APAARI

VISION 2025

Agricultural Research for Development

ASIA-PACIFIC ASSOCIATION OF AGRICULTURAL RESEARCH INSTITUTIONS
FAO REGIONAL OFFICE FOR ASIA AND THE PACIFIC
BANGKOK

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PREFACE

The Asia Pacific region is agriculturally the most vibrant globally. At the same time it sustains more than fifty percent of the world population as well as the maximum of poverty. The Green and White Revolutions have also been witnessed in this region which have provided the means to cope with the rapidly increasing population and ensure household food security.

Fortunately, all these accomplishments could be possible due to the cutting edge of science. The National Agricultural Research System (NARS) have indeed played an important role in this context. The Asia-Pacific Association of Agricultural Research Institutions (APAARI) strengthens partnership in Agricultural Research for Development (ARD) in the region and works with NARS and other key-players in ARD. In 1995, a perspective plan was adopted which included the guidelines for intensifying cooperation in science and technology, human resource development, technology transfer, information networking, policy advocacy and publications.

The turn of the Century provides a good opportunity to look backwards, evaluate the performance and think about the future. In order to accomplish this task, APAARI had initiated an extensive consultative mechanism for having in place a Perspective Plan for the next 25 years. This Vision 2025 is an outcome of such an exercise. An Expert Consultation on the subject was organized involving all stakeholders of APAARI. It contains input of all partners at the national, regional and international level, i.e. NARS, CGIAR, GFAR, FAO, IFAD, ACIAR etc.

APAARI has developed into a neutral regional forum that provides NARS a platform to exchange views and information on agricultural research for development. It has played an important facilitating role in developing this document. We do hope that this exercise will further strengthen the ARD in the Asia-Pacific region.

(R.S. PARODA)
Executive Secretary
APAARI

LIST OF ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AIT	Asian Institute of Technology
APAARI	Asia-Pacific Association of Agricultural Research Institutions
APAFRI	Asia-Pacific Association of Forestry Research Institutions
APAN	Asia-Pacific Advanced Network
APO	Associate Professional Officer
APRAIS	Asia-Pacific Regional Agricultural Information System
APSA	Asia and Pacific Seed Association
ARD	Agricultural Research for Development
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AST	Agricultural Sciences and Technology
CABI	Centre for Agricultural Bioscience International
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Centro Internacional de Mejoramiento de Maize y Trigo
CIRAD	Centre de co-operation internationale en recherche agronomique pour le developpement
CLAN	Cereals and Legumes Asia Network
CORRA	Council for Collaborative Rice Research in Asia
CORAF	Conseil Ouest et Centre Africain pour la Recherche et le Developpement Agricoles/ West and Central African Council for Agricultural Research and Development (WECARD)
EGFAR	Electronic Global Forum for Agricultural Research (Homepage of GFAR)
FAO	Food and Agriculture Organization of the United Nations
FAO-RAP	FAO Regional Office for Asia and the Pacific
GDP	Gross Domestic Product
GFAR	Global Forum on Agricultural Research
GIS	Geographic Information System
GMO	Genetically Modified Organisms
GoFAR	Group on Fisheries and Aquaculture Research
GRDC	Grains Research and Development Corporation
GRM	Genetic Resource Management
GSV	Global Shared Vision
HRD	Human Resource Development
IARC	International Agricultural Research Centre
IBSRAM	International Board for Soil Research And Management
ICLARM	International Centre for Living Aquatic Resources Management
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
ICT	Information and Communication Technology

ICUC	International Centre on Under-utilized Crops
ICW	International Centres Week
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
INIBAP	International Network for the Improvement of Banana and Plantain
IPGRI	International Plant Genetic Resources Institute
IPM	Integrated Pest Management
IPR	Intellectual Property Rights
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research
IT	Information Technology
IWMI	International Water Management Institute
MARDI	Malaysian Agricultural Research and Development Institute
MoU	Memorandum of Understanding
MTM	Mid Term Meeting
NACA	Network of Aquaculture Centres in Asia-Pacific
NARI	National Agricultural Research Institute
NARS	National Agricultural Research System
NARS-SC	Secretariat of the NARS Steering Committee
NGO	Non-Governmental Organization
NRM	Natural Resource Management
PARC	Pakistan Agricultural Research Council
PCARRD	Philippine Council for Agriculture, Forestry and Natural Resources Research and Development
PGR	Plant Genetic Resources
PNASF	Prem Nath Agricultural Science Foundation
PVP	Plant Variety Protection
QDPI	Queensland Department of Primary Industries
R&D	Research and Development
RDA	Rural Development Administration, Republic of Korea
RRO	Regional Research Organization
RWC	Rice Wheat Consortium
SACCAR	Southern African Centre for Cooperation in Agricultural and Natural Resources Research and Training
SPC	South Pacific Commission/Secretariat of the Pacific Community
SWOT	Strengths-Weaknesses-Opportunities-Threats
TFNet	Tropical Fruit Network
UPM	University Putra Malaysia
UTFANET	Underutilized Tropical Fruit Asia Network
WAICENT	World Agricultural Information Center

PREAMBLE

While economic and social gains in developing Asian and Pacific countries have been impressive during the last 25 years, poverty in the region continues to be a major challenge. In this region, as elsewhere in the developing nations in the world, rural poverty is an important phenomenon. Many of the rural poor depend on agriculture for employment and income. Accelerated agricultural growth thus offers a potential source of poverty reduction.

The National Agricultural Research Systems (NARS) of the region along with International Agricultural Research Centres (IARCs) and regional/sub-regional fora have been successful in increasing food production through improved productivity. However, these efforts are far from adequate. In recent years, there have been significant changes in the economic, political and technological environment. At the dawn of the 21st century, the region faces an increasingly complex challenge of feeding its growing population and reducing poverty while assuring equitable and sustainable use of natural resources. The ability of NARS to respond to these challenges in future depends upon their individual as well as collective strength. Moreover, the increasing socio-economic instability and environmental deterioration taking place in many countries of the region (particularly following the Asian economic crisis with its short and long-term pervasive impacts), gives a sense of urgency in pursuing immediate and collective response.

During its short existence of less than a decade, the Asia-Pacific Association of Agricultural Research Institutions (APAARI), has done very well in promoting a collective response through intra-regional and inter-institutional cooperation. But in view of the above mentioned challenges demanding action with a common and concerted framework that may orient that action, APAARI would like to enunciate its Vision 2025. This vision will contribute to the evolution of NARS in the Asia-Pacific region that will enable them to fight hunger effectively, finally leading to better nutrition and prosperity for all.

AGRICULTURAL SCENARIO

Global

Humankind owes an immense debt to those people who, through their foresight and right decisions, fostered rapid improvements in global food production-growth that has outpaced population growth. The world has won important battles in the area of food security, but the war is still on. Outstanding progress in food production has led to complacency about food security and to lower investments in agriculture. However, eight hundred million people, forming 15 per cent of the world population, do not have access to the food needed for healthy and productive living. Over 50 per cent of the children each year succumb to malnutrition. There are 1.3 billion people who subsist on an income of less than one U.S. dollar per day. One-third of all pre-school children in the developing countries are food insecure and deserve proper care and attention. By the year 2025, the world population will have increased to around 8.5 billion and a large share of the increase in population will occur in the developing countries where urban population will more than triple on account of heavy influx from the rural areas. At present, 75 per cent of the population in developed countries is urban compared to around 38 per cent in developing countries.

Growth rates in yield per hectare for cereals in the developing world and for the world as a whole have declined since the early 1980s and the prognosis for further increases vary widely. The indications are that beyond 2000 AD, agricultural development will be guided not only by the need to improve food and nutritional security, but also by the concerns for environmental protection, equity, social justice, sustainability, energy, employment and profitability. Following the GATT agreement and the liberalization process, globalization of markets requires countries to improve the competitiveness and efficiency of agricultural production. Increasing migration from rural to urban areas will result in a significant shift in the structure of demand for food production. There are also challenges relating to issues arising from a number of global conventions, agreements and protocols requiring a relook at the entire perspective of agricultural growth.

In general, the aggregate global trends indicate that if commitment to public investment in agriculture is sustained, there will not be an overwhelming pressure on aggregate world food supplies from rising populations and incomes. However, the aggregate trends mask severe food security problems at the regional and country level. Thus, regional and country level attention assumes critical significance.

Regional

In Asia and the Pacific, 50 per cent of the world population (3.1 billion) and 70 per cent of the world's farming households live on less than 30 per cent of the global agricultural land. The region presently consists of 30 countries (information on land use, agricultural labor force and production for each individual country is given in Table 1-3 of Appendix 6), majority of which are considered as developing. According to Human Development Reports, 1999, four countries in the region are reported as high

human development countries (HDI value > 0.801), an equal number as low human development countries (HDI value < 0.416) and the rest as medium human development countries (Appendix 6, Table 4).

The vast region of Asia and the Pacific is geographically, agro-ecologically and ethnically very diverse. Broadly, the region includes countries in West Asia, South Asia, South-East Asia, East Asia and Pacific Island countries. The distribution of land area in these sub-regions is give in Figure 1. It has highlands and semi-arid tropics as well as humid coastal plains with climates varying from temperate to tropical. A wide range of social, educational and cultural factors have led to a rich mosaic of people and traditions.

South Asia	412914
South-East Asia	433954
East Asia	1148857
West Asia	162200
PICs	846538

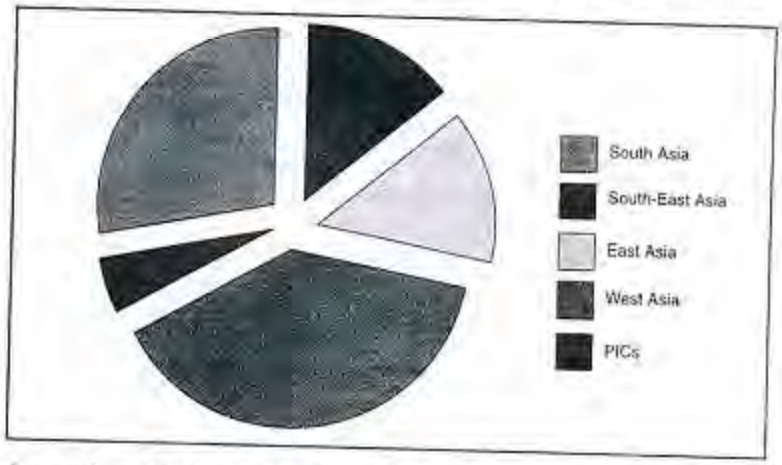


Figure 1. Distribution of agricultural land in the Asia-Pacific region

The percent of economically active population laboring in agriculture for each sub-region is given in Figure 2. The region is a cradle of domestication and diversity for many of the world's crop plants and forest resources. Crops, such as jute, tree cotton, eggplant, pigeonpea, jackfruit and cucumber originated from the Indian Centre of agro-biodiversity; soybean, buckwheat, tea, citrus, litchi, peach, prosomillet and foxtail millet from the Chinese Centre; oriental rice, yam, taro, banana, mango and rambutan from South-East Asia, and coconut and breadfruit from the Pacific islands. A wide range of diversity occurs in grain legumes, oilseeds, leafy vegetables, spices and condiments, medicinal plants, forages and forest species. Besides that, for introduced crops, such as maize, wheat, sorghum, groundnut,

South Asia	59
South-East Asia	55
East Asia	61
West Asia	28
PICs	19

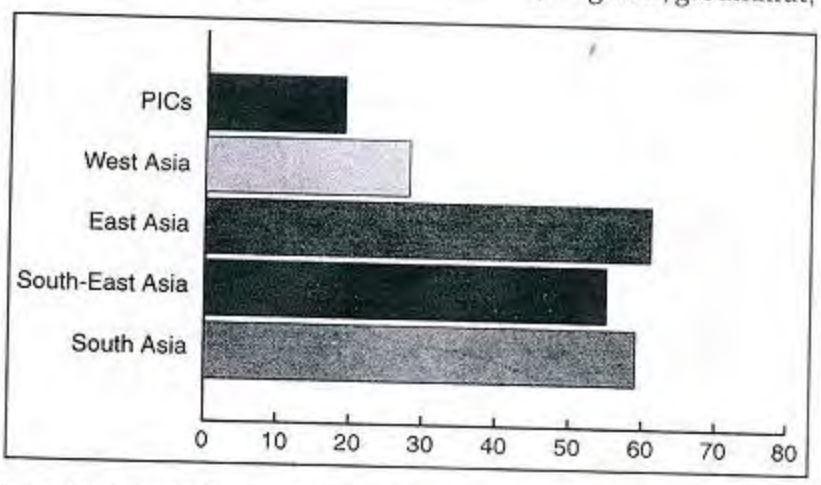


Figure 2. Percent population active in agriculture in different sub-regions of Asia

finger millet, chillies, pumpkin, tomato, potato, sweet potato, papaya, pineapple and several other tropical American fruits, this region is at present a secondary centre of diversity.

Agriculture in the Pacific Island countries is different from the rest of the Asia-Pacific region. The sub-region includes two distinct group of islands, the atolls and the non-atolls (volcanic) islands. Though lacking in technological wealth, these countries show richness in biodiversity and unique ecosystems. Mostly, it is root crop based, such as taro and sweet potato in Samoa, Papua New Guinea and Solomon Islands, although other commodities, such as rice, ginger and vegetables in Fiji and squash in Tonga form important component of agricultural systems in the region. In these islands, other important crops include banana, coconut and breadfruit. Livestock, piggery and fisheries are other important activities which need higher attention. Resource management and conservation also assume greater concern.

During the last decade the Asia-Pacific region has witnessed higher growth rates for food grains, such as wheat (3%), rice (2.3%) and maize (4.1%) compared to other regions of the world. Also spectacular growth rates have been noticed for the crops, such as cotton, sugarcane, soybean, rapeseed-mustard, oil palm and potato. Overall, the impact of the green revolution has been enormous in the development of this region. In this region, Asia is particularly important as it forms more than 98 per cent of the area and population.

Asia is a thickly populated region with an average population growth rate of around 2 per cent during 1980-92 and the estimate for 1993-2000 indicated a marginal decline (1.8%). The average annual growth rate for total GDP in the recent past (1990-94) was 5.4 per cent, whereas the corresponding average annual growth rate of value of agricultural GDP was low (2.3%). Cereal imports to the region registered an increase by over 18 million tonnes between 1980 and 1994.

Asia's population is estimated to be 4.5 billion by 2025. More than half of the world's protein-energy malnutrition problem is in South Asia. In Figure 3 the number of malnourished children is given for the largest affected regions in the world.

Region	Percentage of malnourished children	
	1995	2020
South Asia	51	41
Sub-Saharan Africa	33	29
South-East Asia	35	27
China	17	11
W. Asia & N. Africa	13	8
Latin America	8.5	3.5

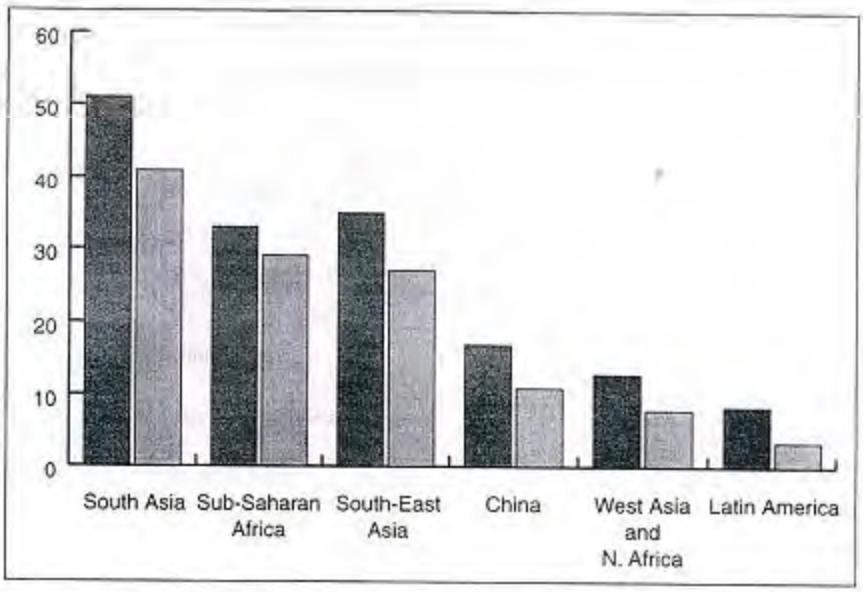


Figure 3. Percentage of malnourished children, 1995 and 2020

While economic and social gains in developing Asian countries during the last 25 years are impressive by international standards, poverty in the region continues to be a major challenge. It should be noted that in immensely populated Asian countries like India, Bangladesh and Pakistan, agriculture is much more vulnerable to climatic variability like droughts, floods, cyclones, etc. The incidence of poverty though was on the decline in both East Asia and South Asia during 1985-95, but these sub-regions still account for nearly three-fourths of the poor in all developing countries. The three big countries namely, China, India and Indonesia accounting for 70 per cent of the region's population, are important in respect of food security in the region. The growing population and consumption pattern of food and feed, and the need for more food will have to be met through increased agricultural production. Raising the food output and providing access to it, are therefore, specific issues which must be addressed now as priorities. Countries should also give priority to the development of human capabilities, by improving access to basic schooling, health and nutrition (FAO, 1998). Emphasis is also needed on governance: policy and institutional reforms on a sustainable basis aiming at improving efficiency in the use of productive resources and building a strong foundation for a broad based and sustainable growth.

There is less agreement regarding prospect for future growth in food supplies. At the pessimistic end of the spectrum, a marked slowdown in cereal production growth as a result of rapid deterioration in the natural resource base and depletion of land and water resources is predicted. Others argue that through technological improvement and trade, the demands can be met and therefore, on the whole, no food supply difficulties for the Asian region are predicted in the foreseeable future (FAO, 1998). This aggregate picture, however, glosses over the substantial differences in the food entitlements of developing Asian countries. Even within a country, food supply availability (and stability) does not ensure uniform food demand stability for the various population groups and administrative regions/ geographic areas. For instance, about 75 per cent of the cropped area in the region is rainfed and situations of drought and floods are among the common features. This region has almost 50 per cent of the developing world's irrigation potential and it has high precipitation figures. Optimistic projections suggest that even after all the irrigated potential in the region is exploited, more than 50 per cent of the arable land will still remain rainfed. Thus, there is a need for integrated management of resources shifting focus from commodity approach to farming system's approach.

With wide diversities notwithstanding, the agricultural sector of the region is characterized by the following (Dar, 1995):

i. Consisting of small farms and farmers;
ii. Unfavourable land/farmer ratio;
iii. Deteriorating soil, water and forest resources, flora and fauna and the atmosphere due to pollution;
iv. Vast area facing risk of droughts, floods and cyclones;
v. Diverse farming systems;
vi. Decreasing farm lands due to the conversion of agricultural land to non-agricultural uses;
vii. Fragmentation of farm holdings due to population increase and consequent division of family;
viii. Limiting farming capital; and

ix. Limited agricultural support services, such as credit, marketing, research, extension and post-harvest facilities.

However, the region has also witnessed major changes in the last 10 years. The most important ones are given in Box 1. The recent South-East Asian crisis is an eye opener and a warning alarm to countries in the region cautioning them to be prudent in their economic (and particularly financial) management. The intensity of the crisis varied depending upon the status of control and health of the monetary/financial sectors and the agriculture and rural development of the member countries. The impact on agriculture of the countries had been felt differently in agricultural exports, pace of output growth, consumer demand, markets for farm produce, prices of farm produce and ultimately farmer's income. But it is well documented that agriculture, being the dominant sector in these countries, assisted in the alleviation of the economic crisis. Structural reforms are ongoing in several economies relating to trade and regulatory reforms, financial and institutional reforms, etc. Globalization involving opening up of commodity, goods, labour, capital and service markets to world trade is also the dominant fixture in the development paradigm of the 1990s in many of these countries. The strong message from the crisis and its ebbing and the ongoing structural reforms is that sustainable agriculture and rural development will remain crucial issues in the region in the foreseeable future. Modern science should function as a stimulus to agricultural transformation and socio-economic development. This challenge has to be effectively addressed by the NARS of each country in the region.

Box-1: Major changes in the Asia-Pacific region in the last ten years

- Management of natural resources;
- Value addition to agriculture;
- Growth of agro-industries and rural industrialization;
- Increasing role of private sector in agriculture;
- Diversification of family farming activities such as livestock and aquaculture;
- Diversification of consumption demand towards livestock and aquaculture products, sugar, edible oils, fruits and vegetables;
- Growth of peri-urban agriculture;
- A wave of financial crisis and macro-economic instability in East Asia.

EVOLUTION OF NARS

World

Different Models

The National Agricultural Research System (NARS) has often emerged as mainly governmental institutional response to address poverty and hunger through growth in agriculture within a country. The NARS movement symbolized initially with public investment for development of national capacity for building agricultural research, education and extension infrastructure in a given country. However, there is a wide diversity in the organization of NARS in the developing and developed countries. The models for organization of NARS in developing countries include the agricultural research council model (ARC), the national research institute model (NRI) and the agricultural university model. A fourth category, namely, "Ministerial Department" model also exists in some countries. There are other more decentralized systems and various combinations of the three models constituting the actual national research system particularly in federal systems, where states also have their own research institutions which also form part of the national systems.

However, with the changing role of the government's public administration reform and the shifts in agricultural policies, there have been parallel shifts in the institutional make up of NARS. In the past, the public sector has depended on the national agricultural research organization (NARO) model. As such, the public funds were provided as block grant, usually through the Ministry of Agriculture, to a centralized research department or institute (NARI) which then set priorities and executes research through a network of centres under the control of NARO. A new paradigm is now emerging for NARS, the main elements of which include pluralistic institutional structures, growing role of the private sector, new mechanisms for research funding and emphasis on organization and management reforms leading to efficiency and effectiveness of institutions. However, the NARS have profoundly changed in the developed countries of the region during the last 25 years; their mandate has moved away from the traditional productivity focus to the issues of wider social interest such as the environment, food safety, increased emphasis on client orientation, demand driven research, efficiency gains through consolidation of research system, more private sector participation and participation by multiple research providers (Box 2 and Box 3). As can be seen, NARS are in several stages of development falling between both ends of the spectrum of NARI and NARS. The role of APAARI is to assist in building the NARS so as to serve the end-users effectively.

Capacity of NARS

NARS in the developing countries have grown rapidly over the last 25 years. By the 1980s, more than 80,000 agricultural researchers were working in the NARS of the developing world. During 1961-85, the average size of a developing country NARS increased from 155 to 630 full time equivalent researchers (Byerlee and Alex, 1998). There is wide diversity across countries in the size and maturity of NARS.

Box-2: NARS in the world – a comparison

Focus	Stronger NARS	Weaker NARS
Mandate	• Major thrusts on sustainability, diversification, post-harvest technology and value-addition, food safety, client orientation, saving bio-diversity, etc.	• Just realizing their importance, no policy statements on saving biodiversity, poor client orientation and very low technology adoption
Organization	• Better organized • Capabilities in terms of system based research, extension, management and teaching involving all stakeholders and interest groups	• Less organized • Commodity based, discipline oriented research with no or less involvement of few stakeholders and interest groups
Management	• Decentralization of powers in favour of grass root level administration • Establishment of effective collaborative linkages between NARS and IARCs, Centres of Advanced Studies, etc. • Agricultural research policy with a vision, research prioritization, demand driven research programmes	• No decentralization, bureaucratic delay in decision making • Ad-hoc collaborations to meet crisis situations • No well defined agricultural research policy and vision, project driven, more donor oriented programme formulation
Resources	• Availability of more qualified scientific and technical personnel • Multiple research providers independent of ARC or government	• Lack of qualified scientific and technical personnel • Structured and limited public sector centralized models
Programmes/ Projects Planning	• Capabilities of both infrastructure and human resource in new sciences of biotechnology, modelling, GIS, agri-business, etc. • Development of Intellectual Property Rights protection system • Availability and effective use of information and communication technology • Emphasis on research prioritization, monitoring and evaluation	• Conventional breeding efforts. "Down-stream" type research. Less focus on new sciences • Non-existence of IPR protection system • Less availability and use of information and communication technology • Subjective prioritization, poor monitoring and evaluation systems

China and India have the largest research systems in the developing world with well defined mandate and they account for more than half of developing countries' research capacity. But 95 out of 130 NARS in developing countries still employ fewer than 200 researchers, and 39 systems employ fewer than 25 researchers (Byerlee and Alex, 1998). The quality of scientific manpower, as measured by the proportion of scientists with post-graduate degrees, has increased in all countries. Currently, more than half of the agricultural researchers in developing countries hold a post-graduate research degree.

Level of Investment in ARD

The intensity of investment by the public sector in research in developing countries, measured as a share of agricultural GDP (excluding the value-addition) is about 0.5 per cent. Although this has risen from 0.38 per cent in early 1970s, it is relatively low and has remained nearly unchanged since the late 1970s. It is also far below the two per cent target recommended by the World Bank (1981) and the average of 2.39 per cent for the industrialized countries (Alston *et al.*, 1998). In recent years, private sector investment in agricultural research is increasing. Currently, the private sector accounts for 10-

Box-3: NARS in the region – a comparison

South Asia

- Considerable expansion of international and national support for agricultural research.
- Support to agricultural research in real terms has declined in recent years.
- Some countries have elaborate NARS. Nepal is establishing a University. Bhutan is emphasizing system based research and strengthens the Research-Extension-Farmers (R-E-F) linkage. ARCs of Bangladesh and Pakistan are striving to increase their effectiveness by integrating state and federal level institutions. But O&M structures need change. All the NARS are strengthening their data and information system.
- The research organizations and institutions are established by the Governments. Agricultural Research Council model is experimented in different ways adapting to specific needs and socio-economic conditions. Projects, regional research stations and institutions, and State Agricultural Universities achieve a high degree of synergy.

South-East Asia

- Massive investment in human resource development made during 1980s.
- NARS consist of national or central research facilities, regional facilities and provincial or location specific research stations. The national research facilities include single-commodity and multi-commodity research. Agricultural Colleges and Universities are engaged in national R&D programmes, regional facilities address regional problems in a multi-disciplinary manner, provincial or location specific stations are involved in fine tuning of technologies to suit to the needs of specific area.
- Most of the countries have an established NARS. But some do not yet have a coordinating system. Most of them are under Ministries and some are having autonomous agency type organizations, where functional autonomy is enjoyed. But all of them are directly linked with the country's politico-economic system.

East Asia

- NARS have played an important role in collaboration between the national and provincial governments, private sector organizations and universities.
- In China, there are 1142 agricultural research institutes out of which 60 are involved in applied and basic research at the national level. The crop based research institutes numbered 688. In Japan, there are 29 research organizations and 381 local research institutions. In the Republic of Korea, Rural Development Administration (RDA) holds the national leadership. RDA is composed of 4 bureaus, 10 national research institutes, one National Seed Management Office, Korean National Agricultural College, 31 region specific crop experiment stations and 9 provincial RDAs.
- NARS are fully reorganized and reoriented and the private sector is now aggressively participating.

Pacific Island Countries

- In most Pacific Island countries, agricultural research is public sector dominated, with very little private sector investment. Access to NARS within and outside the region needs improvement. Most countries find it difficult to establish institutions at the national level. Research programmes are mainly donor-driven and less sustainable. There is need to develop and establish agricultural research stations in this sub-region in all the sub-sectors of agriculture.

15 per cent of resources invested in developing countries (Pray and Umali-Deininger, 1998), compared to about 50 per cent in industrial countries. But private sector has to be more involved in these countries as a proactive partner. It may be noted that studies conducted have found a high rate of return to investments in research in developing countries [*see* Echeverria, 1990; Evenson and Rosegrant, 1993, for a review of more than 100 such studies].

Asia-Pacific Region

Around early 1960s, faced with acute shortage of foodgrains, many of the developing nations especially in the Asia-Pacific region started making efforts to invest and build their agricultural research, education and extension systems. Such investments in agricultural research during 1960s and 1970s had their profound impact on agricultural production, stimulated by the strengthening and reorganization of agricultural research and education which enhanced the process of evolution of NARS. Agricultural research focussed on rural development and equitable and sustainable use and management of natural resources to achieve socio-economic benefits for the farming societies and the upliftment of the poor.

NARS in the region are at different stages of evolution and many of them are still small, weak with inadequate institutional support coupled with human, financial and management resource constraints. The weak NARS need a lot of support for both organization and management as well as for conducting research and extension. It is, therefore, imperative that in the globalized world that characterizes the turn of the century, regional organizations like APAARI play a key role in facilitating scientific and technological cooperation among the NARS by providing a neutral, apolitical forum and by working together with the International Agricultural Research Centres (IARCs) operating in the region.

Level of Investment in ARD in the Region

Investments by national governments of the Asia-Pacific countries (excluding China) in public agricultural research in real terms more than tripled over the past two decades; from 0.9 billion (US dollar) in 1971 to nearly US $ 3.5 billion in 1991. In other words, expenditure on publicly performed agricultural research in Asia-Pacific countries grew by 7.3 per cent as against 3.6 per cent growth at the global level (Alston *et al.* 1998). However, it significantly varies among the countries of the region and investment per capita is still very low.

APAARI, unlike some of the other regional/sub-regional organizations is in a very unique and advantageous position of having members that come from some of the poorest to some of the richest countries of the world. Depending on the stage of growth of NARS, APAARI may have to facilitate building up of NARS, help in carrying out functions of programme implementation, research coordination, research programming, research policy formulation and technology development as well as commercialization.

Successes in the Region

In the field of agricultural research, the region has made a number of significant technological achievements/advances, especially in the past three decades, both through individual national efforts and also in collaboration with the International Agricultural Research Centres (IARCs) under the aegis of the Consultative Group on International Agricultural Research (CGIAR). One of the most spectacular achievements of the region had been both in wheat and rice, mainly in South Asia, as a result of large scale adoption of dwarf wheat and rice varieties evolved initially at CIMMYT and IRRI, respectively. The National Agricultural Research Systems (NARS) by refining and adopting the new technologies have gained substantially. Some of the success stories in the region are: (i) hybrid rice cultivation in China covering almost 18 million ha (54%) of area under rice and contributing around 65% of total

rice production; (ii) oil palm research in Malaysia giving around 6 tonnes/ha of oil yield based on genetically improved materials, thus becoming number one in palm oil production and exporter in the world; (iii) cultivation of single cross hybrids in maize in China giving 5 tonnes/ha of average yield at the national level and accounting for almost 80% coverage under improved hybrids; (iv) hybrid cotton covering an area of 2.7 million ha (36.0% of total) in India, thus making export of long staple cotton possible while also resulting in self-sufficiency; (v) evolving high yielding, short duration and disease-resistant hybrids of sorghum and pearl millet and also of castor and pigeonpea in India; (vi) evolving most productive rice-wheat system in China, India, Pakistan, Bangladesh and Nepal covering an area of 22.5 million ha; (vii) evolving baby corn hybrids and varieties in Thailand resulting in higher production and export; (viii) success of transplanted maize immediately after rice in North Vietnam; (ix) integrated pest management strategy in Indonesia leading to 50% reduction in pesticides and 15% increase in rice yield; (x) production and export of tissue cultured orchids on a large scale in Thailand and Singapore; (xi) promoting a number of high yielding hybrid vegetables (especially cabbage) in South Korea; (xii) soybean production technology in China, Thailand, South Korea and in India where area under this crop in the last decade has increased to about 4 million ha; (xiii) increased production of cotton in Pakistan through improved varieties possessing genes for salt tolerance and earliness; and (xiv) evolving of true potato seed (TPS) technology and its adoption in India.

NARS AT CROSS ROADS – CHALLENGES FOR DEVELOPING COUNTRIES

The NARS in the Asia-Pacific, when compared to their counterparts in developed countries, are now at cross roads. It is widely recognized that many of the agricultural research systems have been quite successful on crops but they have been less efficient in the use of the other resources of land, soil and water. The challenges before the NARS can be summarized as follows:

Political Will and Resourcing

(i) The basic problems of population, food security, poverty eradication and sustainability and management of natural resources are yet to be solved.

(ii) Traditional sources of productivity growth, e.g., modern varieties and hybrids, and fertilizers in irrigated areas through commodity approach have little further potential to dramatically raise productivity, particularly in vast rainfed areas. New sources of productivity growth will have to be knowledge intensive, harness system interactions, address biotic and abiotic stresses, conserve biodiversity, and take account of the new economic environment generated by global conventions and agreements.

(iii) There is substantial fall in the investment on research in public sector though returns to agricultural research are very high and many NARS have failed to muster political support for funding of agricultural research.

(iv) The share of agriculture in GDP is declining and the policy makers are complacent. It is a paradox that sufficient institutional strengthening is not taking place despite higher returns to agricultural research. Policy makers have to be sensitized.

Organizational Challenges

(v) O&M system sicknesses and second generation issues in institutional development have emerged and deserve priority attention for sustaining research capacity.

(vi) The institutional structure and governance needs substantial improvement through management skills and agricultural human resource development.

(vii) There is pressing need to reorient agricultural research method and approach as research agenda has become complex.

(viii) While perceiving new ways of doing business, facilitating and concomitant rules, procedures, autonomy, flexibility, human resource, coordination among many research providers and their system of funding O&M support, and the progressive and positive mindset has to be in place, and requires build up.

(ix) Consolidation, downsizing, system reorientation and reforms are generally resisted and, therefore, needs special attention.

(x) Research systems have difficulties in recruiting or retaining qualified staff on account of fixed personnel policies of the Government.

(xi) There is need for increased linkage with stakeholders. There are already NARS where the private sector is actively participating and NGOs are involved. This has to be extended to other NARS.

On account of these challenges, it is felt at all levels that continuing the business as usual may not be sufficient to address second generation complex problems of the next millennium. There should be paradigm shift in the mindset of all the actors. NARS are required to give attention to these issues and they need a proactive change agent. In other words, NARS are now looking forward to increasing role of some regional organizations to strengthen/empower. them towards sustainable agricultural development through regional cooperation and strategic planning, research prioritization, and organization and management (O&M) reforms.

STRATEGIC ROLE OF APAARI

Genesis

The 17th FAO Regional Conference held in Islamabad, Pakistan in 1984 recommended that an Asia-Pacific Association of Agricultural Research Institutions (APAARI) be established. Further to this, recommendation was for FAO to sponsor the Association to strengthen the national agricultural research capabilities of the region and to enable the sharing of experiences among national partners. In pursuance of these recommendations, the FAO Regional Office for Asia and the Pacific, Bangkok organized an expert consultation in October 1985 which was attended by several countries in the region. The consultation strongly recommended the establishment of APAARI.

APAARI – Constitution

In December 1990, the constitution of APAARI was adopted by the General Assembly in its second meeting held at the FAO Regional Office for Asia and the Pacific at Bangkok. In 1991, the genuine concerns of this region like dense population, poverty, low agricultural productivity, small and low income farm holdings, low production and technology inputs, high demand for food and other agricultural products, lack or no formulation of policies, plans, strategies and programmes were discussed. In 1994-95 considering the changing scenario reflecting trade policy matters such as the Asia Free Trade Agreement (AFTA), the Uruguay round of the General Agreement on Tariff and Trade (GATT) and the concerned membership and its role, APAARI developed its five-year perspective plan to achieve its mission. Its strategies and action plan focussed on regional collaboration, prioritization of programmes, promotion of technology transfer and human resource development, policy advocacy, public awareness, and enhanced publication and information communication. APAARI reinforced collaboration among institutions, tightened its relationship with other agencies through networking, and supported national efforts in improving agriculture in the region.

Since its establishment, APAARI has emerged as a forum that fosters closer linkages among apex agricultural research management organizations of the region. Presently, 17 NARIs/NARS are its members from West Asia (Iran), South Asia (India, Bangladesh, Pakistan, Nepal, Sri Lanka), South- East Asia (Malaysia, Thailand, Vietnam, Philippines), East-Asia (Taiwan, Republic of Korea, Japan), The Pacific (Papua New Guinea, Fiji, West Samoa, Australia). IARCs operating in the region are among the associate

members namely IRRI, IWMI, IPGRI, ICRISAT, ISNAR, ICARDA, CIMMYT and CIRAD. Also international organizations, such as CABI, APSA and AVRDC, are associate members of APAARI.

Mission

The 'Mission' of APAARI is to promote the development of national agricultural research systems in the Asia-Pacific region through facilitation of intra-regional and inter-institutional and international cooperation (FAO, 1995).

Objectives

The objectives of APAARI are as follows (FAO, 1995):

- Promote the exchange of scientific and technical know-how and information in agriculture;
- Encourage and facilitate the establishment of appropriate cooperative research and training programmes in accordance with identified regional, bilateral, or national needs and priorities;
- Assist in strengthening research organization and management capability of member institutions; and
- Strengthen cross-linkage among national, regional and international research centres and organizations including universities through jointly planned research and training programmes.

Current Role

The role of APAARI is to facilitate R&D in the countries to promote food security and improved livelihood to farmers. In recent years, regional research collaboration has received renewed interest as a way of realizing efficiencies in NARS, especially in regions with many small countries (Eyzaguirre, 1996). Regional Agricultural Research Associations (RARAs) have evolved as formal organizations formed by NARS to provide a structure for integrating regional technology programmes under NARS-directed management and capturing the efficiencies offered by regional approaches (Byerlee and Alex, 1998). The potential for collaboration among NARS involving diverse partnerships exists if the total gains from collaboration are greater than the sum of the gains of individual countries acting independently. In practice, however, political constraints including distrust, and high transaction costs - opportunity costs of resources used in information acquisition, organization, and contract enforcement may adversely affect regional collective action and, hence, the realization of gains from collaboration. The Regional Institution can help reduce participation cost for individual countries through information exchange and policy dialogue, and other mechanisms.

Though being relatively young, APAARI has made significant achievements. It has played a very constructive role by bringing in an element of cooperation among NARS in the region. The regular meetings, expert consultations and workshops have resulted in finding suitable solutions to agricultural problems and have further strengthened inter-NARS partnerships. The achievements in developing regional collaboration and networking, policy advocacy, resource generation and publication enhancement are highly impressive. APAARI has also catalyzed NARS by introducing baby corn from Thailand, hybrid rice from China and transplanted maize from Vietnam to India, Tilapia from Philippines to India and Bangladesh, and from India, hybrid cotton technology to Vietnam, co-cane varieties in sugarcane to

a number of countries in the Asia-Pacific region and improved milk production using Murrah buffaloes to Vietnam and Philippines.

In the area of networking a start has been made in developing a database of existing regional/sub-regional networks/fora and this might be extended to include their objectives, activities, mode of operation and funding, etc. A home-page has been prepared and is being upgraded to comfort new information dissemination strategies and knowledge exchange. A start has been made with the establishing of a regional information and knowledge network, possible through support of CABI and ISNAR.

Expert Consultation on research priority setting by NARS in the Asia-Pacific region

SWOT Analysis

An indicative analysis of strengths, weaknesses, opportunities and threats to agriculture in the Asia-Pacific region, Agricultural Research for Development (ARD) and APAARI is presented in Appendices 1 to 3. The analysis will not be discussed broadly here. It speaks for itself. However, the introspective character of this analysis has very much contributed to the vision and the road ahead.

A stronger APAARI can be an effective ambassador of NARS at the global forum. With APAARI's greater recognition at regional and global level, its representation in GFAR, CGIAR, FAO, IFAD, World Bank, ADB, UNDP and other such organizations/fora will mobilize support of policy makers and donors. But despite the important role it plays, it is confronting problems of sustainability as well as an increasing challenge of evolution and consolidation in terms of being able to respond successfully to the opportunities and requirements that are being generated by the deep changes taking place in the organizational and scientific context of agriculture and Agricultural Research for Development (ARD).

VISION 2025

In the backdrop of challenges of the region, status of NARS and cooperation among them in the region, mission and objectives of the APAARI and the SWOT analysis, the APAARI Vision 2025 will be:

> *"Agricultural Research for Development (ARD) in the Asia-Pacific region is effectively promoted and facilitated through novel partnerships among NARS and other related organizations so that it contributes to sustainable improvements in the productivity of agricultural systems and to the quality of the natural resource base that underpins agriculture, thereby enhancing food and nutrition security, economic and social well being of communities and the integrity of the environment and services it provides".*

APAARI will endeavour to fulfil this vision by building and strengthening NARS contribution to sustainable agricultural development, strengthening regional cooperation and coordination of ARD. APAARI's specific objectives are to promote the exchange of scientific and technical information, encourage and facilitate cooperative research and training programmes, and assist in strengthening research organizational capacity of member institutions. It will function as a neutral platform for discussion on major research issues/policies.

Participants of the expert consultation on Vision 2025

NEW STRATEGY FOR ARD AND THE ROAD AHEAD : APAARI's ROLE

There has been a significant shift in paradigm from a supply driven to a demand driven approach in agriculture. This resulted in a change in focus from production levels to production efficiency, productivity and profitability. Besides that, equity, employment, environmental sustainability, nutrition, food quality, trade, etc. have become new areas of concern for agricultural research even as efforts to maintain food security continue. Obviously, these areas make R&D management arduous and challenging.

This demands for effective introspection, re-prioritization and consolidation, besides overall accountability. These underscore a need for an appropriate strategy. The strategy, action programmes and the role of APAARI is outlined in Appendix 4. It may be noted that the elements of the strategy may have to be separately charted out for different countries or sub-regions (e.g., West Asia, South Asia, South-East Asia, East Asia, and the Pacific Island countries).

The following strategies are considered to be pursued:

- Strengthening regional co-operation and partnership through networking and encouraging the use of new information and communication technology
- Publication enhancement for technology transfer among NARS
- Human resource development including improving of research management
- Impact assessment and evaluation
- Advocacy for ARD at the policy level
- Setting strategic directions
- Ensuring sustainability

Each of them will be discussed in detail in the following sections.

Strengthening Regional Co-operation and Partnership

APAARI serves as the Regional Forum for ARD in tandem with GFAR and other players. The membership of APAARI is valuable to countries in the region because ownership of constituencies by APAARI brings NARS partners together and builds strength, addresses strategic issues relevant to ARD, attracts attention of donor countries and key players for ARD, facilitates information exchange, interactions with CGIAR and IARCs, means of self help, enhances public awareness on important agricultural and development issues like IPR, WTO, etc., sensitizes policy makers and above all as a leading organization, represents the region in the international fora/organizations.

One of the goals of APAARI is to strengthen regional coordination and cooperation among all the stakeholders and actors. A clear vision on how it performs this role assumes critical significance. The

mechanisms available are developing partnerships, networking and proper use of information and communication technology.

Partnerships

This is a key mechanism for a facilitating organization such as APAARI, and it is one of the major added values that APAARI can bring to its members, linking regional, sub-regional and national institutions to international institutions and organizations and bringing the best of advanced research to individual researchers and institutions in the region. The ability of APAARI to establish or strengthen these linkages will have an impact on all the other functions/activities. The issues to be addressed while promoting partnership include creating awareness among Asia-Pacific NARS about the potential benefit of APAARI membership and seeking interfaces with other networks/fora operating in or outside the region.

International support to NARS is critical in areas such as information technology, biotechnology, IPR, GIS and remote sensing applications, crop and systems modelling, global climate change, natural resource management (including IPNM and IPM approaches), post-harvest technology and management, agri-business and export related issues. It is also important to recognize the changing balance between the public and private research, the upcoming participatory research model, the increasing role of information in technology transfer to farmers with stronger research/agri-business/extension/farmer links. These areas require substantial institutional strengthening and capacity building. APAARI has a pivotal role to play in coordinating these emerging needs of NARS and in advocating and facilitating technical and organizational support from IARCs, FAO, GFAR and donor support from IFAD, World Bank, ADB, UNDP and bilateral donors.

Partnership with CGIAR/IARCs: The partnership will be helpful in 3 ways, (i) Promoting interaction with NARS leaders, (ii) setting up of research agenda, and (iii) facilitating in taking up some of the research agenda jointly. APAARI's representation in CGIAR, FAO etc. for its visibility is therefore needed. The role of the regional fora is important for shaping the research agenda of CGIAR centres and in guiding NARS participation in the CGIAR's array of Systemwide and Ecoregional Programmes. Donors are now expecting better cooperation by the IARCs with regional fora. APAARI is playing an important proactive role in the regional priority setting and work in partnership with TAC/CGIAR.

Partnership with ARIs: Since several ARIs have research programmes operating in Asia-Pacific, partnership between them, needs to be promoted in the specified areas that are of regional importance. APAARI could also act as facilitator for building consortia bilaterally between ARIs and NARS and in the process explore/ensure donor support.

Partnership with GFAR: The global forum on agricultural research recognizes regional fora as the major players in strengthening regional and global ARD. For effective partnership, regional priorities need to be identified and a legal framework need to be put in place to deal with globalization issues relating to CBD, TRIPS, WIPO, etc. The global agricultural research system should bank upon the strengths of the NARS in the developing countries and their regional/sub-regional ARD organizations which are the corner stones of this system. Effective linkages with the GFAR will surely accelerate support to regional and national R&D programmes.

Partnership with Regional/Sub-Regional Fora: Apart from strengthening linkages with other regional fora/associations, need is strongly felt to set up ad-hoc committees from time to time to discuss sub-regional activities. The role of networks in the Asia-Pacific is appreciated in promoting sub-regional priority-based activities. This approach is considered as more cost-effective in strengthening specific R&D activities among different stakeholders. APAARI should therefore strengthen its linkages with the regional bodies, such as APSA, APAFRI, APHCA and NACA. Linkages with sub-regional bodies like SPC, SAARC, ASEAN will be desirable. APAARI could negotiate reciprocal arrangements with regional organizations/associations such as APAFRI, NACA and APHCA to cover the sectors of forestry, fisheries and livestock in a holistic manner, to add to sustainable agricultural development.

Partnership with Private Sector: The economic reforms and the liberalization measures introduced in the Asia-Pacific countries envisage a much bigger role for the private sector. APAARI should facilitate building up of closer links between research institutions in the public sector and the private sector including agri-business, universities, other R&D institutions and the NGO community. So far public sector research institutions have received more attention than those in the private sector. Some of the responsibilities for research and research related services of the public sector research institutions should gradually be transferred to the private sector. As the public sector institutions move to new priorities, specially in the area of natural resource management, some of the existing research responsibilities in the field of plant breeding, fertilizers, pesticides and farm machines may be transferred to private sector.

Networking

Models of networking of APAARI are NARS-NARS, NARS-APAARI-CGIAR Centres, NARS-APAARI-Donor, and NARS-APAARI-UN System. It may also include networking between public and private sector.

The concept of networking research activities, specially in agriculture, is now finding acceptance within institutions of a country as also between and among countries in recognition of the needs to build individual strengths. APAARI has taken a conscious decision to support agricultural research networks in the region, such as TAMNET, CLAN, UTFANET, etc. Newer networks such as CORRA and GoFAR have already affiliated with APAARI. APAARI is also associated with the network on plant genetic resources managed by IPGRI and INIBAP, through their regional programmes in the Asia-Pacific. The networks help the weaker NARS to join the mainstream of the global research community. Networks also constitute a cost effective way for any institution, IARCs as well as NARIs or NARS, to complement its core research activities. APAARI could then consider providing an umbrella cover to these networks for seeking financial support from interested ODA donors and national governments.

Networks may face constraints/limitations in sharing of credit facilities and resources, administrative procedures and protocols, funding agency driven agenda for planning and resource allocation to activities, and possible dominance of bigger NARS/CGIAR centres.

Areas in which new networks could play a role are:

- NRM in a farming systems perspective (but taking into account the role that IBSRAM already plays in this regard). The variety and dynamism that exists in the management of natural resources can only be dealt effectively through high quality interdisciplinary approaches.

- Biodiversity conservation and management extending perhaps those already in place under the aegis of IPGRI. Others such as on livestock in agriculture (building links to APHCA) and strengthening of networks like ANMAP.

However, too many networks in the region may also not be sustainable. APAARI may frame some guidelines on which networks can be supported in future. A comprehensive database on networks would assist in promoting research and co-ordination and dissemination of results. Periodic studies of various networks in the region and their impact may need to be assessed to get a generic view for future planning.

Information and Communication Technology (ICT)

Taking advantage of the new information and communication technologies that are presently available is a topic of high priority for ARD in the region. The problem of difficult access to information and knowledge creates a need for facilitating the application of new information and communication technologies (ICT) in agricultural and rural development. The issue is how to strengthen national information capacities and how to move towards a regional knowledge system for agricultural R&D that effectively links up to the emerging global knowledge system without countries missing the boat. There is need for identification of current information capacities and requirements of the NARS and how to link them to a regional system for information and knowledge exchange in ARD.

The aspects that need attention in this context include access to information and knowledge through improved information flows among the stakeholders (improved information systems) as well as access to the ICT as such. Improving capability of NARS in the application of GIS technology is a priority for NARS information system development. Finally ICT may even be used to address rural development problems to meet the needs of the rural poor.

In many NARS the ICT infrastructure is not well developed. However, many institutions do have a homepage. APAARI could facilitate the establishment or improvement of homepages and link them with the APAARI web site that will then function as a regional portal. Upgrading of the current APAARI web site to suite that purpose is therefore critical.

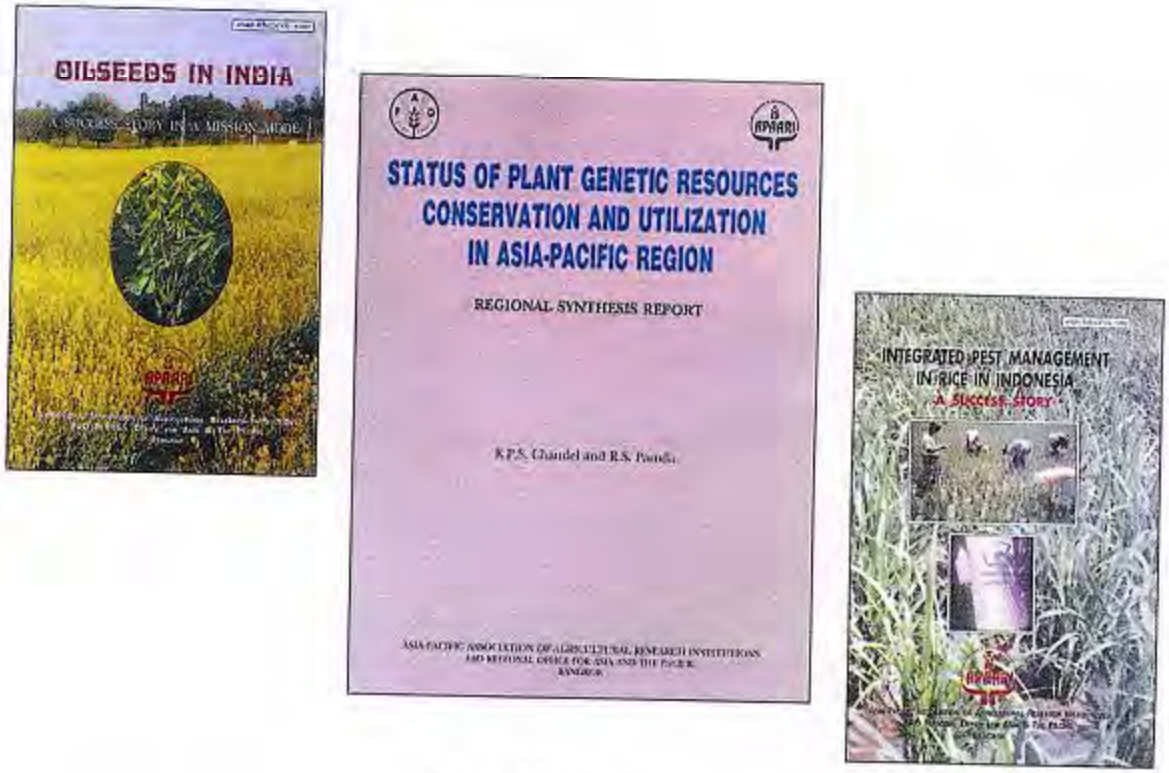
Electronic Conferences (or even video conferencing) could be hosted at the APAARI web site to promote policy awareness on IPR, biodiversity, biotechnology and GMOs. APAARI should then be linked to global information systems (EGFAR, WAICENT).

Directories of agricultural research institutions in the Asia-Pacific region could be created or updated and maintained on the web, preferably in a decentralized manner having each NARS to update it's own directory. There are a number of such directories already present on the web (AROW of ISNAR and WISARD of IAC) to which APAARI could link and ask its members to feed the database. This would lessen the burden for APAARI and will be more effective in its linkage to the global knowledge system.

Networking through e-mail and Internet connectivity would enable APAARI members to have access to the best possible knowledge, information and technologies. This will facilitate in receiving, providing and sharing knowledge and information worldwide for everyone's benefit. APAARI will have to facilitate the assessment of the value and usefulness of a regional information facility among the members that would ideally lead to the establishment of a Regional Agricultural Information System for Asia and the Pacific.

Publication Enhancement for Technology Transfer among NARS

APAARI has made a significant headway in its publication programme: newsletters, success stories, expert consultation proceedings, directories, special reports etc. APAARI publications are made available to IARCs/CGIAR Secretariat and the FAO offices in the region for better visibility of its activities. ISNAR and CABI may help APAARI to further strengthen this activity. Other options become available like web publishing in downloadable format, development of searchable CD-ROM's of selected areas of interest (such as of CABI), electronic communication and low cost conferencing.



Recent APAARI publications

There are many good experiences in NARS of organization and management of R-D-E and technology transfer initiatives. These success stories/experiences, expert consultations, status reports, newsletters, etc. when shared contribute to the information flow and knowledge transfer among NARS. Ultimately it speeds up technology transfer to a far wider group of farmers, and hence assists others in improving their own production/research/management systems. APAARI has made a useful contribution in this area through its ongoing programme of publication and wider dissemination of success stories in the region. These success stories should ideally be translated in local languages and made available in electronic and hard copy format.

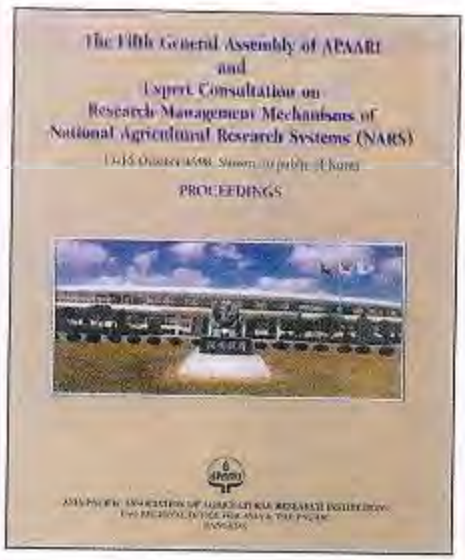
Development of technology using participatory research methods is becoming more and more important. Once the technology is developed, effective technology transfer among NARS and ultimately to farmers is critical for agricultural development. Therefore the researcher-extension worker-farmer linkage should be built effectively.

Human Resource Development (HRD)

Capacity building

HRD is rated as a high priority activity at national and regional level. The existing national capacities/capabilities need to be assessed and special training needs identified that may be specific for a certain sub-region or individual NARS. Possible linkages for HRD should be identified keeping in view the facilities and comparative advantages of NARS. Both long-term and short-term needs of the national programmes in capacity building are required, including major practical trainings through formal and non-formal courses, skill building in participatory approaches involving village level extension workers and farmers organizations. APAARI could facilitate in gathering comprehensive information on training need and training facilities available in the region and sharing such information on it's web page with linkages to the training institutions. This should include the facilities and courses in regional training and education institutions like AIT and SEARCA, and among NARS' centres of excellence, in India (NAARM and NBPGR), Malaysia (MARDI), Phillippines (PCARRD). APAARI could facilitate in planning of capacity building programmes for NARS by assisting in prioritizing. APAARI could also facilitate exchange of expertise/scientists among NARS. In view of the critical importance of HRD in the region, APAARI may have to develop a regional perspective plan for HRD, based on NARS needs.

APAARI's Role in Improving Research Management, Impact Assessment and Evaluation



Proceedings of the Expert Consultation on Research Management Mechanisms of NARS

Special attention should be paid to upgrading the managerial skills of NARS institutional managers and senior scientists for effective research and financial management. Also information managers should be trained. As a result projects and activities will be suitably identified and prioritized, funding support/grant for research will be obtained and made available, and programmes and funds will be managed efficiently and effectively. The Asian Institute of Technology (AIT), NAARM, ISNAR, and IFPRI can play a vital role in this regard. There is also need to monitor on a regular basis the progress of various research activities/programmes and to evaluate the scientific achievements and outcomes to justify funding and satisfy accountability. It is necessary to assess the development impact of research activities and programmes and determine social, economic and environmental benefits. There should be periodic internal and external reviews of NARS to ensure that they remain responsive to stakeholder needs and the changing

research environment. APAARI can facilitate these important functions of monitoring, evaluation and review by assisting in the training of NARS staff and by prescribing guidelines and benchmarks.

APAARI could highlight successful case study of O&M reforms among NARS of the region. It could also facilitate the execution of a SWOT analysis of some well developed NARS of Asia-Pacific region to draw lessons that can benefit other developing NARS.

Advocacy for ARD at the Policy Level

It may be a useful initiative for APAARI to organize meetings for high level policy makers on strategic issues affecting agricultural research and facilitate policy and market studies at the regional level in the context of globalization of agriculture and its effects on future research directions and emphasis. Policy makers need to be sensitized for highlighting the value of investment in ARD.

Issues like representation of APAARI as a regional forum in FAO, Regional Conferences, CGIAR, etc., through appropriate mechanisms, should be thought about and pursued. APAARI should have access to planning/policy documents that NARS/FAO/GFAR/CGIAR/IPGRI/UNDP/ADB/WB/ACIAR/ ISNAR/IFPRI produce for exchange with NARS.

In promoting policy awareness, APAARI on its website can exhibit published documents in its field, such as those of ISNAR, IPGRI and IFPRI. APAARI needs to ensure greater public investment in ARD by catalyzing policy makers and also the NARS leaders. It needs to encourage policy analysis through involvement of NARS and through a network in partnership with IARCs such as ISNAR and IFPRI.

Setting Strategic Directions

There is an urgent need for improving strategic planning processes of many NARS in the region. Such planning should adequately combine long-term perspective (15-20 years) with mid-term plans (5-10 years), ensuring flexibility in long-term implementation. In developing strategic plans, all stakeholders including farmers, NGOs and the private sector should be actively involved. APAARI may be able to facilitate access to external funds for NARI/NARS strategic planning activities including training but this area is the responsibility of national governments and the institutions involved. A more appropriate role for APAARI would be to assist NARS in strengthening their planning capacities and processes through training and to facilitate linkages among NARS and global partners who might assist in planning such as ISNAR and ARIs.

Sustainability of APAARI's Efforts

Membership

The current membership of APAARI includes 17 NARIs/NARS of which three are agricultural research agencies from donor countries in the region. Several IARCs are it's associate members. To strengthen APAARI further, and to make it more viable its membership needs to be expanded to include other NARS and relevant organizations. It has been suggested (Byerlee and Alex, 1998) that over the long run Regional Agricultural Research Associations must develop strategies for funding and operation that

overcome the current heavy dependence on donor support. The relevant question is, is donor approach the only way to support networking activities, or are there other innovative approaches which can at least complement donor support? APAARI is facing the problem of frequent change of top NARS officials. Also changes in Government in member countries imply changing awareness at the national policy level of the need for ARD. APAARI is considering how best it might extend its membership to be more inclusive of research providers in the NARS of the region At the national level, the issue of NARI–NARS could be addressed and willingness of the existing members taken to accept others as members. Also, NARS who are not able to afford membership may be taken as interim members. At the regional level APAARI may approach other regional fora for membership on a reciprocal basis APAFRI, APSA, GoFAR, CORRA, NACA, APHCA etc. At international level APAARI may approach more international organizations or research centres to explore possibilities of trial membership (associate members) for a given period of 3 years.

Funding

Extended membership also should bring with it a wider and increased funding base. Membership might eventually be extended to include NGOs and the private sector (including universities) provided that such organizations are active in ARD and are financially viable. APAARI attracts limited ODA donor support for its activities but this is an important source of funds. Donor dependence for APAARI project activities might be reduced by attracting support from governments whose national agricultural development APAARI is assisting in. In view of funding constraints, APAARI will need to prioritize its own activities, keeping also in view regional equity in resource allocation considerations.

In Figure 4 the mechanisms discussed in this chapter have been summarized and connected with the goals of APAARI. In Appendix 5 the APAARI goals are connected to the journey forward for ARD in the Asia Pacific, clearly showing the facilitating role APAARI plays in the region.

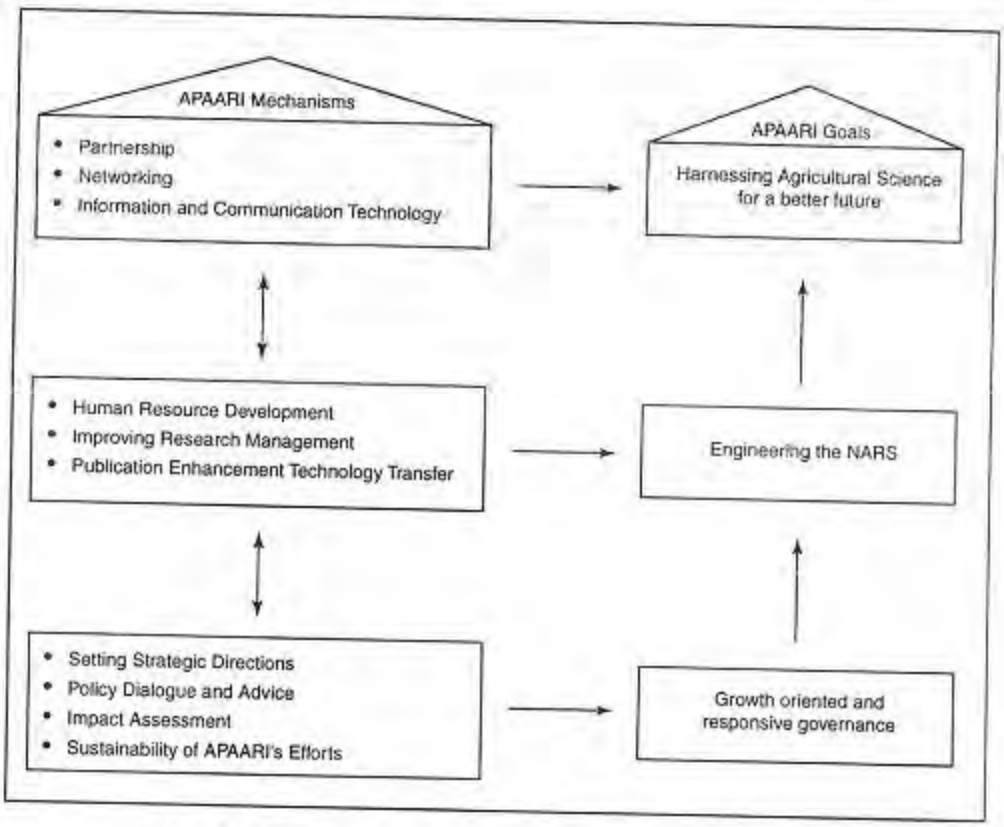


Figure 4. The journey forward for APAARI – goals and mechanisms

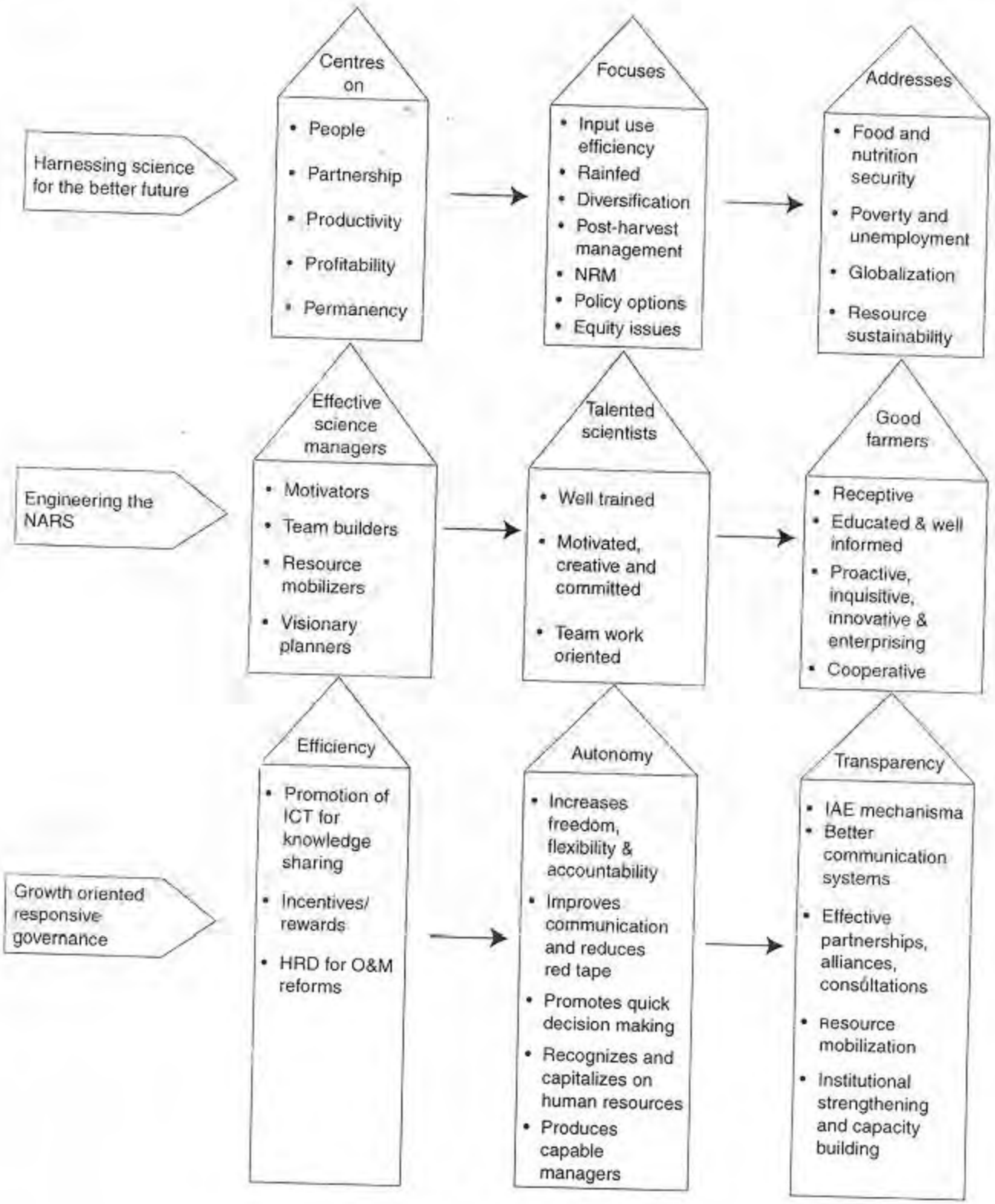


Figure 5. The journey forward for ARD

EPILOGUE

APAARI as a young yet dynamic regional forum has done well in promoting sustainable agricultural development through communication among NARS and the regional cooperation through its support for networks. Rapidly growing population coupled with the noble vision of ensuring comprehensive and sustained physical and economic access to food and a quality livelihood for all the people in the region, clearly point towards the urgency and unquestionable need for concerted action to ensure increased productivity and sustainable food security across the countries in the region. There is a compelling need to link NARS across agro-ecological and economical and political boundaries, and to enter regional and global associations and networks for sharing of knowledge and information.

APAARI's Vision 2025 clearly outlines the pathway and the strategy to translate future goals into current activities. Today's action is the basis for tomorrow's progress, and strength is built through partnership with mutual benefit and combined action by all the key players responsible for ARD in the Asia-Pacific Region - a region that is dynamic and agriculturally vibrant. Hence, this vision provides a clear path and directions set for all the key players to ensure that this dream becomes a reality. APAARI Vision 2025 is decidedly a significant step in that direction with the aim to achieve regional welfare and prosperity.

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APPENDIX-1

SWOT ANALYSIS OF AGRICULTURE IN THE ASIA-PACIFIC REGION

Strengths

- Agriculturally a most vibrant region with visible impact of agricultural technologies
- Most countries have rich genetic and natural resources
- Regional self-sufficiency for most of the agricultural commodities, though there are some exceptions
- Fastest growing region in the world and advancing towards integrating with the world economy
- Rich traditional (farmer) wisdom which can be articulated and used

Weaknesses

- Breaching the limits of arable land
- Fast natural resource degradation
- Easy options for development of irrigation systems have already been exploited
- Weak agro-based industry
- Decline of capital investment in agriculture as its share in GDP declines
- Weak policy environment
- Less investment in agricultural research
- Lack of organized private sector

Opportunities

- In major enterprises, the actual productivity is much less than the potential
- Changing consumption patterns offer much scope for diversified agriculture
- Rich biodiversity offers opportunity for genetic enhancement
- Large and potential domestic/regional market
- Fast growing and dynamic economies in the region
- Greater private sector agri-business development
- Agricultural intensification to be consonant with environmental protection and sustainable resources management and rehabilitation
- Agriculture is just emerging as a business activity in some of the countries
- Fostering improvements in policy environment
- Potential to improve productivity in rainfed areas

Threats

- Thickly populated region and population is estimated to grow at 1.8 per cent as against 2 per cent now
- Fast urbanization replacing good arable land
- Decline in capital investment in and for agriculture
- Water is becoming scarce and its quality being affected
- Sustaining farmers' interest in cultivating rice
- Barriers to flow of technologies/knowledge/material as the fall out of TRIPs
- Maintaining quality of products
- Impact of climate change and global warming

APPENDIX-2

SWOT ANALYSIS OF AGRICULTURAL RESEARCH AND DEVELOPMENT IN THE REGION

Strengths

- Adequate institutional mechanisms to address agricultural research issues
- Availability of some advanced NARS
- Inexpensive manpower and trained human resource
- Availability of model networks
- High returns for investments in agricultural research
- Presence of CGIAR institutions in the region
- Policy support and appreciation to establish institutions exists

Weaknesses

- Weak research-extension-farmer linkage
- Institutional capacity for R&D&E is low
- Ineffective research with minimal outputs by many NARS
- Agro-biodiversity issues are receiving low priority
- Dwindling funding resources and low participation of the private sector
- Poor management skills of research managers
- Lack of trained manpower in new sciences
- Poor/weak data base and information and communication technology
- Linkages vertical and horizontal both inside and outside is less
- System approach is lacking

Opportunities

- Scope for promoting sustainable agricultural development and resource management by harnessing new sciences and resource management principles
- Scope exists for collection, conservation and utilization of large variety of plants, animals and fish genetic resources
- Significant opportunities exist for new or underutilized crops
- Vast potential exists for water conservation and management including utilization of rain water
- NGOs are fast emerging in the region and, therefore, there is a need to optimally utilize their strengths for sustainable agricultural development and technology transfer
- Private sector is fast emerging as potential stakeholder in ARD
- Interaction of R&D at sub-regional level
- New sciences, such as biotechnology, ICT, space science etc. offer future growth possibilities
- System's approach for research could enhance synergies

Threats

- Decline in R&D support despite better returns
- Non-existence of IPRs and lack of public awareness
- Lack of enabling research environment and appropriate incentive and reward systems resulting in brain drain
- Decline in R&D support despite better returns
- R&D not organized to promote rural development

APPENDIX-3

SWOT ANALYSIS OF APAARI

Strengths

- NARS driven and bottom up organization
- The Association enjoys a goodwill among all the stakeholders and strengthening of regional representation in the Global Forum
- Successful coordination demonstrating the utility of several effective research networks in the region for promoting the exchange of scientific and technical know-how and information in agriculture
- Identified priority research areas for the region and also for some countries in the region
- Brought in an element of cooperation among NARS, contributed to find solutions to the common agricultural, O&M and partnership problems of the region. It has been able to canvass for support and funding to NARS from donors though APAARI is not formally represented in these bodies
- Catalyzed NARS by introducing proven technologies from different NARS

Weaknesses

- Sustainability and level of funding
- Lack of enthusiasm/eagerness of non-member NARS to join, fund, support and benefit from APAARI
- Narrowness of existing membership, not all NARS components are present/represented in APAARI and not all Asia-Pacific countries are represented in APAARI
- Limited capacity for further development due to organization, management and funding constraints
- Not currently dealing with all sub-sectors of agriculture
- Non-inclusiveness of APAARI
- Lack of linkages with other regional fora
- Need to have sub-regional fora groupings

Opportunities

- Harmonization of rules for sharing of genetic material, etc.
- Promotion and facilitation of genetic resource conservation, exchange and use including underutilized species
- Vast opportunities exist for inter-NARS and transnational collaboration and cooperation
- Maximum involvement of all research institutions engaged in ARD in NARS is necessary for future successes
- Articulation of the regional issues at the global forum
- Self-help mechanism among NARS in region facilitated by APAARI
- Promotes apolitical organization
- Possibilities for fostering linkages with other Regional Fora, Global Forum, ARD institutions, groups, such as FAO Commissions, IARC's and donor community

Threats

- Poor response of NARS to introduce new R&D initiatives
- Lack of adequate enthusiasm to participate and support the activities of APAARI
- Need for revitalization of organizational structures
- Building from NARI to NARS

APPENDIX-4

STRATEGY AND ACTION FOR THE NEXT MILLENNIUM – KEY ELEMENTS

FOCUS	ELEMENTS	ACTION PROGRAMMES FOR ARD	APAARI'S ROLE
MANDATE	Policy setting and governance	O&M Reforms for improved governance	Facilitate
		Economic and Policy analysis	Advocate/Analyze
ORGANIZATION	Partnership	Complementarity in research efforts among institutions and agencies at national and international level	Networking
		Public-private sector linkages	Promote
		Effective role of stakeholders (Farmers associations, Universities, NGOs, Public and private sectors etc.)	Advocate
RESOURCES	Infrastructure including Informatics	Develop adequate infrastructure and core human resource for strengthening NARS, promoting co-ordination and co-operation among NARS through networks, and helping them in strategic planning and prioritization	Networking
	Efficiency	Research resources providing sufficient social benefits per unit of research inputs and add value for investment	Encourage
	Equity	Decentralization of agricultural research management	Advocate
		Technological empowerment of women in agriculture	Promote
		Removal of regional imbalance for institutional infrastructure and human resources	Advocate
	Enlightened human resource including informatics	Small farm mechanization and precision farming	Promote
		Thrust on manpower planning	Support
		Developing centres of excellence	Support
		Training in new science and technologies and agricultural research management	Support
		Developing new course curriculum	Encourage
		Knowledge based society	Promote
		Inter-institutional exchange/visit of scientists and research managers	Coordinate
		Thrust on improving public awareness	Encourage
		Enhancement in vocational skill Documentation, publication and dissemination of information	Support Facilitate
PROGRAMMES/ PROJECTS PLANNING	Research relevance	Participatory approach for conducting research	Facilitate
		Involvement of diverse partners, scientists, farmers, NGOs, farmer organizations, private sector etc.	Promote
		Research planning and prioritization as a bottom up initiative which meet users' needs, targeted to rural welfare	Support
	Saving biodiversity	Germplasm collection, conservation, characterization, evaluation and documentation	Encourage
	Environmental sustainability	System based interdisciplinary research thrust	Advocate
		Concern for conservation and effective use of life-support systems (such as soil, water, flora, fauna and the atmosphere), and integrated approach to manage agro-ecosystem	Promote
		Organic recycling and waste and by-product utilization	Networking
		Addressing global climate change	Strengthen
	Diversified agriculture	Diversification of agriculture with major focus on livestock, fisheries, horticulture and agro-forestry and exploitation of underutilized and native biodiversity	Promote
		Special attention to post-harvest technology, value-addition and agri-business management and trade	Advocate

APPENDIX-5

Table 1: Land Use in Asia-Pacific Countries *1000 ha in 1997

Region / Country	Land Area (a)	TempCR (b)	PermCR (c)	CR (d=b+c)	%TempCR/Area (b/a x 100)	%PermCR/Area (c/a x 100)	%CR/Area (d/a x 100)
Asia-Pacific	3,004,466	461,888	55,387	517,275	15%	2%	17%
West Asia							
Iran	162,200	17,750	1,650	19,400	11%	1%	12%
Total	162,200	17,750	1,650	19,400	11%	1%	12%
South Asia							
Bangladesh	13,017	7,916	325	8,241	61%	2%	63%
Bhutan	4,700	140	20	160	3%	0%	3%
India	297,319	161,950	7,900	169,850	54%	3%	57%
Maldives	30	1	2	3	3%	7%	10%
Nepal	14,300	2,898	70	2,968	20%	0%	21%
Pakistan	77,088	21,034	566	21,600	27%	1%	28%
Sri Lanka	6,463	868	1,020	1,888	13%	16%	29%
Total	412,917	194,807	9,903	204,710	47%	2%	50%
South-East Asia							
Cambodia	17,652	3,700	107	3,807	21%	1%	22%
Indonesia	181,157	17,941	13,046	30,987	10%	7%	17%
Laos	23,080	800	52	852	3%	0%	4%
Malaysia	32,855	1,820	5,785	7,605	6%	18%	23%
Myanmar	65,755	9,556	595	10,151	15%	1%	15%
Philippines	29,817	5,120	4,400	9,520	17%	15%	32%
Thailand	51,089	17,085	3,360	20,445	33%	7%	40%
Vietnam	32,549	5,668	1,534	7,202	17%	5%	22%
Total	433,954	61,690	28,879	90,569	14%	7%	21%
East Asia							
China	932,641	124,145	11,220	135,365	13%	1%	15%
DPR Korea	12,041	1,700	300	2,000	14%	2%	17%
Japan	37,652	3,915	380	4,295	10%	1%	11%
Mongolia	156,650	1,319	1	1,320	1%	0%	1%
Rep. of Korea	9,873	1,724	200	1,924	17%	2%	19%
Total	1,148,857	132,803	12,101	144,904	12%	1%	13%
Pacific Island Countries							
Australia	768,230	52,875	225	53,100	7%	0%	7%
Cook Islands	23	4	3	7	17%	13%	30%
Fiji	1,827	200	85	285	11%	5%	16%
New Zealand	26,799	1,555	1,725	3,280	6%	6%	12%
Papua New Guinea	45,286	60	610	670	0%	1%	1%
Solomon Islands	2,799	42	18	60	2%	1%	2%
Tonga	72	17	31	48	24%	43%	67%
Vanuatu	1,219	30	90	120	2%	7%	10%
W. Samoa	283	55	67	122	19%	24%	43%
Total	846,538	54,838	2,854	57,692	6%	0%	7%

Source : FAO Yearbook 1998

Land Area:Total area, excluding area under inland water bodies

Temp CR: Land under temporary crops

Perm CR:Land under permanent crops (excluding pastures, forest and woodland)

Table 2: Population in the Asia-Pacific Countries *1000 in 1998

Region/ Country	Total Population	Rural Population	Economically active People	People active in Agriculture	Economic active people as a percentage of total population	People active in agriculture as a percentage of economically active people
Asia-Pacific	3,346,023	1,879,746	1,704,973	1,001,673	51%	59%
West Asia						
Iran	65,758	18,518	21,956	6,069	33%	28%
Total	65,758	18,518	21,956	6,069	33%	28%
South Asia						
Bangladesh	124,774	71,985	64,578	37,257	52%	58%
Bhutan	2,004	1,880	970	910	48%	94%
India	982,223	548,794	428,850	259,600	44%	61%
Maldives	271	79	115	28	42%	24%
Nepal	22,847	21,294	10,760	10,028	47%	93%
Pakistan	148,166	76,579	54,894	26,318	37%	48%
Sri Lanka	18,455	8,656	7,962	3,673	43%	46%
Total	1,298,740	729,267	568,129	337,814	44%	59%
South-East Asia						
Cambodia	10,716	7,589	5,577	3,950	52%	71%
Indonesia	206,338	93,679	98,077	48,775	48%	50%
Laos	5,163	3,964	2,530	1,942	49%	77%
Malaysia	21,410	4,089	9,018	1,823	42%	20%
Myanmar	44,497	31,520	25,224	17,868	57%	71%
Philippines	72,944	29,577	30,447	12,419	42%	41%
Thailand	60,300	30,428	36,067	20,925	60%	58%
Vietnam	77,562	52,869	40,322	27,485	52%	68%
Total	498,930	253,715	247,262	135,187	50%	55%
East Asia						
China	1,255,698	854,501	749,683	510,159	60%	68%
DPR Korea	23,348	7,382	12,132	3,836	52%	32%
Japan	126,281	5,685	67,441	3,076	53%	5%
Mongolia	2,579	663	1,298	334	50%	26%
Rep. of Korea	46,109	4,570	23,005	2,593	50%	11%
Total	1,454,015	872,801	853,559	519,998	59%	61%
Pacific Island Countries						
Australia	18,517	878	9,396	473	51%	5%
Cook Islands						
Fiji	796	326	311	127	39%	41%
New Zealand	3,796	343	1,885	174	50%	9%
Papua New Guinea	4,600	3,590	2,261	1,701	49%	75%
Solomon Islands	417	308	214	158	51%	74%
Tonga	98	N/A	N/A	N/A		
Vanuatu	182	N/A	N/A	N/A		
W. Samoa	174	N/A	N/A	N/A		
Total	28,580	5,445	14,067	2,605	49%	19%

Source : FAO yearbook 1998

Table 3: Food production, total agricultural production, total crop production, total production of live stock products, per caput food production and per caput agricultural production of FAO indices (1989-91=100) in Asia Pacific countries in 1998

Region / Country	Food	Agriculture	Crops	Livestock	Per Caput Food Production	Per Caput Agricultural Production
West Asia						
Iran	149.3	148.8	143.1	147.8	121.2	120.8
South Asia						
Bangladesh	112.3	112.7	108.8	137.4	99.3	99.7
Bhutan	107.2	107.2	112.5	94	91.9	91.9
India	120.4	121.2	119.4	128.5	104.9	105.6
Maldives						
Nepal	117.3	116.9	117.5	119.1	95.1	94.7
Pakistan	142.6	134.3	121.1	151.1	114.9	108.3
Sri Lanka	114.3	115.1	112.8	133.5	105.7	106.4
Total	714.1	707.4	692.1	763.6		
South-East Asia						
Cambodia	132.9	132.9	131.5	137.7	107.4	107.4
Indonesia	120.2	119.9	115.5	140.9	106.4	106.1
Laos	134.2	131.9	123.5	172.4	105.1	103.4
Malaysia	123.7	116.5	108.7	145.5	103.2	97.2
Myanmar	136.7	138.8	139.8	131.5	118.6	120.5
Philippines	118.1	116.7	104.2	164.8	99.5	98.3
Thalland	110.8	113.1	111.5	126.9	103.2	105.3
Vietnam	145	149	148.5	149.8	124.1	127.5
Total	1021.6	1018.8	983.2	1169.5		
East Asia						
China	157.2	152.2	135	196.3	147.7	149.1
DPR Korea						
Rep. of Korea	126.9	125.8	108.7	158.4	118	116.9
Japan	93.5	93	91.1	94.6	91.7	91.3
Mongolia	90.2	90.5	29.5	96.3	76.2	76.4
Total	467.8	461.5	364.3	545.6		
Pacific Island Countries						
Australia	136	123.3	158.8	107.8	124.5	112.9
Cook Islands						
Fiji	98.8	98.6	93.3	109.6	87.4	87.2
Papua New Guinea	100.4	101.7	97.5	129.6	83.8	84.8
W. Samoa						
New Zealand	123.9	116.4	135.8	114.8	113.2	106.3
Solomon Islands	118.6	118.5	119.8	105.9	91.1	91
Tonga	76.2	76.2	78.5	70.3	74	73.9
Vanuatu	103.9	104	99	123	85.3	85.3
Total	757.8	738.7	782.7	761		

Source : FAO yearbook 1998

Table 4: Human Development Index Value for the Asia-Pacific Countries

Level of Human Development	Country	HDI
High Human Development	Japan	4
	Australia	7
	New Zealand	18
	Republic of Korea	30
Medium Human Development	Malaysia	56
	Fiji	61
	Thailand	67
	Samoa	70
	Philippines	77
	DPR Korea	88
	Sri Lanka	90
	Iran	95
	China	98
	Indonesia	105
	Vietnam	110
	Vanuatu	116
	Solomon Islands	118
	Mongolia	119
	Myanmar	128
	Papua New Guinea	129
	India	132
	Cambodia	137
	Pakistan	138
Low Human Development	Laos	140
	Nepal	144
	Bhutan	145
	Bangladesh	150

Source: UNDP, Human Development Report, 1999
HDI is a measure of development reflecting longevity, education and income per head