues to be at the top of many government agendas in Asia-Pacific. Government intervention in all areas of food and agriculture is increasing and whether this intervention is positive or negative depends on effective and robust dialogue. The Rice Bowl Index (RBI) is a tool that brings together open data to inform dialogue on how countries can improve their food security. In line with this the RBI has developed new food security thresholds to provide governments and other stakeholders with more actionable insights.

What has happened to food security over the past 12 months?

Over the last twelve months, the food security robustness of the 15 countries covered by the RBI has continued to improve, though this has been at a slower pace than in previous years. Scores increased by 2.0 per cent compared to 3.6 per cent in 2014, while the 10 year average improvement is slightly above this year's result at 2.9 per cent.

What is causing the slow down?

Lower commodity prices have resulted in reduced investment by farmers in technology which is likely to reduce on-farm productivity, and this may offset the (short term) benefit lower commodity prices bring in terms of lower food prices.

For top performing countries who we consider to be food secure, the scope for further improvement in overall food security robustness is tempered while reduced volatility due to wider macroeconomic improvement can be seen as net positive to food security robustness across the region.

The results tell us that efficient regulatory systems, investment in technology, infrastructure and access to markets are needed, by both the public and private sector, for countries to be able to manage volatility and create a robust food security system.

What lies ahead?

Five emerging challenges to food security in the region have been identified:

1. Managing the impacts of climate change within the agrifood system – as considered through the Environmental rubric;

2. Adopting a new business model for smallholder producers – developing models that increase productivity – as considered through the Farm-Level rubric;
3. Improving supply chain effectiveness through to market – as considered through the Demand and Price rubric;
4. Investing in innovation and infrastructure within a partnership – as addressed through the Policy and Trade rubric and Farm-Level;
5. Creating an enabling policy and regulatory environment to underpin robustness – as addressed through the Policy and Trade rubric.

Based on these challenges, it is the intention of the RBI to continue to refine its data to ensure that the tool is well equipped to support policy makers in identifying areas for improvement. Food security in Asia-Pacific is not beyond the reach of the region's consumers, farmers, governments, technology providers and relevant support agencies. Achieving food security does however require robust dialogue and sensible policy which the RBI aims to continue to make a valuable contribution.

Session III (c): Scoping Investments in Agricultural Research and Innovation – Capacity Development for Sustainable Agriculture

SIII (C).1 Return from Investment in Agricultural Education, Research and Outreach Extension Systems for Development: Some Policy Guidelines in the Context of Pacific Island Countries

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This paper reviews some past studies on the contribution of investment in education especially higher education, research system and community extension services in agriculture over the years in different countries. Experiences of the PNG University of Technology are also described as a case study for the Pacific island countries. Finally, recommendations are made for policy guidelines for future investment.

Increased investments in higher education, research system and extension services for development in agriculture are desirable as economic success in the global market is closely linked to the out puts of these activities. Estimated real net benefit of higher education from graduates' income to the government exceeds the cost of higher education in the last two decades or more. There are also quantitative and qualitative benefits of higher education. The main quantitative benefit is the enhanced earnings of the graduates. They pay higher tax on earnings to the government. Qualitative benefits are improved equity, "spill over benefits" and direct external benefits to the community. The spill over benefits from the investment in university education, research system and community extension services are enormous because the university system provides more opportunities to make their outputs public, instead of keeping them private, through access to public media. Geographical clustering of innovations in these sectors also results into international knowledge spill over. Studies from several countries over three decades and more support the high return from investment in agricultural extension services for community development, even quite often without considering the impact of inter-farmer communications. Apart from yielding significant financial returns, extension advisory services have also yielded positive social returns, particularly for women, people with low literacy levels, and farmers with medium landholdings. Investment in higher education, research, extension and innovations

through university system pays off. Its value is borne out by history across time and space. Particularly Agricultural Universities and institutions engaged in teaching, research and extension services play significant role in integrating "knowledge triangle" through their programs and projects. Policy guidelines to address these issues need to be updated in the context of changing environment. The disadvantaged geographical locations as isolated island countries which are not easily accessible need special attention for investment through policy supports.

SIII (C).2 Investment in Extension and Advisory Services in Asia-Pacific Region: Status and Opportunities

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Though agricultural production and productivity have generally increased in Asia, poverty and food and nutritional insecurity is widespread in many of the less-favored agricultural regions. Agriculture thus remains critical for these issues and generally for improved livelihoods in the Asia-Pacific Region. Extension and advisory services are a fundamental institution to support agriculture to achieve these objectives. Countries in Asia, particularly Eastern, South-eastern, and Southern Asia have the largest extension systems in the world. In Asia, extension and advisory service provision is largely in the public domain and most of it is funded and implemented through the national and state level ministries or departments of agriculture. Universities and agricultural research centers are also engaged in limited extension work. However, these services have been traditionally weak, in part because it is difficult to show impact of extension, which could convince policymakers to prioritize and invest in extension and advisory services. Research, regional dialog, and expert opinion show that there are several key areas where extension should be strengthened: in the individual key competencies of advisory service providers, capacities at the organizational and system level within countries, in the development of national extension platforms to share knowledge, participate in innovation processes, and engage in policy dialog, and in the development of policies and strategies for extension. The authors therefore recommend: (i) Better collect and data on extension systems; (ii) Development of advisory services and extension policies, (iii) More investment in extension, and (iv) Capacity strengthening especially functional capacity for extension professionals as well as organizational and system capacity.

SIII (C).3 Agricultural Sustainability Through Collaboration, Beyond Competition

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The Sustainable Agriculture Initiative Platform was founded by three companies in 2002 and now in 2015 has more than 80 members representing the entire supply chain and sourcing from countries all around the world. Our vision is to: Implement secure and thriving agricultural supply chains and protect the earth's resources through widespread adoption of sustainable practices that deliver value to our members, farmers, farming communities, and consumers.

At its conception, it was an unprecedented and experimental effort of collaboration between fierce competitors in the market. They had the vision that they could not solve the issues they faced alone. Since, SAI Platform has developed the trust and clear precompetitive space among members to leverage collective knowledge and develop practical tools for sustainable sourcing. By working through crop specific working groups and thematic committees, we started to develop a common understanding of sustainable agricultural challenges and directions for solutions. This has been a long technical and consensus building process that concluded in **'Principles and Recommended Practices'** for several agricultural raw materials as well as many other supporting tools and guidance (Technical briefs, Practitioner's guide for sustainable sourcing, Executive Training and more)

Ambitious members started to implement these principles and practices in their respective supply chains – which resulted in swamping the market with dozens of sets of good sustainable agricultural practices. All were slightly different, which in some supply chains has led to confusion, frustration, and unintended bureaucracy. Add to this the already existing private (third party) standards and labels with very similar (intentions or goals), and it is safe to state the well-intended yet diverse and complex systems not always created the improvement we all wanted to see at farm level. To address this, SAI Platform decided to develop one common global tool for assessing, improving and communicating sustainable agriculture, the **Farm Sustainability Assessment (FSA)**, based on the commonly agreed Principles and Practices.

FSA is now being built an online universal database, in multiple languages and with multiple filtering options to allow for tailoring the use of FSA to regional situations and crops. This IT system will offer a complete supply chain mapping and the ability

to communicate data on on-farm sustainability throughout the supply chain, from farm to retailer. Users of the database can also blend in other standards and labels in several ways through benchmarking exercises and filters, which can result in a significant simplification and reduction of duplication.

The FSA system is ambitious, yet only a first step of an exciting journey. It provides the foundation for many more opportunities, like training facilities, knowledge exchange between farmers beyond their direct neighbors, avoidance of multiple audits, links to governmental programs or the base for improvement plans, both individual and structural, and finally a base for secure financing.

Session V: Impact Expectations from Investment in Agricultural Research and Innovation

SV.1 Agricultural Research in a Transforming Country: Views from the Vietnamese (Rice) Field

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Vietnam is a middle income country that continues to demonstrate impressive rates of economic growth and poverty reduction. Yet it remains heavily dependent on agriculture and natural resources as a source of growth, employment (both rural and, through agri-based processing, urban) and foreign exchange earnings. Moreover, the majority of Vietnam's poor and near-poor remain dependent on agricultural livelihoods, especially among its ethnic minority groups. Yet many bilateral donors have left Vietnam, and the terms on which multilateral donors are continuing to provide official development assistance (ODA) are less concessional. This is affecting both the broad strategy of remaining donors, and the attitudes of the Government in terms of the priority sectors for the use of more costly (but still concessional) ODA, with the result that ODA-financed agricultural research projects are declining. At the same time, the ability of Vietnam to invest itself is increasing and continued agricultural research can be expected to deliver important results in the future. Yet the domestic structures for impactful agricultural research are not yet well configured to fill the gap, and Vietnam is arguably not fully leveraging partnerships with the relevant CGIAR centers. This presentation will illustrate some of the emerging trends and opportunities for improvement with reference to Vietnam, but which has relevance to other countries on similar development pathways across the region.

SV.2 Investing in Agriculture to Feed Asia Securely

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Two-thirds of the world's hungry or 512 million undernourished people in 2014–2016 are found in Asia, roughly 1 in every 8 Asians. By 2050, Asia's population is expected to increase by about 1 billion, requiring an increase in food production by 70 per cent to meet the calorie requirements of the region's population that is estimated to reach 5.2 billion. Other demand factors also come into play. Growing economies lead to an expanding middle class especially in urban areas where 64 per cent of the Asian population is expected to reside by 2050. Rising incomes spawn more diversified lifestyle and diets with the more affluent consumers in urban areas consuming more resource intensive food, such as meat, dairy and processed food. On the supply side, land, soil, natural resource base and ecosystem on which agriculture relies are degraded, limited, and are also needed by other sectors in society, and are threatened by the impacts of climate change. Post-harvest losses in South and Southeast Asia reach one-third of food production with most of the losses or waste occurring during the handling and storage phase of the value chain. Going forward, investments in agriculture within the Asia context should result in ensuring access to safe and nutritious food at an affordable price. The paper will discuss areas where research and development, and investment in agriculture are needed to address the food security issue, citing the Asian Development Bank's intensified response to the food security challenge by committing $2 billion annually to meet the rising demand for nutritious, safe, and affordable food in Asia and the Pacific.

SV.3 Expectations from Investments in Agricultural Research and Innovation – An NGO Perspective

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Over the last 60 years we have seen an overdose of interventions in agriculture and livestock sectors, mostly technical in nature, in a massive effort to maximise food production, farmers' income being an offshoot. Focus was on high production goals with little or no recognition of the farmers' capacities, resource availability, traditional knowledge, aspirations or what is happening to the land. When crises related to the farmers surface, which have been quite often over the years, ad hoc solutions are provided with no vision in place so that they are not repeated. Indian agriculture depends on the monsoons and it is well-known that monsoons are erratic and will get worse with increasing variability of climate. Even after achieving the full irrigation potential, nearly 50 per cent of the net sown area will remain dependent on rainfall. The concentration of research has been on well-endowed arable areas in terms water and land and they have been deluged with subsidised chemicals (fertilisers, pesticides and the like) besides electricity and machines (tractors, combined harvesters, etc.) in order to increase the food supply. The results have been that large tracts of land remain fallow due to increased salinity and water logging. The same formula has been co-opted for the drylands. Public investments in real term have been declining fast in agricultural research in general and in the rainfed areas in particular. However, the contingency payments are increasing. In the livestock sector, the persistent model has been introduction of exotic breeds in spite of there being more than sufficient evidence from the colonial era itself that this is not the path to be trod. However, we have continued the same only to realise at least in the small ruminants that it is not going to work but still we continue to persist with it in cattle. The irrigated areas have peaked in production and the increase in national food production is from newer areas coming under irrigation. The need of the hour is that farming today has to be treated as an entrepreneurship. Research investment needs to engage realistically with dryland variability, support the logic behind the dryland food production and understand integration as multitude of paths. The legacy of the past interventions in drylands has to be acknowledged and investments to be made on furthering it. Investments have to engage with the dynamic correlations, to build social capital and complementarity rather than in isolation or competition. Small scale producers should be given real chance because with inheritance laws, land holding may get further fragmented. Heavy and meaningful investments are required for agricultural research and extension with suitable provision for course correction and impact assessment.

SV.4 Developing Capacity for Change to Enhance the Potential of Investments into Agricultural Innovations

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Findings of regional assessment in South Asia and in two other regions undertaken by Tropical Agriculture Platform (TAP) and its partners in 2013 revealed that several tropical countries lack the resources and capacities to fully develop their Agricultural Innovation Systems (AIS). In the Asia-Pacific region, the development of the agricultural sector of a group of least developed countries (Bangladesh, Cambodia, Laos, Myanmar and Timor Leste) is hampered by the adverse effect of climate change and especially by a weakness in the countries' agricultural research, development and extension services. The smallholder farmers, who mostly live in poverty-stricken rural areas, are often suffering from shortage of food supplies, poor access to agricultural support (input supply and technology) and lack of advisory services and agricultural training. Supporting smallholder family farmers is crucial to the emergence of functioning AIS that improve farmers' income, food security, nutrition and environmental sustainability. To develop the capacity for agricultural innovation in the least developed countries of the Asia-Pacific region, TAP advocates for increasing investments in agricultural research and development (R&D) and more coherent, efficient and coordinated capacity development interventions that address individual, organisational and institutional capacity needs.

The paper will include the Common Framework on Capacity Development (CD) for AIS. The framework is a core component of the Action Plan of TAP, a G20 Initiative, aiming to increase coherence and effectiveness of capacity development for agricultural innovation that lead to sustainable change and impact at scale. The framework developed with contributions by TAP Partners including from APAARI consists of a conceptual background document and a practical guide for the operationalization of the framework. It is planned to apply the Framework initially in eight countries in Africa, Asia and Central America with support of the EC funded CDAIS project, jointly implemented by AGRINATURA and FAO in collaboration with local organizations from 2015 to 2018. Countries in the region include Bangladesh and Laos, where the framework will be applied and needs capacity development interventions will be undertaken. APAARI will facilitate the application of the common framework, policy dialogue for improved capacity development for agricultural innovation in the Asia-Pacific region.

Session VI: Innovative Funding Mechanisms

SVI.1 Time for a Step-Change: The Agricultural Innovation and Enterprise Facility

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The global fragmentation and under-resourcing of public innovation, education and advisory processes, and weak linkages with wider development processes and with farmers, NGOs and the private sector, are major bottlenecks constraining the value and impact of agricultural innovation on the lives and livelihoods of the poor. Chronic public underinvestment in agricultural research for development in low-income countries has resulted in weak national agricultural research and innovation systems that will not be able to cope with the massive challenges that lie ahead.

The FAO/IFAD/WFP 2015 Report: "Achieving Zero Hunger by 2030" estimates 17 per cent of new rural development investments, i.e. USD 17,628 million, should be in agricultural research, development and extension, plus other essential investments to turn innovation into impact. IFPRI estimated that national investments in the sector need to triple by 2025 to meet future food and nutrition security needs, alongside a similar increase in support to international research. However, national investments have only grown 20 per cent in a decade. Spending in many countries is stagnating or declining and many are re-investing well below the UN recommended 1 per cent of agricultural GDP.

The Agricultural Innovation and Enterprise Facility, now being developed through the many partners from all sectors involved in the Global Forum, will establish a multi-stakeholder convening mechanism to directly create effective and integrated innovation systems, enabling effective scale-out of appropriate innovations and turning innovation into enterprise opportunity for rural women and youth. The Facility will coherently integrate the resources, education and capacity development, technical assistance, equitable partnerships and enabling environment required to transform the lives and livelihoods of rural women and youth across a range of countries, and at a significant scale.

In so doing, the Facility will directly address the 'Missing Middle' between agricultural research, innovation and their impacts at scale in ending poverty and hunger, promoting gender equality and economic empowerment for women, girls and rural

youth and fostering more resilient and sustainable systems, to transform the lives of the rural poor and poor consumers. Driven by the needs of national systems and in programs managed and delivered by national partners, the Facility will mobilize the resources and identify appropriate capacity development support to strengthen and transform local and national agricultural innovation systems, in line with the GCARD Roadmap.

Funds will be managed through established multilateral financial institutions such as IFAD, GAFSP and the World Bank, in association with other development investments, and subject to the same rigorous quality control and supervision as other funds. Through our multi-stakeholder governance, the extensive networks of Partners involved in GFAR from each region will catalyse, engage and mobilize the delivery partnerships required and provide effective multi-stakeholder oversight of program activities with the financing agencies concerned. Essential principles are the equitable inclusion of public, private, producer and civil partners – particularly smallholder farmers. The Facility concept has gained much traction and is now being developed into practical actions in a range of countries, with considerable potential value in Asia and the Pacific regions.

SVI.2 Innovative Funding Mechanisms of Public Sector: The Case of National Agricultural Innovation Project (NAIP) of Indian Council of Agricultural Research

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The Indian Council of Agricultural Research (ICAR) is a premier apex public sector agricultural research organization of India. Along with other partners of National Agricultural Research System (NARS), by effectively providing science and knowledge inputs, it has significantly contributed to accelerated and sustainable agricultural development of India. In this endeavour, one of its strategies particularly for addressing emerging and anticipated challenges through out of box solutions has been to seek and utilize external funding support particularly from the World Bank to reform and reorient the NARS. Some of the recent projects supported with credit assistance from World Bank include, National Agricultural Technology Project (NATP) during 1998-2004 to augment technologies and strengthen agricultural extension system and National Agricultural Innovation Project (NAIP) during 2006-2014 to put technologies into effective and wider use through innovations. NAIP was implemented at a total cost of USD 250 million which included USD 200 million credit assistance from the World Bank.

The project development objective was to facilitate an accelerated and sustainable transformation of the Indian agriculture so that it can support poverty alleviation and income generation through collaborative development and application of agricultural innovations by the public organizations in partnership with farmers' groups, the private sector and other stakeholders. It is planned to achieve this objective through excelling in basic and strategic science (Component 4), market orientation (Component 2), social inclusion (Component 3) and strengthening institutional capacity (Component 1). The main focus of NAIP is on innovations some of the notable of which include strong project design; consortium approach; use of Help Desk; bigger projects; massive capacity development in advanced institutions in India and developed world; research on value chain, sustainable livelihood security, and hard core basic and strategic sciences; effective and elaborate M&E and E&S frameworks; responsive and transparent project management; and establishment of business planning and development units. The NAIP has worked with 203 consortia, 653 consortia partners covering public

[1]The support to NAIP by ICAR is gratefully acknowledged. The views expressed in the paper are personal and not of ICAR

sector institutions (about 60%), private sector and NGOS (25%) and State/Central/ International institutes (15%) working in 856 institutions situated all over India.

Among other several deliverables, the project has developed and validated 51 diverse value chain models, 36 livelihood models in the most backward regions of India, and 272 production and processing technologies; piloted 62 rural industries; promoted 5 producer companies; commercialized 80 technologies/products; filed 149 patents, published 635 papers in high impact international journals besides several innovative *e*-products like *e*-courses, agro-pedia, *e*-Granth, etc. and supported capacity development of 1000 scientists in advanced labs/institutions in India and the developed world. With these remarkable achievements, the project has ended up with an overall Financial Benefit Cost Ratio (FBCR) of 1.81 and Economic Benefit Cost Ratio (EBCR) of 1.75. The economic and financial benefits which accrued from the project is estimated to be USD 430 million on an initial investment of Rs. 240 million with an overall internal rate of return (IRR) of about 40 percent.

SVI.3 Intellectual Property Management and Commercialization of Agricultural Research: A Case of MARDI

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Agriculture continues to represent an important source of income for Malaysia. The government provides the majority of funding for agricultural R&D. The relatively high and increasing R&D investment in Malaysia has strengthened its agricultural productivity, particularly in terms of the country's major export commodities. The country's main public agricultural R&D agency is the Malaysian Agricultural Research and Development Institute (MARDI), accounting for more than a quarter of national agricultural research investment. Narrowing down to commodity-based research agencies, the Malaysian Palm Oil Board (MPOB), the Malaysian Cocoa Board (MCB), and the Malaysian Rubber Board (MRB) come into the picture. These three agencies' research investment mainly focuses on high value export crops and other related commodity-based resources. Investment in R&D will fully benefit from strong intellectual property (IP) and commercialization regimes. Similarly, it will also propel more R&D investment. Meanwhile, the main purpose of the National Intellectual Policy of Malaysia is to harness IP as a new engine of growth for the enhancement of economic and social prosperity. The focus on development of proficient IP management capabilities covers the whole IP chain activities from creation to protection with support of good infrastructure for IP transaction, protection of National IP interest and at the same time promote foreign investment and technology transfer to ensure IP as a stimulant for innovation. Thus, to ensure the relevancy in the mainstream of national invention and innovation arena, MARDI has proactively strengthened her in-house IP management portfolio. This paper aims to share an overview of agriculture research investment in Malaysia, MARDI's IP and commercialization management, focusing on effectively managing the R&D&C as well as innovation thus stimulating and fostering technology transfer. It also provides an overview of operational approaches, success stories as well as the issues and challenges in IP management and commercialization in the context of MARDI.

SVI.4 Regional Partnership to Address Food Production Crisis in the Pacific Islands

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The Pacific region has reached a juncture where food production is in crisis. Per capita crop production has been falling in nearly all the Pacific countries over the past decade, even in countries with little population growth. The food production crisis has been caused largely by: (i) downward spiral of soil productivity as a result of increasing deforestation, high rates of soil erosion, and declining levels of soil organic carbon caused by intensive use of soils; (ii) Loss of biodiversity as a results of changing modes of production from traditional mixed cropping to mono-cropping, increasing bush fires, increasing pests and diseases, and climate variability/extreme events; (iii) increase in food waste; and (iv) the need to build capacity of land users in how to properly manage land, soils and forests.

In order to sustain this intensification of food production, there is a need to develop and adopt technologies that will improve or sustain productivity while enhancing natural capitals and ecosystem services. But, the proportion of national budgets allocated to agriculture development is quite low, ranging from less than 1 to 3 per cent. This means that national budget for research is insufficient and relying on donor support. The Secretariat of the Pacific Community Land Resources Division (SPC LRD) with its technical human resources cooperates with national ministries of agriculture and international agencies like FAO, ACIAR and IFAD and donor agencies like EU, DFAT, NZAID in developing and implementing research proposals addressing priority research issues in the countries. This partnership is very successful and donor agencies use SPC LRD as a hub to channel funding for agricultural research in the Pacific Islands.

SVI.5 A Comparison of Public/Private Agricultural Research Partnerships

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The Rural Research and Development Corporation (RDC) model of joint industry and government funding has been a vital element in the success of Australia's research effort in the agriculture, fisheries and forestry sectors for over thirty years. Co-funded public/private research has helped Australian agriculture to double its productivity over the past twenty five years. There are currently fifteen RDCs co-ordinated by a Council of Chairs, but with each RDC focussed on particular farm sectors covering crops, horticulture, livestock, forestry and fisheries. Producers in each farm industry pay levies for collective research. This recognises that individual farmers are not normally positioned to undertake such research or to appropriate the benefits of the investment.

The RDCs commission agricultural research on a competitive basis amongst public and private providers using investment funds from farm based production levies matched up to a formulated limit by Federal government grants. Currently, the government provides dollar for dollar matching of industry funds up to a maximum of 0.5 per cent of each industry's gross value of production (GVP).This joint public/private funding system enables close partnerships to determine and agree on research investment priorities that address triple bottom line (economic, social and environmental) outcomes.

Major successes of this Australian case study include:

- more effective research, development, innovation and extension of results than would be possible without such partnerships in areas that are priorities for both industry and government such as productivity growth, climate change and natural resource management
- the ability to tackle projects jointly increases efficiency and effective communication of outcomes thereby contributing directly to productivity growth
- increased funding incentives to leverage higher total research investment than would be possible by each party acting alone.

While this public/private partnership model has been generally regarded as a success, the presentation gives consideration to whether the Australian model, or an adapted version of the model, could be usefully applied in other Asia-Pacific countries. This raises a number of structural, commercial and financial considerations, as well as administrative challenges for regional countries and industries to consider.

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