

East Asia and Pacific Region Report of the IAASTD

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Summary for Decision Makers

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Overview of the region and the context for AKST

The ESAP region is home to about 3.398 billion people or just over half of the world's current population, with China and India currently constituting around 37 percent of the global population. A majority of the ESAP population - 53% – are still engaged in agriculture, predominantly as smallholders, relying on it primarily for family sustenance, livelihood and income. Agricultural area per capita averages 0.64 ha and concentration of most of the people on less than half of the land area results in severe and increasing pressure on natural resources (land, water, flora and fauna) in many places. With the exception of the few developed countries, the majority of the ESAP countries' economy remains strongly agrarian although this is changing as ESAP countries move towards rapid industrialization and urbanization. Agriculture provides food security, livelihood, income, and agricultural trade - for both import and export. Agriculture also provides other ecosystem services, including cultural services. These emerging multiple roles of agriculture are becoming much more apparent and prominent as different economies strive for sustainable development.

ESAP countries include 33 nations: Australia, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China PR, Fiji, India, Indonesia, Japan, Kiribati, Republic of Korea, Lao PDR, Malaysia, Maldives, Republic of Marshall Islands, Micronesia, Mongolia, Myanmar, Nepal, New Zealand, Palau, Papua New Guinea, Philippines, Samoa, Singapore, Republic of Solomon Islands, Sri Lanka, Thailand, Timor-Leste, Tonga, Vanuatu, Vietnam

There has been an overall improvement in human welfare in the region, but South Asian countries continue to have the highest concentration of poverty. There are wide disparities in well-being between urban and rural areas, with rural areas demonstrating increasingly greater incidences of poverty. In addition, women are highly represented among rural poor. Two current threats to human well being in the region are HIV/AIDS and highly pathogenic avian influenza virus; these have an adverse impact on rural economy.

The agriculture labor force composition is changing with increased female participation and child labor. Unpaid and low paid work in agriculture is a prominent feature. The population's educational attainment is marked by gender and rural disparities. The region also demonstrates high level of migration both international and internal leading to labor flight especially from rural areas, but with remarkable gain in remittances received.

The ESAP Region is characterized by considerable diversity in terms of agroecological zones, climate and farming systems. Major farming systems, in terms of the land area of the region, include pastoral, arid region, upland intensive mixed and lowland rice, agroforestry and plantations. In terms of the population involved in farming, lowland rice and upland intensive systems predominate. In more recent decades, aquaculture and mariculture have become

economically important for many countries, especially in south and south-east Asia. The region has continued to rely on many of its traditional and local knowledge and indigenous practices for which agriculture and human well-being..

The global orchestration of AKST development started with the creation of the Consultative Group of International Agricultural Research (CGIAR) and the establishment of National Agricultural Systems (NARS) which also led to regional R&D networks. These global, regional and national bodies set the directions of R&D in many countries in ESAP. Private organizations are also now highly involved in the generation of AKST especially in the development of GMO products while the Non-Governmental Organizations (NGOs) are leading in the AKST development to suit specific needs of the region's diverse environment. Agricultural extension services are mainly provided by central governments but more and more countries in ESAP are starting to devolve this responsibility, especially to private sector.

In subsequent sections, an overview of the IAASTD framework is provided and the key messages presented around the four questions posed by the IAASTD Bureau:

This Summary for Decision Makers for the ESAP region addresses four key questions posed by the Bureau:

Question 1: What are the development and sustainability challenges that can be addressed through AKST?

Question 2: What are the likely positive and negative consequences of AKST on the development and sustainability goals?

Question 3: What are the enabling conditions required to optimize the uptake and diffusion of AKST?

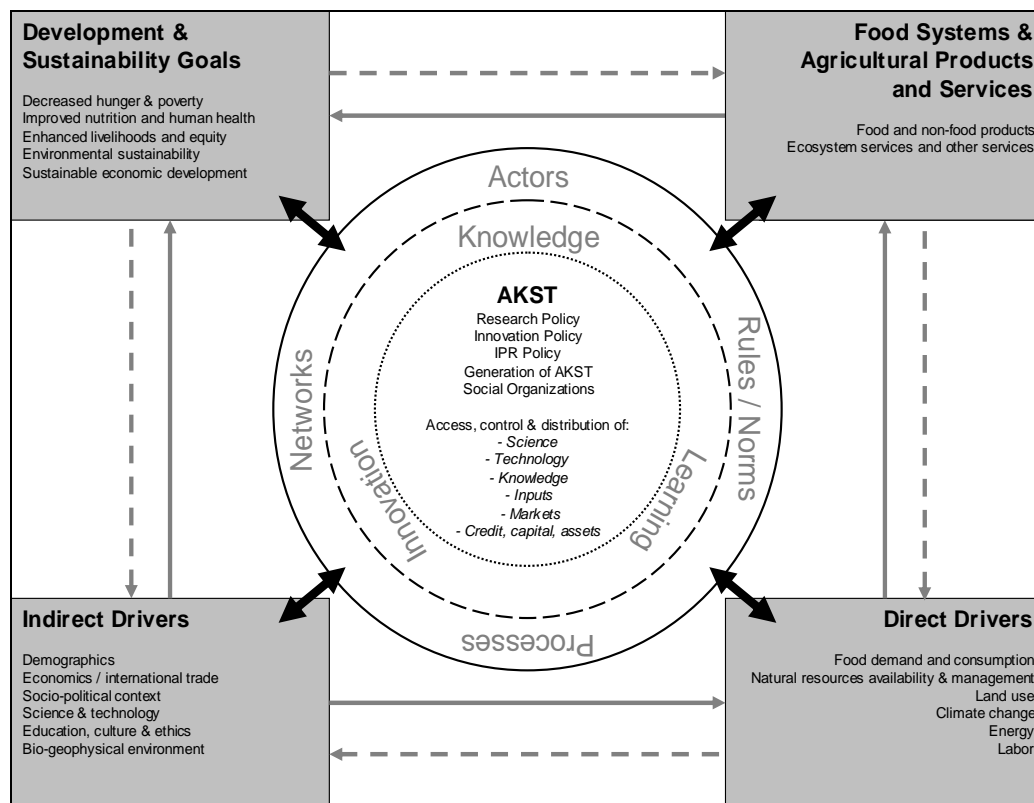
Question 4: What investments are needed to help realize the potential of AKST in realizing the development and sustainability goals?

IAASTD conceptual framework

The IAASTD conceptual framework illustrates the complex relationships among agriculture, AKST and the IAASTD development and sustainability goals. The conceptual framework – figure 1 - was developed as part of the IAASTD assessment process. It illustrates the inter-relationships among and between the indirect and direct drivers of change, food systems and agricultural products and services, the development and sustainability goals, and how each of these influence and are influenced by AKST. *[A legend for the figure will be inserted as developed in the global chapters]*

Figure 1: IAASTD Conceptual Framework

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Past and present consequences of AKST on development and sustainability goals

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Decreased hunger and poverty; Improved nutrition and human health; Enhanced livelihoods and equity

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1. **The application of AKST has enabled increased agricultural production and has improved human nutrition. Despite the increase in agriculture production, food insecurity, poverty and malnutrition remain widespread** in many countries, especially of south Asia and in rural areas. There have been gains in cereal production and the Asian countries have also made remarkable productivity gains in the dairy and fishery and aquaculture sectors. The increase in food production during the last 50 years has been at a greater rate than population increase thus improving overall food security in the region. However, focus on micronutrient rich crops such as fruits and vegetables continue to be inadequate. East Asia is a region where demand for meat is on the increase. The increase in production has been achieved mostly in intensive irrigated systems; the rainfed production systems that represent the greater part of the agricultural resource base for the largest number of rural poor across the region have received much less attention in AKST compared to irrigated systems.

21

- 1
- 2 **2. ASKT has enabled the development, increased the productivity, and improved the**
- 3 **sustainability of aquaculture especially in Asian countries.** Diversified aquaculture
- 4 technologies – pond, pen, cage, raft and raceway culture, monoculture, polyculture,
- 5 integrated aqua-agriculture, etc have developed to suit the region's diversified aquatic
- 6 environment (both inland and coastal). Production per unit area has been steadily
- 7 increasing with the application of improved AKST technologies such as liming,
- 8 fertilization, better water management, balanced feed formulation and better feeding,
- 9 improved fry quality and improved post-harvest technologies. Fish and shrimp production
- 10 is intensifying in many countries such that production of 10 MT/ha or greater is common
- 11 in many countries. Aquaculture in many Asian countries is used as an option to improve
- 12 household nutrition, increased income and provide employment to offset the stagnation
- 13 and decreased productivity of marine and inland fisheries.
- 14
- 15 **3. There is an increasing trend towards feminization of agriculture in the ESAP**
- 16 **region.** Factors contributing to the feminization of agriculture include male migration to
- 17 urban areas, labor intensive high value crop production with low wages often paid to
- 18 female workers and loss of land. All these contribute to changing women's role from one
- 19 of unpaid family labor to low wage labor in agriculture and thus to increasing
- 20 predominance of women in agriculture. The micro-credit/finance for women promoted
- 21 enterprises such as sales, crafts, stores, food vending, tailoring, dairy, poultry. These
- 22 complemented the major crop production enterprise of the farm household to provide
- 23 income. However, women's capability to manage productive resources (land, knowledge,
- 24 and technologies) and income is still limited.
- 25
- 26 **4. The application of AKST has reduced workload of farmers in some places, but is**
- 27 **likely to contribute to further inequity if options to recognize and address these**
- 28 **inequities are not implemented.** The saved time by the increasing use of AKST is
- 29 generally used in subsistence and income generating activities. However, the benefit of
- 30 this additional gained income is not distributed equitably. Both the unpaid and paid
- 31 contribution of women and children to agricultural production is often not fully recognized
- 32 or is under valued. Women, children, poor farmers and indigenous people who have low
- 33 educational background and fewer assets tend to benefit the least partly because they
- 34 have less access to technologies. With agriculture rapidly becoming a knowledge
- 35 intensive venture rather than labor intensive industry, there is likely to be AKST gaps
- 36 among rural women who are highly represented among illiterate Asians. Equal access to
- 37 education, information and capacity building are important elements to address the power

1 relations and inequity at both the household and community level. Recognition of both
2 the paid and unpaid contribution of women, children and poor farmers when developing
3 policies for AKST and implementing technology for agriculture programs would help
4 these groups receive greater benefit of AKST.

5

6 **5. With the exception of Pacific small island nations, the contribution of agriculture to**
7 **national economies is gradually declining in many ESAP countries.** The reasons
8 include globalization and high economic growth in manufacturing and service industries.
9 However, the contribution of agriculture and allied sectors to the manufacturing sector is
10 increasing. The integration of the Asian ESAP region with Western economies is
11 increasing and this has improved investment and AKST transfer to ESAP with beneficial
12 outcomes for development.

13

14 **6. Many Pacific small island countries are dependent on imported foods, trade and**
15 **subsistence agriculture.**

16 • The Pacific island nations can be portrayed as being characterized by ‘subsistence
17 affluence’, meaning that living standards are high compared with, for example, South
18 Asia. A critical issue for these nations is inappropriate diet rather than poverty *per se* due
19 in part to the limited incidence of processing/storage/preservation locally and changes in
20 taste associated with advertising and rising incomes. This has led to a propensity to
21 consume imported processed foods and sugars with resultant adverse health implications
22 such as high levels of diabetes and the widespread incidence of obesity. It also has
23 implications for food security because an increasing portion of the food consumed in the
24 region is met from imported supplies.

25

26 • In some nations, about 85% of the population depends on agriculture for their livelihoods.
27 There has tended to be duality in economic development with the export sector of sugar,
28 coffee, cocoa, squash pumpkin etc being very much in the realm of the global economy
29 and the remainder being highly subsistence. Because the economies of these small
30 island nations are small, the development of a single economic activity can lead to
31 domination of the economy by a single agricultural sector (such as forestry and fisheries).

32

33 **7. Support for traditional and local knowledge systems can provide multiple benefits,**
34 **but in some nations is ignored.** Cropping systems based on traditional varieties
35 conserve landraces and tend to be diverse. They employ intercropping and agroforestry
36 to ensure against total crop failure, and enhance nutritional value. The use of traditional
37 knowledge associated with plant-based medicines is additional benefits for human

welfare and rural livelihoods. Traditional and local knowledge systems can also maximize organic inputs and minimize chemical inputs including pesticides, with attendant positive ramifications for biodiversity and soil and water resources. In Pacific island nations, production, especially of root tubers, is largely based on traditional technologies and indigenous knowledge. One of the greatest lacunae in policy has been the neglect of farmers' knowledge and know-how, if at all; the traditional systems are coping with rising populations. Options to remedy this need to be considered, including resources devoted to IPR protection and plant breeding.

Environmental sustainability, Sustainable economic development

Increased agricultural production through application of AKST has had considerable effect on sustainability of soil and water resources and biodiversity. In many countries in ESAP, increased production has been achieved at the expense of the environment, including offsite effects. Biodiversity conservation is not generally integrated in major agricultural production systems. Pest and disease management has contributed to minimize crop losses but with adverse impact on the environment.

8. Natural resources availability is under serious pressure from agriculture and other sectors.

- Intensive agriculture, rapid urbanization and industrial expansion are creating huge and increasing demands for land and water.
- Intensive agriculture and overuse of fertilizers have led to soil degradation, decline in water quality in many parts of ESAP. It has also contributed to decreased areas being available for fisheries and livestock production.
- Water transfers to intensive irrigation based agriculture and urban areas are placing substantial pressure on water resources and this trend will become more severe in the future. Industrial and agricultural effluents are also affecting water quality across the region and threaten public and aquatic health.
- Fish production in most Asian countries are either stagnating or dwindling due to over exploitation, aquatic habitat changes and destruction, excessive withdrawal of surface water, pesticide use and industrial pollution. In the Pacific small island nations, fishing is undertaken by commercial fleets (and is a source of foreign exchange earnings); while the industry may not yet be stagnating or dwindling, harvesting rates might be unsustainable.
- Forest and reef diversity are threatened by logging and commercial fishing.

9. Climate change and variability are added stress to the region particularly developing countries dependent on agriculture and Pacific small island nations.

Over the 20th century, average temperatures in the ESAP region have increased in line with the global average of 0.4 to 0.92 °C and the rate of sea level in the region, especially in the Pacific Island nations, has been found to be higher than the global average of 1-2mm per year. Changes in precipitation are less discernible. Extreme events such as floods, droughts and cyclones/typhoons in the last two decades of the 20th century are more intense than before. Natural climatic events have caused significant damage to agriculture and livelihoods, resulting in food insecurity at local level and increased poverty among rural communities. Extreme climatic events are projected to increase over the 21st century adding to the stress already experienced by the region.

10. Pesticide use has increased rapidly in the ESAP region, with consequent health, environmental and social impacts.

Pesticide residues and the use of banned chemicals led to problems in meeting SPS standards for agriculture-based export products. In order to utilize the potential for exports, more attention to AKST and extension is necessary to reduce pesticide use and eliminate banned chemical use. Various alternatives, such as Integrated Pest Management, organic agriculture and agroecology exist. The challenge is to mainstream and promote their adoption, while providing the necessary policy and investment support.

11. With possibly the exception of some Pacific small island nations, countries in ESAP have developed AKST and associated policies, to varying degrees, to reduce the impact of logging on forest ecosystems and to support improved forest management and reforestation.

Further development of AKST is required to support improved forest management for timber, non-timber products and other ecosystem services. Plantation forestry has become a key form of forest management, particularly in China and Japan with some economic benefits but also some adverse impacts on environment and societies.

Technologies

12. ESAP region is the home of two noteworthy agriculture innovations of the last century, namely green revolution and integrated pest management:

- For the green revolution there are different perspectives on its contribution to food security and poverty alleviation depending on the geographical location (especially with respect to water availability and the education level of the farmers), the time period being considered and the stakeholders who give their individual perspective.

- Integrated pest management is seen to be a response to counteract the intensive use of chemicals often associated with the green revolution.

13. Plant breeding remains the major method of plant improvement but with increasing application of biotechnology.

Conventional breeding that is more suited to important multi-gene traits such as drought resistance or yield is now assisted by use of genetic markers. Micropropagation, such as for of bananas, is another technology being used. Greater resistance to diseases and environmental stresses and higher survival and higher production at a cheaper cost are highly desired qualities of the agricultural crops, cattle, poultry and fish. Biotechnology has and can continue to contribute to the development of these desired qualities. However, the short-term and long-term effects of the biotechnological products such as transgenic species on ecology, genetic integrity of the local species and human health need further research and assessment.

14. Use of technologies has made some agriculture products from ESAP region

competitive in global markets. Textile and rubber producers in ESAP for instance can expect to face stiff competition due to the fact that they currently are in a position to displace many other less competitive suppliers at current world prices. At the same time, the expansion of products based on nanotechnologies poses a potential threat to their ability to capitalize on this competitive advantage. In order to capture and hold on to such markets, governments and producers in the region will need to play an active role in the international trade fora and ensure that resources are directed to research and production technologies that can keep such sectors competitive.

Present and past investments in AKST

15. With the exception of the developed economies in the region, funding for AKST of most ESAP countries has been inadequate and is declining. The public sector remains the major source of most of the agricultural R&D expenditures in many ESAP countries due largely to the “public good” character of most AKST products. Public sector research also faces barriers in terms of IPRs preventing access to research materials, tools and technologies.

16. There has been a concentration in agricultural research and development and extension, on a few major crops and tradeables, varieties and traits, to the neglect of locally relevant crops and technologies, which have been marginalized, both in the private and the public sector. Investments in rainfed agriculture and crops grown predominantly by the poor have generally been neglected. Another neglected area is

technologies to reduce post-harvest crop losses which result in huge economic losses to the countries and financial losses to the poor farmers. More investment in research on agroecosystems and locally adapted technologies could help develop approaches that promote food security and environmental sustainability.

17. There has been neglect in investment in agriculture and rural development. This has resulted in the displacement of many rural inhabitants (with indigenous or tribal peoples, small farmers and the landless disproportionately represented among the displaced) who are not the beneficiaries of the resulting industrial or other non-agricultural employment associated with higher rates of growth of per capita income. There has also been an increase in income inequality. Development policies could be more balanced by increased investment in agriculture and rural development and more emphasis on non-tradable sectors.

Consequences of trade

ESAP is a very important agricultural trade region, with Japan, China, Australia, Thailand and South Korea as top trading countries. Australia and New Zealand export mainly livestock products while Indonesia and Malaysia export palm oil and rubber; Thailand and Vietnam export a large amount of rice and China exports mainly vegetables and fruits. The Pacific countries are exporters of copra, cocoa beans and timber.

18. Agricultural and trade commodities in the ESAP region are changing but are dependent on more labor intensive technologies than in OECD countries. The composition of ESAP agricultural output and trade commodities is changing because of the changing composition of demand for agricultural commodities in favor of more expensive foods, like fish, meat and poultry products as well as the production of labor-intensive agricultural commodities, like vegetables and horticulture products (due to the comparative advance of the abundance of labor in Asian countries). AKST developed in OECD countries is focused on labor-saving and thus may not be suitable for ESAP countries which is based on labor-intensive but land- and capital-saving technologies. Further, trade is not an end in itself; its purpose is to further the goals of improving livelihoods and reducing poverty. Labor-intensive technologies do have a comparative advantage in ESAP, which means that ESAP has and is more likely to develop international trade in more labor-intensive technologies and crops, than in labor-saving technologies and crops.

19. Vertical integration/coordination of agriculture products centered around export

1 **has marginalized primary producers in some countries and the dominance of retail**
2 **chains may further this trend.** This does not mean that there can be no countervailing
3 power, e.g., if primary producers were to get organized, they would improve their share of
4 the market. Small farmers need better access to capital and technology, along with
5 facilitation to meet the challenges of vertical domination of the agricultural sector.

6
7 **20. There are vulnerabilities in international and region-wide trade caused by rising**
8 **energy costs, volatility of markets, and over dependence on imports for food and**
9 **agricultural technology.** The current long-distance trade in agricultural commodities
10 depends crucially on cheap transport costs. While ESAP countries should continue to
11 utilize trade opportunities, they need to consider the possibility that with rising oil prices,
12 increased transport costs may nullify production cost differences and thus threaten
13 portions of international trade in agricultural commodities, with likely implications for the
14 nature and location of AKST generation and dissemination. There are also issues related
15 to size and variation of risk between markets for different products. These factors have
16 implications for the extent to which individual countries and their different types of farmers
17 stand to gain from entering the market. In order to make the field even, governments
18 have a role in addressing the global management issues as well as formulating strategies
19 for risk reduction and management, so as to provide support to farmers in specific
20 markets. There is also a need to examine the management and design of the global trade
21 architecture as captured at the WTO especially as it impacts on the least developed
22 countries and small nations. Allocation of resources for risk reduction and management
23 during crop and market failures may be necessary. Comprehensive safety net measures
24 and social welfare systems could help to protect well-being in situations of growing risk
25 and uncertainty.

26
27 **21. International trade regimes raises issues of relevance, adequacy, affordability and**
28 **access to AKST.** IPR standards under trade agreements have contributed to a shift in
29 and access to AKST, by facilitating private sector dominated research and consequently
30 privately-generated and owned AKST. Patents, and to some extent plant variety
31 protection (PVP), have played a part in the major consolidation of the global seed and
32 agricultural input corporations, many of which are also developing transgenic crops. IPRs
33 may restrict access to plant material for farmers and threaten farmers' rights.
34 Implementation of farmers' rights at the national and international level is critical to
35 ensure continued conservation and maintenance of agricultural biodiversity and
36 associated AKST, and provide an important counterbalance to the rights accorded to
37 formal plant breeders under PVP and patents.

22. **Continuing OECD agricultural subsidies, for instance for rice and sugar, make Asian small producers unable to compete in external markets or domestic markets without tariff support, and have detrimental impacts on their livelihoods and food security.** Furthermore, many of the developing countries in Asia, in particular the least developed countries, have limited fiscal capacity and are unable to provide the support allowed under WTO regulations. Along with eliminating agricultural subsidies in the OECD countries, there may be a case for providing support to producers in least developed countries, more transparent rules and the fair implementation of those rules to all members of the WTO. National trade policies should also balance the interest of net food buyers with the requirement for rural development.

23. **There is good opportunity in organic and fair trade markets, and their social, sustainability and ethical objectives often overlap.** If the overlap is encouraged, this could have considerable implications for the volume of trade, and for the working conditions and livelihoods of producers. Developing country producers' ability to meet organic and fair trade standards, can be facilitated through better access to locally-developed AKST. There could be benefits to small producers through mainstreaming organic and fair trade markets, provided that the ill-effects of conventional supply chains are avoided.

24. **The complexity of some trade agreements can compromise the pursuit of national sustainability goals.** The more agreements a country signs the less room it has for maneuver especially as regards pursuit of domestically driven priorities on environment and social dimensions. In addition, many of the current agreements are complex and administratively costly to implement and thus are not implemented in some countries. Policy makers therefore need to consider the complexity, costs and implementability when negotiating new trade agreements. An example is the sanitary and phytosanitary agreements - an idea to promote better human and animal health and environmental standards - wrapped in complex and little understood or administratively costly framework and serving as a device for protection of producers in OECD countries.

Enabling conditions to optimize uptake and diffusion of AKST and help achieve development goals

25. **Addressing issues of equity and a reduction of social exclusion can increase productivity, adoption of AKST and provide gains from international trade.** In many countries, women have been drawn in large numbers into export-led manufacturing, with

1 resulting improvement in incomes, but there are also problems of wage differentials,
2 short-term industrial working life, occupational hazards and health risks. Inclusion of
3 social groups such as women, indigenous peoples, local small producers, certain caste
4 groups and minorities who are often marginalized and excluded in decision-making in the
5 agricultural sector. In addition, it is important to recognize them as holders of AKST.
6 Therefore overcoming socio-cultural rigidities permits their participation in AKST activities
7 thereby permitting access and dissemination of such knowledge.

8
9 **26. Intellectual Property Rights have the potential to create barriers to the**
10 **transformation of ESAP countries and their capacity to start higher up on the**
11 **science and technology ladder.** The equitable resolution of conflicting international
12 interests will largely depend on the extent to which the region is able to draw negotiators'
13 attention to intra-regional differences in capacity and needs since IPRs will have
14 consequences for a range of activities, from the development of indigenous knowledge to
15 the exploitation of processes developed in low-income countries. These effects are likely
16 to attract increasing attention as IPR agreements are negotiated since in their final form
17 they will have different implications for different countries within the ESAP region.

18
19 **27. Private sector investment in AKST should be encouraged by providing an**
20 **appropriate enabling environment.** Funding from the private sector has generally been
21 low. There has been some increase in investment by private sector in some areas in
22 recent decades. Public sector institutions may need to reevaluate their funding portfolio
23 in ways that complement this increasingly diversified environment to enhance the
24 collective performance of the sector as a whole. The legal and policy frameworks have to
25 ensure that this is done with the aim of achieving development and sustainability goals.

26
27 ***Future challenges and options for action***

28 Development of government policies, public-private-NGO partnership, further development,
29 dissemination and implementation of new technologies - especially those focused on the specific
30 needs of the region – and capacity building can be appropriate options for actions to meet the
31 challenges highlighted below.

32
33 **28. Factors such as the growing population, rapidly changing demographics, growth**
34 **in urban population and changing diets presents challenges to the ESAP region.**
35 **Therefore, the option to use AKST to meet development and sustainability goals is**
36 **important.** AKST in the past (such as the green revolution) has played an important role in
37 increasing productivity, albeit at some social and environmental costs. Thus to meet the future

challenges, the full array of available technologies and practices, some of which are complementary to each other, will have to be considered. These include integrated farming practices, wider acceptance and use of traditional and local knowledge and practices for farming and rural livelihoods, technologies including biotechnology, drip irrigation, targeted chemical use, and use of information technology for farm decision-making. Farmers' understanding of and ability to develop and implement integrated agricultural practices and production technologies can be strengthened through training, vocational education, and extension support. This may be accomplished by training personnel to understand how different agricultural practices contribute to achieving productivity and sustainability goals.

29. Education, science and technology will play significant roles in shaping the future of agriculture. Science and technology will play an increasingly important role in providing adaptive responses for agriculture to stressors such as climate change, increasing natural hazards, poverty and inequality, HIV/AIDS, avian flu, SARS and malaria. Increased investment in science and technology will be an imperative for the ESAP region to facilitate adaptation.

30. Improvement of rural livelihoods in the ESAP region will arise from choices and decisions beyond the immediate agricultural sector. Reduction of hunger and poverty in ESAP will result from agricultural sustainability (including fisheries, livestock and forestry) and the emergence of non-farm employment opportunities. International climate change treaties, foreign direct investment, bilateral or multilateral investments, growth of health and education facilities and insurance etc, will bring a wide range of actors with diverse priorities and demands to the agricultural sector. The strength of democratic processes and decentralization will determine how these diverse actors will perform in technology generation and utilization – for example bio-pesticides, organic leather industry, GMOs, new livestock management practices, and coastal ecosystem management practices.

31. The demography of the ESAP region is changing rapidly and an educated younger generation, especially in the Asian countries, is less likely to be interested in agriculture thus reducing the agricultural labor force. The population in India will exceed that in China within a few decades. In India and some other ESAP countries, the younger generation will continue to dominate the labor force, though lack of appropriate skills may present barriers. Economic development and rural-urban wage differentials will encourage rural to urban migration. The trend of rural depopulation will continue into the future. Therefore, a declining labor force (and in particular a declining male labor force) will be available for

agriculture, particularly on small to medium farming enterprises, and the available labor force will be dominated by women and young people. In Japan, Australia, New Zealand and the Republic of Korea, an ageing population will present challenges to agriculture sector in productivity and adoption of innovation.

32. New and emerging technologies (e.g. transgenic technologies, nanotechnology) and those focused on “resource conservation” can contribute to AKST goals.

However, successful application requires their adaptation to farmer needs and conditions, and rigorous site-specific scientific and social monitoring. These technologies can improve agricultural productivity using existing land and water resources by protecting crops against biotic and abiotic stresses. They also have positive ramifications for natural resource and human welfare, for example through reduced pesticide use, and increased profits. While nothing about these technologies precludes the integration of low-impact practices, they are often expensive and complicated to implement successfully, requiring reliable access to credit and to knowledge in ways that limits their utility in the ESAP region. These social dimensions, coupled with gene flow and insect resistance concerns, dictate that the dissemination of these technologies occurs within a stringent biosafety framework and enforcement, in conjunction with scientific and social monitoring.

33. Water management for agriculture is becoming a challenge in many ESAP

countries. With rapid urbanization in many countries, the use of waste water for agriculture is posing serious problems of health, nutrition and health safety concern for producers and consumers. Due to pollution, soil erosion and salt water intrusions into fresh water lenses, water management has become a challenge in both urban and rural areas of the Pacific islands. As elsewhere in the region, both human habitation and livestock production remain critically dependent on access to adequate quantities and an acceptable quality of potable water, a very scarce resource.

34. Projected changes in trade regimes pose opportunities as well as challenges for ESAP countries and producers.

The current efforts to reform the international and regional trade architecture are intended to remove tariff barriers, to institute transparent universal rules and to facilitate a fair and buoyant international market for goods and services. process is proving to require more time than many countries anticipated, but the rate of change in some areas is more rapid than in others. Within the ESAP region there are proposals to establish regional groupings as already represented by ASEAN, SAARC and the proposed Pacific Islands Free Trade Agreement. These are intended to liberalise

trade within the region and to facilitate the emergence of competitive enterprises based on skill levels and economies of scale generated by a large regional market. Obviously if this process is not to simply lead to elimination of the weak enterprises and to accentuate regional imbalances, then, agricultural, industrial and trade policies will need to be geared to making currently weak sectors and enterprises competitive. In addition, there is growing recognition of the need to address the skewed allocations of support and investment in order to respond to the needs of crops which are of importance to local consumers and small-scale producers, (as distinct from grain and plantation crops). Beyond the region, ESAP and other developing regional producers face incomplete international trade. Hence, AKST should aim to assist farmers in this region to adopt efficient farming practices, to improve the quality of exportable agricultural produce and commodities particularly as they pertain to food safety. At the same time proposed reforms under the WTO regime - Common Agricultural Policy (CAP) reforms, EU Generalised System of Preferences (GSP) and WTO disciplines in relation to tariffs, protection, and market access etc - have varying implications for different types of producers as well as for different sectors.

35. An important challenge facing public sector managers in ESAP is to judiciously foster the involvement of the private and non-state sectors in research activities and investment in ways that bolster and support growth and equitable distribution.

Such involvement could include the increased role of the latter in research where they may have special strengths as well as promoting collaboration among the sectors. Government organizations will also need to reevaluate their current funding portfolios and institutions capacities so that they can find complementarities in an increasingly diversified environment in ways that enhance the collective performance of the sector as a whole.

36. Recognition and protection of traditional and local knowledge to AKST will remain a challenge. Some local and traditional knowledge systems may become mainstream and get protected, for example medicinal and aromatic plants, but other continues to decline. Tribal and mountainous communities are likely to become more marginalized with a loss of their traditional/local knowledge.

37. Although the contribution of traditional and local knowledge to AKST has been recognized, there are many issues relating to intellectual property rights (IPR) and the general trend in loss of knowledge that have to be addressed. In the last decade or so, formal organizations such as CGIAR have been paying more attention in

1 participatory plant breeding for diverse conditions. NGOs and local and communities in
2 recognizing the loss have become active in recording and promoting the use of
3 traditional, local and indigenous knowledge systems. There are questions about whether
4 patentability and ownership of such knowledge are appropriate, and what processes are
5 needed to protect them and further to share the benefits of protection.

6

7 **38. More investment and research prioritization need to be considered for independent**
8 **biosafety and long-term risk-related research.** The development and
9 commercialization of transgenic crops is currently concentrated in the private sector,
10 where market forces rather than food security considerations have dominated. With
11 regard to poor and small farmers, it is unlikely that traded commodity transgenic crops,
12 which are currently the bulk of commercially available transgenic crops, can meet their
13 needs. Regulatory, monitoring and institutional capacity and resources are lacking in
14 many developing countries, which are mainly importers of transgenic crops. Therefore,
15 the precautionary principle and the principle of prior informed consent need to be
16 implemented, in accordance with the Cartagena Protocol on Biosafety, which primarily
17 regulates the trade in transgenic organisms. Labeling and traceability of traded
18 transgenic crops and products would help address consumer demands, as well as enable
19 biosafety functions such as monitoring, correlation with risk assessments, product recall,
20 emergency measures, liability and redress.

21

22 **39. The integrated development and management of knowledge lies at the heart of the**
23 **knowledge and information society and has to be reflected in national and regional**
24 **agricultural policies.** The single most important characteristic that lies on the horizon is
25 a growing dependence on dramatically changing knowledge whose importance cannot be
26 overestimated. Without enhanced capacity, countries and farmers will not be able to
27 adequately keep up with the growing competition and complexities already evident in
28 products and markets. Different actors need to respond to innovation and manage
29 interventions through flexible, adaptable, inter-related (networked) and science and
30 technology intensive frameworks or “innovation systems”. At present, public sector
31 research and extension alone cannot effectively respond to either the increasing
32 complexities of agricultural technologies and markets or the new challenges posed by an
33 increasingly fragile environment. To meet these challenges requires integrating the public
34 sector, private sector, civil society as well as the inclusion of social groups, such as ethnic
35 and caste minorities (who are currently excluded from governance, public services and
36 markets), in the process in ways that synergize their complementary knowledge and
37 expertise. However, a number of institutional barriers including institutional hierarchies, a

1 linear approach to technology development and promotion, centralized funding,
2 implementation and evaluation prevent knowledge flows and joint working relations
3 among AKST actors.
4

5 **40. Policies to improve the ESAP region's natural resource base (especially soil, water,**
6 **ecosystems - rangelands, forests), conserve genetic resources, and maintain**
7 **biodiversity are critical for attaining the sustainability and development goals of**
8 **AKST.** Policies to achieve these goals need to be developed and implemented by
9 national governments and inter-governmental organizations and could be iteratively
10 improved through ongoing monitoring and evaluation. An option is to provide systems of
11 compensation for the provision of some environmental services, such as flood control,
12 soil erosion and those associated with maintenance of biodiversity.
13

14 **41. Climate variability and change will emerge as threats to the agricultural sector in**
15 **most of the ESAP region.** Increases in average temperature and changes in
16 precipitation patterns may lead to lower agricultural yields in many parts of ESAP. Sea
17 level rise and resulting inundation in the coastal areas and increases in soil and water
18 salinity, may have negative effects for agriculture in many parts of the region. Increases
19 in temperature and humidity may also create a more favorable environment for increased
20 pest and diseases. However, climatic changes may also have some beneficial effects for
21 agriculture in the high to mid latitude areas. The challenge is to reduce greenhouse gas
22 emissions from the agriculture sector and implement risk management strategies to
23 minimize the impact of climate change and variability on the sector as a whole.
24

25 **42. The agricultural sector will continue to compete with other sectors for energy and**
26 **a range of other services.** The gap between energy demand and supply is growing and
27 is likely to be met increasingly by biofuels and other renewable energy sources. Declining
28 use of draught power, increasing rural industrialization, warehouse and storehouse
29 energy demands, and rural transport will be met by expansion of alternative energy
30 sources. Biofuels such palm oil in Malaysia and Indonesia, and jatropha or the endemic
31 kusum in India will play a major role in many parts of the region. However, there is the
32 continuous threat of converting natural ecosystems (including forests) into biofuel
33 planting areas such as plantation forests which are monocultures. A major challenge is to
34 ensure that the development of biofuels meets the IAASTD sustainability goals.
35

36 **43. The effect of HIV/AIDS on rural populations and food security is a growing concern**
37 **in many parts of the region.** HIV/AIDS is highly prevalent throughout the Mekong

countries, particularly in Myanmar and Thailand. At the sub-national level that the effect of HIV/AIDS on the economic output is likely to be hardest, especially in a region where more than 800 million people live on less than one US dollar a day. In rural parts of Cambodia, the high cost of medicine and the rural credit system combine to make HIV/AIDS a significant cause of landlessness. In Thailand, among the HIV/AIDS affected households, one financial management strategy was disposing of productive assets such as land, animals and equipment.

44. Health issues related to animal-human diseases appear to be on the rise and can affect both agriculture production and human well-being. Climate change and variability are affecting the distribution of vector and water borne diseases and can affect labor force for agriculture.

45. Promoting traditional, indigenous and organic practices and information technology in integrated agriculture will continue to be an option for ESAP region. Projected changes in demography, arable land availability coupled with forest conservation goals, will necessitate the maximization of agricultural efficiency. This will ideally favor low-impact technologies and it would be appropriate to adopt a combination of traditional, indigenous, organic, and integrated practices. Information technology tools in combination with efficient agricultural systems, could contribute significantly to the realization of AKST goals throughout the ESAP region.

46. Consumer demand within the ESAP region and beyond suggests that targeting niche markets, such as organic products along with livestock production systems, can be lucrative and help achieve AKST goals. Growing demand for organic food in urban centers of many ESAP and other countries is fuelling an expansion of organic production, particularly in Australia, New Zealand, and, more recently, India. However, they are labor-intensive and require high rates of organic inputs (e.g., manure), which are limited in many countries in. Areas associated with livestock systems will therefore offer the greatest potential for sustainable organic production systems.

47. AKST has not adequately addressed the needs of post-harvest care and processing of food crops, fruit, vegetable, fish and animal products. With Asia's characteristic of labor abundance relative to land and capital, there is a comparative advantage in crops, like vegetables, fruits and flowers, which use more labor per unit of land and capital, as against, say, cereals. Development of appropriate technologies ensuring higher and cost-effective production, environmental social sustainability,

1 prevention or reduction of on-farm and post-harvest losses of food crops, fruit, vegetables
2 and fish at various stages along the value chain from the farm to processing plants to
3 consumers, along with certification of the products with respect to food safety and
4 environmental and social sustainability could greatly improve access and profitability of
5 the agricultural products in local and export markets.

6

7 **48. Capacity building, strengthening AKST infrastructure, and facilitating collaboration**
8 **between the public and private sector can contribute to achieving AKST goals**

9 **within ESAP.** There is wide variation in the technological capacities of ESAP countries
10 as exhibited in different levels of basic education, science and technology infrastructure,
11 regulatory capability, biosafety facilities, and research and extension capacity. Regional
12 variation is a consequence of differences in the adequacy of funding and the extent and
13 integration of public, private, and civil society participation. For example, while Australia,
14 New Zealand, Japan, South Korea, China, and India already provide a basis for
15 infrastructural improvement, the smaller countries of Bhutan and Nepal and the island
16 nations of the Pacific still requires improved infrastructure that can benefit from greater
17 collaboration among various national actors. Non-governmental organizations, regional
18 fora, and donors can contribute to these efforts through funding, training, scientist
19 exchange, and policy and institutional reform.