

SAARC Agricultural Vision 2020

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Abstract

This paper has visualized how agricultural scenario would evolve in the near future and what policies and strategies would be appropriate to adjust to the emerging changes and to harness the new opportunities. The major challenges for agriculture in the region are: raising and sustaining agricultural growth; ensuring food and nutritional security; facing impact of climate change; adjusting to changes in energy scenario; maintaining biosafety and bio-security; make sustainable use of natural resources and protecting biodiversity. The new opportunities lie in trade, marketing, biotechnology, shifting demand preferences in domestic and overseas markets, technology sharing, resource sharing and investments in research, extension and infrastructural development. SAARC countries need to develop science-based strategies for collective response to challenges and opportunities and global shocks in agriculture.

Introduction

SAARC comprises eight countries of South Asia, namely Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, all of which are classified in low income or low middle income category. Poverty and hunger are the most serious problems faced by the region. Agriculture is the predominant sector of economies of all SAARC countries. A vast majority of population in the region live in rural areas and depend upon agriculture for livelihood and sustenance. Despite rapid growth of some of the economies in the region, dependence on agriculture as principal occupation has seen very small decline. It is now abundantly clear that future growth of agricultural sector holds the key to livelihood security, eradication of poverty, reduction in hunger, inclusive growth and sustainable progress of economy of each of the nations. However, this sector is now facing several challenges. Growth of agricultural output has slowed down in most of the SAARC countries and in other countries where growth is still at reasonably high level, it is becoming increasingly difficult to maintain that. Despite high potential, agricultural productivity is getting stuck at low level and increase in productivity

requires increased use of inputs. This is lowering efficiency of production and squeezing profit margins. Natural resources like land, water and ecosystem are showing symptoms of degradation and causing adverse effect on sustainability and prospects of future growth. Plant and animal species are getting vulnerable to pest and diseases which threaten to take epidemic form and can cause large scale destructions. Many of such outbreaks are not confined to a particular or limited geography and are of trans- boundary nature.

Three very profound events have started impacting agriculture in a big way and these are also going to influence those dependent on agriculture very strongly. These events are: (a) climate change, (b) use of food crops for producing liquid bio fuel, and (c) escalating energy prices. Rising energy prices are directly impacting food prices in several ways; through increase in prices of fertiliser and agricultural chemicals used as inputs in agriculture, increase in cost of operation of farm power and machinery, and increase in transportation cost. While agriculture is seen to have potential to provide an alternative to rising energy crisis, future course of agricultural production also depends considerably on crude oil prices. Agricultural production would be required to move towards less energy-intensive production systems in future.

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Two main dimensions of climate change that would impact agriculture are increase in temperature and changes in pattern of precipitation. These changes taking place on a global scale would impact local agriculture, and therefore would affect the local and global food supply. It is difficult to precisely estimate how farming might be affected in different regions, as the impact on the agricultural economy in a given region, or country, will depend upon the interplay of the set of dynamic factors specific to each area. Global warming is predicted to lead to partial melting of glaciers, resulting in a rise of sea level which may range from 0.1 metre to 0.5 metre (4-20 inches) by the middle of next century (IPCC, 2007). Such a rise could put agriculture in low-lying coastal areas under threat and affect in several other ways. Agriculture is likely to become difficult to sustain in low-lying coastal areas of South Asia. Likewise, agriculture is also facing new challenges like food safety and bio-security.

On the other hand, there are new opportunities in choice of technology, changing demand patterns, upcoming value chains and supermarkets, revolution in communication technology, institutional innovations and globalization. High and rising food prices resulting from higher use of food crops and area for production of liquid bio fuel are seen both as a threat and opportunity to stimulate food production and growth in farmers' income. The situation has in fact turned quite complex and involves heavy trade-offs and difficult choices. Exact impact of some of the events like aberrations in temperature and rainfall pattern is not even known exactly and it would require lot of wisdom and acumen to frame right set of policies to achieve multiple goals, ranging from mitigating adverse impact of climate change to taking advantage of high food prices.

If the above-mentioned changes in physical, ecological and socio-economic environment, in which agricultural production takes place, are not managed appropriately, they could cause disastrous consequences in terms of production, food and nutritional security, vulnerability, economic stability, well-being and even survival of a large percentage of vulnerable groups. SAARC countries need to reflect upon the emerging scenario in and around agriculture and prepare medium- and long-term perspectives of agriculture in the region to adjust to the emerging challenges and opportunities being faced by the agricultural sector.

This document is an attempt towards preparing a vision for agriculture for the SAARC countries towards 2020. It visualizes how agricultural scenario would evolve in the near future and what policies and strategies would be appropriate to adjust to the emerging changes and to harness upcoming opportunities.

2. Socio Economic and Agricultural Profile

As per the latest estimates, SAARC region is home to 1.567 billion people. This constitutes 23.7 per cent of the global population. The share of region in global land and water resources is much lower than population share. Geographic area of SAARC region is mere 3.95 per cent of geographic area of the world. Because of high population pressure on land, percentage of arable land to total area is much higher in the region than global average. The share of SAARC region in global arable land is 14 per cent. The region has very high concentration of poverty and hunger. Based on the country-wise data available with Asian Development Bank it is estimated that 451 million people in SAARC countries live below respective national poverty line. Proportion of these people in total population is 28.83 per cent. The principal reason for high incidence of poverty in the region is low per capita income. With 23.7 per cent share in global population, SAARC region has only 2.62 per cent share in global income, which is woefully low.

Per capita gross national income (GNI) in SAARC countries varies from US \$ 345 to US \$ 3277. The lowest per capita income was in Afghanistan and highest in Maldives in 2006-07 as seen in Table 1. Per capita GNI in India and Pakistan was around US \$ 1000. Most of the population in South Asia live in rural areas with agricultural activities as their principal occupation. Share of rural population in total population varied between 66 per cent in Pakistan and 86 per cent in Nepal. Except Maldives, the share in total GDP varied between 16.5 per cent and around 40 per cent. In Maldives, less than 3 per cent of total GDP was contributed by agriculture.

As mentioned above, agriculture is the principal occupation for the majority of population in SAARC countries. Due to low productivity of agriculture, per worker income in agriculture is low and as a consequence, proportion of population living under poverty is quite high. Incidence of poverty varies from 21 per cent in Maldives to 53 per cent in Afghanistan.

Table 1. Important socio-economic characteristics of SAARC countries

Characteristics	Period	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Per capita income (US\$)	2006-07	345	462	1951	971	3277	361	1019	1658
Rural population (%)	2005-06	78.7	76.6	69.1	71.1	67.7	86.1	65.7	84.8
Share of agriculture in GDP (%)	2005-07	39.5	18.7	22.4	17.5	-	38.2	19.4	16.5
Share of agriculture in workforce (%)	2006	69.6	51.7	-	56.14	3.84	76.0	43.4	32.19
Hunger (Undernourished population) (%)	2001-03		30		20		17	23	22
Poverty (%)	Latest	53 (2003)	40 (2005)	31.7 (2003)	27.5 (2004)	21 (2004)	30.9 (2004)	23.9 (2004)	22.7 (2002)

Note: Per capita income refers to per capita gross national income.

Source: 1. *Key Indicators*, Asian Development Bank.

2. Country documents and databases available online at www.adb.org

Similarly, percentage of population that suffers from hunger (below minimum level of dietary energy consumption) varies between 17 per cent in Nepal and 30 per cent in Bangladesh.

2.1. Agricultural Profile

Farm scene in South Asia except Pakistan is dominated by small holders. The average size of holding is below half hectare in Bangladesh and below one hectare in Sri Lanka and Nepal. In India, average farm size is 1.41 hectare. Pakistan is much better endowed with land resources in the region with average farm size of 3 hectare. Except Pakistan, holdings below one hectare account for more than 60 per cent of farm holdings in the SAARC region (Table 2).

Table 2. Structure of landholdings and status of irrigation in SAARC countries

Country	Average landholding size (ha)	Holdings below 1ha (%)	Irrigated area: % of arable land
Afghanistan	-	-	-
Bangladesh	0.46	86.46	56.1
Bhutan	-	-	31.2
India	1.41	61.58	32.9
Maldives	-	-	-
Nepal	0.79	74.15	47.0
Pakistan	3.09	36.09	90.6
Sri Lanka	0.83	71.23	38.8

Source: 1. www.adb.org for farm size and holdings

2. *The State of Food and Agriculture* (2005), FAO, Rome

Small size of holding is reflected in very low land-to-labour ratio. Except Pakistan and Afghanistan, one hectare of arable land supports more than one agricultural worker. Close to five workers draw their livelihood from one hectare of arable land in Bangladesh and Nepal. Another disquiet aspect of agriculture is that dependency on land for livelihood is rising in all the SAARC countries, as revealed by the increase in number of workers per hectare of land (Table 3).

Another serious disadvantage faced by the farmers in South Asia is heavy dependence on the rainfed agriculture. Area under irrigation as per cent of arable land is around 33 per cent in India, 39 per cent in Sri Lanka, 47 per cent in Nepal and 56 per cent in Bangladesh. Agricultural cultivation in Pakistan is 90 per cent irrigated (Table 2).

Table 3. Pressure on land indicated by ratio of agricultural workers to arable land

Country	Agriculture workers/100 ha of arable land	
	1989-90	2003-04
Afghanistan	52	67
Bangladesh	361	495
Bhutan	-	-
India	141	172
Maldives	-	-
Nepal	366	473
Pakistan	77	79
Sri Lanka	270	260

Source: FAO database.

2.2. Agricultural Productivity

Cereals and pulses are the main food staple for the SAARC region. Growth in productivity of major cereals and pulses in the SAARC countries can be seen from Table 4. Per hectare yield of paddy rice varied from 2.15 tonne in Afghanistan to 3.85 tonne in Bangladesh. Bhutan recorded highest growth and India recorded lowest growth in productivity of rice after 1991-93. Rice yield in Bangladesh increased by more 2.6 per cent per year for the past fifteen years. Rice productivity in all countries of South Asia was lower than world average. However, annual growth in productivity was higher than world average in all the countries.

The productivity of wheat in the region was highest in India, closely followed by Pakistan. These two countries harvested more than 2.6 tonne wheat from one hectare of area. Wheat productivity in other countries was much lower than these two countries. It is interesting to point out that productivity of wheat increased by more than 2 per cent a year since 1991 in Pakistan, Nepal, Bhutan and Afghanistan. Like rice, productivity of wheat in all South Asian countries was lower than the world average and productivity growth was found higher than the world, except in the case of Bangladesh.

For the cereals group on the whole, per hectare productivity ranged from 1.65 tonne in Afghanistan to 3.77 tonne in Bangladesh. Growth rate in cereal productivity was around 1.5 per cent in India, Sri Lanka and Nepal and more than 2.4 per cent in other countries. Productivity of cereals doubled in Bhutan during past fifteen years, which is notable. Unlike major cereals, the productivity of total cereals in Bangladesh, Sri Lanka and Maldives was higher than world average.

Productivity of pulses was lowest in India with average at 604 kg per hectare. In contrast, productivity of pulses in Bhutan was as high as 1961 kg/ha. Sri Lanka and Afghanistan harvested close to one tonne pulses from one hectare of land. Productivity of pulses shows annual increase of 6.62 per cent in Bhutan, 2.46 per cent in Nepal, 1.89 per cent in Pakistan and 1.63 per cent in Sri Lanka. Bangladesh and India experienced 1.07 per cent and 0.62 per cent annual growth in productivity. Average productivity of pulses in the world was 844 kg per hectare which is in the middle of productivity recorded in different countries of South Asia.

Table 4. Growth in productivity of major cereals and pulses in SAARC countries: 1991-93 to 2005-07

Crop	Country	1991-1993	2005-2007	(kg/ha)
				Annual growth (%)
Rice, paddy	Afghanistan	1788	2154	1.34
	Bangladesh	2689	3850	2.60
	Bhutan	1654	2631	3.37
	India	2689	3184	1.21
	Maldives	-	-	-
	Nepal	2247	2685	1.28
	Pakistan	2476	3177	1.80
	Sri Lanka	3070	3731	1.40
	World	3584	4119	1.00
Wheat	Afghanistan	1025	1644	3.44
	Bangladesh	1792	1779	-0.05
	Bhutan	970	1322	2.24
	India	2334	2631	0.86
	Maldives	-	-	-
	Nepal	1330	2122	3.39
	Pakistan	1926	2625	2.23
	Sri Lanka	-	-	-
	World	2507	2809	0.82
Cereals, Total	Afghanistan	1130	1650	2.74
	Bangladesh	2620	3769	2.63
	Bhutan	1167	2348	5.12
	India	2012	2465	1.46
	Maldives	1000	3429	9.20
	Nepal	1811	2271	1.63
	Pakistan	1882	2639	2.45
	Sri Lanka	2969	3636	1.46
	World	2735	3301	1.35
Pulses, Total	Afghanistan	998	1073	0.52
	Bangladesh	722	838	1.07
	Bhutan	800	1961	6.62
	India	554	604	0.62
	Maldives	632	643	0.12
	Nepal	597	839	2.46
	Pakistan	509	662	1.89
	Sri Lanka	761	954	1.63
	World	789	844	0.48

Source: FAO database

Productivity is very closely related to use of yield-enhancing inputs like fertilizers. As can be seen from Table 5, use of fertilizer was less than 5 kg/ha in Afghanistan and around 26 kg/ha in Nepal. On the other hand, per hectare fertilizer application in Sri Lanka was 287 kg.

Table 5. Fertilizer consumption per hectare of arable land: 2003 to 2005

Country	NPK (kg/ha)
Afghanistan	4.75
Bangladesh	172.34
India	114.01
Maldives	11.83
Nepal	26.23
Pakistan	159.49
Sri Lanka	287.31

Source: FAO database.

There is considerable scope to increase fertilizer use in most of the SAARC countries to increase agricultural productivity and production.

3. Growth Experience

Economies of SAARC countries have shown high growth in the recent past. Except Nepal and Sri Lanka, total GDP of other SAARC countries increased by more than 5 per cent per year during the first six years of the 21st century (Table 6). The growth rate was more than 7 per cent for India, Bhutan, Maldives and Afghanistan. Even during 1995 to 2000, growth rate in GDP was more than 5 per cent in five out of eight SAARC countries. The growth rate in total GDP showed acceleration in a majority of these countries. A major deceleration was seen in the case of Nepal and Sri Lanka. As can be seen from Table 6, growth rate of GDP agriculture remained much lower than growth in total GDP during 1995 to 2000 as well as 2001-2006, with single exception of Pakistan during 1995-2000 and Nepal during 2001-2006. These trends in growth rate shows that the gap between growth rates of agricultural and non-agricultural sectors has been widening. As a result, per capita income in non-agricultural segment and urban areas is rising at a much faster rate as compared to the agricultural segment and rural areas. This is raising a serious question of equity and is adversely affecting the interest and investments in the farming occupation.

One can argue that non-agricultural sector growing at a faster rate than agricultural sector is something that must happen in normal course of development. What has caused concern and disparity is that share of agricultural employment in total workforce has not been keeping pace with the decline in share of agriculture in GDP. The share of those employed in agriculture in

Table 6. Annual growth rates in total and agricultural GDP during 1991 to 2006

Country	(per cent)			
	Total GDP		GDP Agriculture	
	1995-2000	2001-2006	1995-2000	2001-2006
Afghanistan	-	9.2	-	2.6
Bangladesh	4.8	5.6	3.2	2.8
Bhutan	5.8	7.6	2.2	2.5
India	5.6	7.2	2.8	3.0
Maldives	7.5	8.1	2.0	6.3
Nepal	5.0	2.7	2.4	3.1
Pakistan	4.0	5.3	4.5	2.1
Sri Lanka	5.3	4.5	2.1	1.2

Source: *Key Indicators* (various issues), Asian Development Bank, Manilla.

total employment in all the countries is much higher than share of agriculture in GDP (Table 7). Because of this difference, a worker earns much higher income in non-agricultural sector than in agricultural sector. A worker in non-agricultural sector earns more than the income of 4 workers in the agricultural sector in India, Nepal and Bangladesh.

Disparity between per worker income in agriculture and non-agriculture is the main source of income inequality in the developing countries of Asia. There are only two ways to reduce this inequality: (i) by shifting work force from agricultural to non-agricultural sectors, and (ii) by raising growth in agricultural sector. Both of these options are important for reducing income inequality, poverty and hunger in the SAARC region.

4. Looking into the Future

SAARC Agriculture Vision 2020 should aim at evolving a strategy to achieve stable and efficient output growth necessary for eliminating poverty and hunger, improving food and nutritional security and income of farmers, and meeting other societal requirements, by making sustainable use of natural resources and availing new opportunities and challenges. It should provide a road map to adapt to climate change and prepare for facing challenges of escalating energy prices, diseases and pests outbreaks, bio-security, bio-safety, biodiversity and IPRs.

Elimination of poverty, improvement in nutrition and supply of safe food are of prime importance for almost all the SAARC countries. The SAARC vision on

Table 7. Dependence on agriculture for output and employment

	Share in GDP (%)		Share in workforce (%)		Ratio of per worker income in non-agricultural to agricultural sectors	
	1990	2005	1990	2005#	1990	2005
	Afghanistan		39.5		69.6	
Bangladesh	29.4	21.0	61.6	51.7	3.9	4.0
Bhutan	—	22.4		—		
India	29.3	18.3	64.0	54.4	4.3	5.3
Maldives	—	2.6		3.0		1.2
Nepal	50.6	38.2	—	76.0	—	5.1
Pakistan	26.0	21.5	51.2	43.0	3.0	2.8
Sri Lanka	22.9	17.3	46.8	30.7	3.0	2.1

#Data for Bangladesh refer to year 2003

Source: adb.org database

agriculture should examine how best agriculture can help in future to achieve such goals. It is important to emphasize that no production activity can be sustained in the long-run by overlooking the health of the production base and the producers. In this context it is essential that SAARC countries focus on farmers and natural resource system, comprising land, water, vegetation, which form the production base of agriculture. Often, policies are focused on farming without looking at their implications for the farmers. Unless growth and development of farming lead to improvement in well-being of farmers, it cannot be sustained.

Agricultural diversification towards high-value agricultural commodities like fruits, vegetables and dairy products is seen to hold vast potential to accelerate growth and improve farm income in all the SAARC countries. Harnessing full benefit of agricultural diversification requires new institutional and contractual arrangements for production and marketing, ensuring that smallholders are not excluded from the process. The vision should throw light on how networks of farmers, agribusiness and public agencies operate and what are the conditions and policies that facilitate integration of smallholders.

4.1. Accelerating Output Growth

There is renewed emphasis on agriculture for development and for addressing poverty and hunger. Agricultural growth not only offers a pathway out of poverty in the sector itself but it also promotes employment in non-farm rural activities and facilitates

migration to non-agricultural avenues without causing distress. Based on this, growth in agriculture and overall rural development are considered essential for a sustainable exit from poverty (FAO, 2002). Agricultural growth helps in reduction of poverty and hunger not only by raising income of the poor but also by checking high rise in food prices and keeping price of wage good low. This recognition of importance of agriculture has led to a shift in emphasis from growth *per se* to inclusive growth. Some studies on poverty in India have shown that it would be hard to restore India's momentum in poverty reduction without higher and more stable agricultural growth. The relationship between poverty and growth rates in the agricultural and non-agricultural sectors for 17 major states of India shows that the correlation between the rate of reduction in poverty and agricultural growth was 0.52; non-agricultural growth shows a correlation of -0.13. Further, level of poverty across states in India during 2004-05 showed a significant and negative correlation (-0.613) with NSDP per worker in agriculture, whereas, the correlation with NSDP per worker in non-agricultural sector was close to zero (0.058) and positive. These results have important implications for poverty reduction in the SAARC countries where dependence on agriculture for employment is high. Non-agricultural growth does not help in poverty reduction, whereas, agricultural growth has very strong impact on reducing poverty. These results show that non-agricultural growth has not contributed much for the India's poor.

Growth in output and farm income depends upon a large number of factors, viz. prices of output and inputs

and non-price factors. Raising of growth requires remunerative pricing environment for output, access to improved technology, application of quality inputs and use of modern machinery. Further, growth has to be achieved from a shrinking natural resource base which implies that growth comes primarily from the increase in productivity.

Plenty of scope exists in raising farm output and income by diversification towards high-value crops and by harnessing niches particularly in the mountainous region. This requires market for those products, which depend upon the private sector, cooperatives or joint-ventures of public and private agencies.

4.2. Technology

Technology is the prime mover for agricultural growth. Considering the costs and constraints of resources such as water, nutrients and energy, the genetic enhancement of productivity should be coupled with input-use efficiency. This can be made possible only by utilization of the existing improved technology and by developing new technology.

Agricultural research system has developed a large number of promising technologies to achieve high growth and promote farming systems that improve natural resource base too. However, these are not seen at farmers' fields at large. Frontline demonstrations of various departments provide clinching evidence of large gaps between what can be attained at farmers' fields with the adoption of improved technology and what is obtained with the existing practices followed by the farmers. This is a clear pointer to the large potential for raising output through the effective dissemination of technology. But this is not happening because of the absence or weak Research-Extension-Farmer linkages. The reason is poor marketing of technology. As public extension system is proving increasingly inadequate for dissemination of technology, there is a need to involve private sector in marketing and dissemination of technology. This would require increased public-private sector participation through appropriate returns and incentives for the innovators and disseminators.

Several MNCs in developed countries are investing heavily in agricultural biotechnology and are expected to come out with new seeds, and other inputs of high commercial value. There would be a need to access these frontier technologies at costs affordable by the farmers.

4.3. Seed and other Inputs

Good quality seed is the primary determinant of productivity. Harnessing benefits of technology generation requires a well-developed system for sales and distribution of seeds and plant propagation material. In almost all SAARC countries, supply of seed and plant propagation material is highly inadequate to meet the emerging and growing needs and demand. The advantage of this is being taken by the unscrupulous private trade. There is a need to develop competitive seed industry by involving private sector in seed production and distribution. SAARC countries need to think of more FDIs in these areas as domestic corporate sector is also keen in these new ventures, when there is challenge from outside.

4.4. Food Requirements

Long-term trend in consumption pattern at household level shows that per capita direct consumption of foodgrains has been declining and that of livestock products and fruits and vegetables has been going up for a fairly long time in most of the SAARC countries. Despite this shift in dietary pattern, foodgrains are considered to be of paramount importance for household food and nutritional security. It is because of four reasons. One, cereals and pulses are staple foods and there is no perfect substitution between staple foods and other foods. Two, due to inadequate intake of almost all foods, increased consumption of other foods, in most cases, fill dietary deficiency. Three, foodgrains are the major and cheapest sources of energy and protein as compared to other foods and are thus vital for food and nutritional security of low-income masses. Four, increased production and consumption of livestock products resulting from rising per capita income require high growth in use of grain as feed for livestock. Because of these reasons, foodgrains continue to be the main pillars of food security in South Asia and any slack in their production translates into persistent price shock and adverse impact on common people.

Future requirement of foodgrains should be based on population growth, composition into rural and urban population, growth in per capita income in rural and urban areas and change in taste and preferences. According to demand projections prepared by Paroda and Kumar (2000) under low income and high income scenarios, demand in the region would grow by 1 per

Table 8. Annual growth in domestic demand for food in South Asia: 1995-2030

Food	(in per cent)	
	Low income growth	High income growth
Rice	1.2	1.2
Wheat	1.3	1.2
Maize	1.1	1.0
Other coarse grains	0.9	0.8
Total cereals	1.2	1.1
Pulses	1.5	1.7
Foodgrains	1.2	1.2
Roots & tubers	1.6	1.9
Edible oils	1.6	1.8
Vegetables	2.3	2.9
Fruits	2.3	2.9
Sweetnes	1.5	1.6
Milk	2.3	2.8
Animal fat	2.3	2.8
Meat	2.7	3.4
Eggs	2.6	3.3
Fish	2.5	3.2

Source: Paroda and Kumar (2000)

cent for cereals and by 1.7 per cent for pulses. Demand for edible oils is projected to grow by more than 1.6 per cent. Demand for fruits and vegetables and livestock would rise by around 3 per cent or more under high income scenario.

These growth rates in demand can be used to work out feasible levels of agricultural diversification.

4.5. Sustainable Use of Natural Resources

Land and water need special attention for their sustainable use as they are showing signs of degradation in all the SAARC countries. Agriculture is the main user of natural resources and it affects land, water, forests, soil conservation, genetic diversity of crop and livestock and other ecosystem services. Improving natural resource management requires right price signals to farmers, strengthening of property rights and of NR-based institutional arrangements like devolution of control to local organizations for community natural resource management.

Better technologies and better ways of managing water and modern farm inputs are now available to make farming more sustainable. But, their widespread adoption is hindered by inappropriate pricing policies, insufficient training of farmers, and failure to manage

negative externalities. Many opportunities exist to harness agriculture's potential as a provider of environmental services. The emergence of new markets and programs like 'carbon credits' for environmental services is a promising approach that should be pursued by local and national governments in the SAARC region.

Resource conserving technologies are now available for various ecological regions. These can be very helpful in saving water and energy, reducing cost and increasing farmers' income. Adequate emphasis and investments are needed to harvest and conserve rain water and use available water optimally.

The SAARC region needs to have a clear land-use policy so that the demands for industrialization and urbanization are met without compromising on its agricultural use.

Since water is emerging as the main constraining factor, particular attention needs to be given to check its wastage. Land and water need to be used efficiently and on a sustainable basis. Rain water going waste needs to be captured and conserved. Major emphasis is needed on water conservation and recharging schemes, including restoration and renovation of traditional water bodies, as an integral part of watershed development with the involvement of local communities and NGOs. There is need for a paradigm shift in promoting agricultural productivity not only per unit of area but also per unit of water and time.

Water being a common pool resource serving a large number of users, it is almost impossible to monitor the behaviour of individuals to ensure that its use is efficient, equitable and sustainable from the social viewpoint. Strong governance is essential but not sufficient. Therefore, institutional changes to improve the overall water governance need to be reinforced by instituting strong incentives for individual users to make prudent and economical use of water. Increasing the effective cost of water for individual users and aligning the relative costs for different uses to serve social priorities are essential measures.

4.6. Farm Structure

Small-sized farms in South Asia face serious constraints in adopting modern technology and in marketing their produce. To some extent, size disadvantage can be obviated through contract farming.

In most cases, the size of farm would remain unviable and insufficient to provide enough income for the farmers and their families. One way to raise the size of operational holdings is to create suitable jobs in the non-agricultural sector to attract or pull out unviable marginal and small farmers from the agricultural sector. Experience of developing Asia shows that Thailand and Vietnam have achieved substantial reduction in poverty by shifting a large workforce out of agriculture; between 1990 and 2005, the share of workforce in agriculture in these two countries declined by about 20 percentage points — a shift of more than 1 per cent workforce from agriculture to non agriculture each year.

Unlike the experience of South-east Asia and developed countries, high growth in SAARC countries is not leading to large shifts in workforce from agricultural to non-agricultural sector. The reasons for this seem to be: (a) strong attachment of people in Asia with the land, native place and the society, and (b) inhospitable and harsh conditions for migrants in the urban areas, particularly for unskilled low-wage labour. These constraints can be overcome through industrialization in the rural areas and by generating employment opportunities in the non-agricultural sector in and around rural locations.

4.7. Biotechnology

Some countries have very effectively applied tools of biotechnology to raise yield, reduce cost of production, and improve quality of some edible oilseeds, and this has imparted them significant advantage. There are also reports of large area being brought under transgenic crops, namely soyabean, cotton and vegetables in countries like USA, Argentina, Canada and China. The new biotech crops can help in developing drought tolerance, and reduce use of inputs and water. The immediate benefit of success of transgenics is the reduction in cost of production. However, these technologies involve environment and health risk due to which all SAARC countries are following a cautious approach. Some experts claim that transgenic crops and genetically modified foods can play a crucial role in raising quantity and quality to address the future demand and food security in South Asia, while others question suitability of such technologies for developing countries. They feel traditional germplasm and conventional methods of breeding are far superior to GM approach to improve nutrition quality and enhance productivity of various

crops. They also indicate that GM technology is expensive and full of hazards which cannot be checked through a weak regulation system prevailing in the developing countries. SAARC countries need to learn from the experience of other countries, particularly from China, to take advantage of future biotech crops.

4.8. Adaptation to Climate Change

A wide variety of adaptive actions may be taken to face adverse effects of climate change on agriculture. Before that, each country/region needs to know with some degree of confidence what kind of changes in temperature, rainfall, and other climatic factors it is likely to face. This should be followed by policies for putting in place adaptation and coping up mechanisms. On-farm adjustments to climate change would require crop varieties suitable for late/early sowing, new cropping sequences, supply of seed and inputs on demand, water conservation, diversified production, etc. All these would require major investments. Agricultural adaptation to climatic variation, say from cereal crops to fruit and vegetable production, requires new types of market, credit arrangements and input supply chain. Similarly, new demand on water and land as a response to climate change will require different set of protective and regulatory policies and agricultural institutions. Success in adapting to possible future climate change will depend on a better definition of what changes will occur where, and on prudent investments and policies. Unfolding impact of climate change is not only threatening production stability and growth, it also underscores the need for preparing and putting in place adaptation strategies to adjust to vagaries of nature and prepare for mitigation of adverse effects, including spate of natural disasters.

4.9. Escalating Crude Prices and Bioenergy

Increase in prices of crude oil, natural gas and other sources of energy affect almost all the sectors. They directly impact food prices in several ways; through increase in prices of fertilisers and agricultural chemicals, operation of farm power and machinery, and transportation. Between 2004 and 2007, prices of crude oil increased by 89 per cent and of urea (FOB Ukraine) by 77 per cent. While agriculture is seen to have potential to provide an alternative to rising energy crisis, future course of agricultural production also depends considerably on prices of crude oil. Pressure

is building to move towards less energy-intensive production systems. Escalating prices of crude oils and desire to develop alternative sources of energy are leading to increasing use of food and agricultural crops for production of bio-energy in the form of ethanol and bio diesel. Bio-energy is also seen as a cleaner fuel as it emits much less green house gases compared to hydrocarbons. The immediate impact of diversion of foods crops and area to energy crops is being felt in terms of food shortage and increase in food prices, which is posing new food security risks and challenges, specially for poor people.

On the other hand, bio-energy production is believed to have potential to benefit small scale farmers and rural poor by creating employment and new market opportunities if appropriate technologies are used to make use of degraded or marginal lands for bio fuel production. SAARC countries depend heavily on import to meet their demand for crude oil and would be hit by increase in crude oil prices. These countries need to develop strategies to harness potential of bio-energy crops and tree species and develop technologies for utilization of agricultural wastes and surpluses for generating green energy.

4.10. High Food Prices: Challenge and Opportunities

High food prices in the world offer opportunities to countries in South Asia to increase their food and agricultural production. This could be a good opportunity to improve income of small farmers and harness potential of agriculture in developing countries. At present, agriculture in developing countries is caught in a vicious cycle of low income - low investment - low technology - low productivity - low income, mainly because prices of agricultural commodities in real terms have been declining since the beginning of twentieth century, notwithstanding their occasional spikes. Keeping food prices low is something good for the poor but it should not hurt the incentive to produce. High prices of food and agriculture can transform the vicious cycle in agriculture to a virtuous cycle, if these prices reach farmers and improve their income translating it into high investment- improved technology - high productivity scenario.

If increase in food prices do not percolate to the rural poor and their incomes do not improve in the process, they would need strong safety net either in

the form of direct income transfers or a system of subsidized food. Food security of these vulnerable groups should not become a binding force to maintain food prices at low level if it stifles production. High food prices resulting from increase in bio fuel production or other factors would help in raising food and agricultural production in several areas which have high potential for raising food production and where this potential is blocked due to low prices. This throws serious policy challenges to ensure that market functions efficiently and benefit of higher prices reaches the producers and vulnerable sections.

4.11. Food Safety and Food Standards

Consumer preferences for quality, variety, and safety of food commodities are rising rapidly. Modern trade and retail in food also prefer conformity to specified standards and their enforcement as these help in segregating product distribution to suit requirement of suppliers and consumers across several regions or countries. The standards also help ensure public food-safety. SAARC countries need to enact legislation to upgrade and enforce standards in tune with changing consumer and market demand. This would also help in better compliance of sanitary and phyto-sanitary measures and export promotion.

4.12. Biodiversity and Intellectual Properties

All SAARC countries have very rich plant and animal biodiversity which holds promise and potential for its commercial use in future. However, there is a danger of loss of biodiversity and maintaining claim of ownership over it. SAARC countries need to prepare authentic documentation of all kind of biodiversity at sub eco-regional level and initiate necessary measures to preserve their biodiversity. Adequate attention is also not being paid to document and patent intellectual properties and knowledge related to agriculture and animal husbandry. Making investment in biodiversity and intellectual property would translate into future wealth and SAARC countries should be pro-active in this area.

4.13. Bio-safety and Bio-Security

Biosafety is essentially required to protect human health and environment from the possible adverse effects of the products of modern biotechnology. It is also required to promote safe laboratory practices,

procedures, proper use of containment facilities, equipment, risk assessment and risk management, evaluation of genetically modified organisms (GMOs), etc. Provisions of international conventions and protocols such as Convention on Biological Diversity (CBD) and Cartagena Protocol also have influence upon the biosafety considerations. Issues related to biosecurity of the SAARC region are gaining significance in the changing global scenario, and SAARC has to take adequate institutional measures for safeguarding its biodiversity and natural wealth.

4.14. Infrastructure and R&D

Agricultural infrastructure is weak in all SAARC countries and priority accorded to public investments in agriculture has receded considerably during the past two decades or so. These countries spend only a small fraction of agricultural GDP on R&D. On the other hand, research in modern science is getting increasingly costly. In order to take advantage of the emerging market opportunities and technological breakthroughs, SAARC countries should invest heavily on rural roads, electrification, market development, water management, land improvement, agri-R&D, transport, etc.

4.15. Technology Delivery System

Agriculture is getting more knowledge-intensive, market-oriented and demand-driven. Therefore, extension is required in the system's perspective from production to consumption in a value chain mode. Conventional systems of technology transfer are inadequate in the fast changing agricultural scenario. Diversified nature of farming demands, against the background of economic liberalization and globalization, a radical change in the spectrum of service providers to the farmers. Indeed different stakeholders like the private sector, farmers' organizations, cooperatives, self-help groups, para-professionals, non-governmental organizations, input suppliers and small agri-businesses are increasingly engaged in providing information and services. Increased reliance on the private sector's extension does not imply a complete withdrawal of the public sector, which must continue to finance public goods extension and information services and coordinate extension activities. There is a need to have a re-look at the basic extension strategy considering the strengths of both public and private sectors. The

extension system has to capitalize on the complementarity and harness coherent synergies between the public and private sectors. Further, research, education, extension and marketing in agriculture need to be in a continuum mode.

The development of information communication technologies (ICTs) and telecommunication networks has paved the way for creation of information network, knowledge pools and services on new agricultural technologies, products and marketing of produce, which must be intensively used and disseminated. It will be appropriate to develop farmer-friendly information networks to provide the whole range of information to farmers leading to delivery of knowledge on new agricultural technologies, products, procedures, and related services to enable them to take control of their farming environment in near future.

The rapid spread of new ICTs across semi-urban and rural areas, especially the mobile telephony, in recent years, coupled with continuing cost reduction in real terms, has provided an unprecedented opportunity to deploy ICTs in serving the farming community and extension system (Mittal and Tripathi, 2009). SAARC countries in future should focus on new ICT-mediated engagements in the research-education-extension continuum that promotes technology exchange among relevant agencies and with farmers while improving farmers' opportunities for improved income and livelihood security.

4.16. Capacity Building

Development of institutions and capacities for facing challenges and harnessing opportunities in agriculture differ across SAARC countries. Some of them do not have sufficiently trained manpower and institutional capacity to implement the required programmes for achieving objectives of SAARC Agricultural Vision. Mechanisms should be put in place for these countries in capacity building for development manpower and institutions.

4.17. Regional Complementarities and Collaborations

Some problems, such as the spread of plant and animal pests and diseases and climate change, require cooperation at the regional and global levels. Increase in travel and trade and intensification of farming systems

can result in fast spread of various plant and animal diseases and invasive species across countries. Similarly, natural carriers can take pathogens from one country to the other. The costs on management of these diseases may become quite high if the diseases spread widely, as has been seen in the case of 'Highly Pathogenic Avian Influenza'. There is a clear case for regional cooperation for prevention and control of infectious plant and livestock diseases at their source and to prevent their spread across countries. SAARC region does not have any mechanism to deal with the threat of bio-terrorism that may affect the food and agricultural system in the region.

The Vision presented above relates to the SAARC region as a whole and some aspects have been presented in a general way. Implementation of this Vision would require action at local, national and regional levels and development of appropriate strategies. Within a broad framework, each country would be required to follow area-specific strategies. This would involve clear understanding of area-specific linkages between new driving forces and operating environment and characteristics of agriculture. Each country and SAARC region as a whole, should estimate linkages, for instance, between climate change, agricultural growth and poverty reduction. What are the doomed crops and what are the resilient crops? What inputs and practices aggravate impact of climate change and what reduce it? Similarly, an optimal combination of policies to achieve growth, sustainability, food security and poverty reduction has to be developed along with risk assessment involved in different types of options. After finding answers to questions like above, the member countries of SAARC have to identify policy interventions that could help in achieving optimal results. These policies would relate to investments, credit, incentive structure, trade, marketing, risk and insurance, technology and institutions in agriculture.

5. Roadmap

The whole world is witnessing strong wave of regionalism, and, countries in the neighbourhood are contemplating different ways of cooperation to maximize benefit from the available options and to face new challenges and harness upcoming opportunities. As a result, the number of regional groupings is rising and regional cooperation is deepening. Growing interdependence among countries is putting further

pressure for such cooperation. The regional cooperation in agriculture in South Asia should be the core strategy for implementing SAARC Agriculture Vision 2020 and this should focus around the identified challenges and opportunities.

The major challenges for agriculture in the region are: raising and sustaining agricultural growth; ensuring food and nutritional security; facing impact of climate change; adjusting to changes in energy scenario; maintaining biosafety and bio-security; make sustainable use of natural resources and protecting biodiversity. The new opportunities lie in trade, marketing, biotechnology, shifting demand preferences in domestic and overseas markets, technology sharing, resource sharing and investments in research, extension and infrastructural development. SAARC countries need to develop science-based strategies for collective response to challenges and opportunities and global shocks in agriculture.

Acknowledgement

This document was presented in various fora of SAARC including meetings of Technical Committee on Agriculture and Rural Development. An abridged and revised version of this was discussed in the SAARC Agricultural Ministers' Meeting held at New Delhi on 5 November, 2008.

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