Green Ideas Sleep Furiously:
An Analysis of Agricultural Trends in Asia and the Near East During the 1990s

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"Colorless green ideas sleep furiously."
Noam Chomksy, *Syntactic Structures*.

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INTRODUCTION

In the late 1980s, at the tail end of the Green Revolution, the Asia and Near East (ANE) Bureau reevaluated its agricultural perspective. Faced with a rapidly growing Asian population, declining agricultural production, and a decrease in donor funding for agriculture, the ANE Bureau chartered a symposium titled *Agriculture in the 1990s: Strategic Choices for Asia/Near East Countries*, organized by the Harvard Institute for International Development (HIID). A number of papers were commissioned on all aspects of agriculture in the region by some of the leading experts in the field. The symposium was then followed by the *Agricultural and Rural Development Officers' Conference* in 1989, during which the Bureau's strategy for agriculture in the 1990s was outlined, much of which can be viewed in the 700-page document *Responding to the Challenge: Agricultural and Rural Development Strategies for the 1990s*.

Sadly, most of the suggestions outlined in the symposium and ADO conference went unheeded. Most of the problems that faced agriculture in Asia in the late 1980s remain. In fact, many feel that they have worsened during the 1990s. The specter of child malnutrition, rising levels of social inequity (particularly in rural areas), and increasing environmental degradation and pollution continue to plague the region. This has as much to do with a leveling off of agricultural production and rising population as it does with a concurrent marginalization of agriculture's role in the development process. Government expenditure and development assistance for agriculture in Asia and the Near East is drying up (U.S. investment alone has dropped approximately 70 percent since the mid-80s). Increasingly, there has been a greater focus on trade, economic policy, and agri-business, with a hope that the private sector will start to play a greater role in agricultural development. However, private sector response so far has been tepid, and even if its involvement were to increase, it would be unlikely to touch the environmental or equity issues that determine the sustainability of agricultural development.

With recent evidence showing that agriculture is of particular importance in the campaign against poverty reduction, it is becoming clear that the agricultural sector in Asia and the Near East is at a crossroads.

Given the significant role the U.S. Agency for International Development (USAID) has historically played in the agricultural development of the Asia and Near East region, it was felt that these signs of agricultural inertia warranted further study. In many respects, this paper attempts to accomplish some of the same goals as its illustrious predecessor: to identify major trends in agriculture in Asia and to assess the adequacy of USAID's strategy in light of these trends and the activities of other partners. The major difference is that this paper is not intended to be as exhaustive nor as analytical as its predecessor. It is largely an overview of agricultural trends in the 1990s, drawn from statistics and a review of the major literature. However, implicit in any analysis of past trends is the glimmer of both current and future trends. It is hoped that this trends analysis will serve as a rough guide for the reassessment of the Bureau's agricultural strategy.

However, the reader should be cautioned that while the subject of this paper is vast, its focus is general and its "confines," by demand, brief.

The Asia and Near East region is of course an ecologically and culturally diverse region, and in attempting to analyze regional trends one is tempted to make interregional comparisons that occasionally stretch the parameters of objective comparison. For these reasons, this paper has been divided into two parts: the first part focusing on the Asia subregion and the second part focusing on the Middle East and North Africa subregion (MENA).[1] These regions are then often further subdivided[2] to facilitate intraregional comparison. However, geographical classification is a subjective art, and it should be noted that comparison is rendered more difficult due to the fact that different authors and agencies classify these subregions differently. And more often than not, comparisons between these differently defined subregions were made. While this is not ideal, it is largely unavoidable. And given that the results of this survey are general, it does not seem to have affected the outcome in any remarkable fashion.

For an overview of the countries included in this survey please refer to annex A.

[1] Also called the West Asia and North Africa (WANA) and Near East and North Africa (NENA).

[2] South Asia, South East Asia, Near East, and North Africa.

I. ASIA

1.1 Agricultural Production

Agriculture in Asia is often synonymous with the Green Revolution. And despite the ongoing debates on its effectiveness to reduce poverty, it is clear that the Green Revolution brought on a dramatic increase in agricultural production with very little increase in land used (ADB 2000). From 1961 to 1996, the growth rate in agricultural output averaged 3.49 percent per annum throughout the region, over one percentage point higher than the rest of the world (Fan and Pardey 1998).

Most experts agree that the productivity of agriculture in Asia has been slowing down in the 1990s (Pyakuryal 1999; ADB 2000; Koppel 1995). As will be illustrated in this paper, there are a number of reasons for this. It is widely felt that the population base is growing at faster rates than agricultural productivity, that levels of soil degradation are increasing, that mismanagement of irrigation systems are leading to water resource management problems, that there are growing agricultural labor shortages as people move to the cities, and that investment in agriculture both internally and externally is decreasing (Koppel 1995).

This decline is demonstrated by several indicators at several different levels. First, the share of agriculture in GDP in Asia has declined from 30 percent in the mid-1980s to around 20 percent in recent years (Onchan 1997), as illustrated in the World Bank figures listed in the table below.

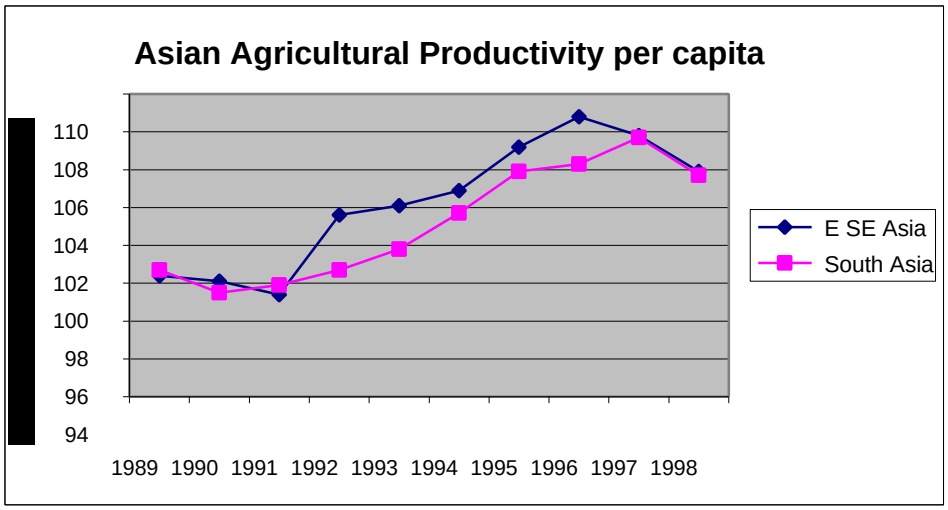
Change in Agricultural GDP

	1990	**1997**	**1998**
East Asia and Pacific	20.0	14.5	14.6
South Asia	30.0	27.0	28.3
Middle East & North Africa	14.9	14.2	N/A

Source: World Bank

It should be noted that this downward trend can be deceptive, for a decline in the role of agriculture in the GDP is a natural process of economic development. As Chaudri observes, paraphrasing Simon Kuznets in the article *Productivity Trends in Asian Agriculture 1950–1990:* "in all cases of successful and sustained economic growth the share of agriculture in labor force and in Gross Domestic Product declined" (Chaudhri 1993). But while agriculture's importance in GDP will naturally decline, its importance should only decline relative to other sectors, and total agricultural output should continue to grow steadily (ADB 2000). There is evidence that this is not the case in Asia.

This declining trend is thus due to a number of interrelated economic factors: the relative fall of prices, the high rate of growth of nonagricultural sectors, increased demand for nonagricultural products as income increases, and—of relevance to this paper—relatively limited technological change in the agricultural sector (Pyakural 1999). Technological changes that increase labor productivity are only effective if labor productivity grows faster than the agricultural labor force (ADB 2000). And agricultural production per capita has begun to tail off, as is illustrated in the table below.



Source: FAO[3]

It is widely felt that agricultural growth should increase by 2 to 3 percent above the rate of population growth in order to contribute to both economic growth and rural development (DeRosa 1997). According to FAOSTAT, East and South East Asia and South Asia's agricultural growth exceeded population growth by only about 1 percent during the 1990s.[4]

	Annual Agriculture growth rate	Annual Population growth	Difference
E SE Asia	2.60	1.52	1.08
South Asia	2.86	1.70	1.17

Calculated from FAO statistics

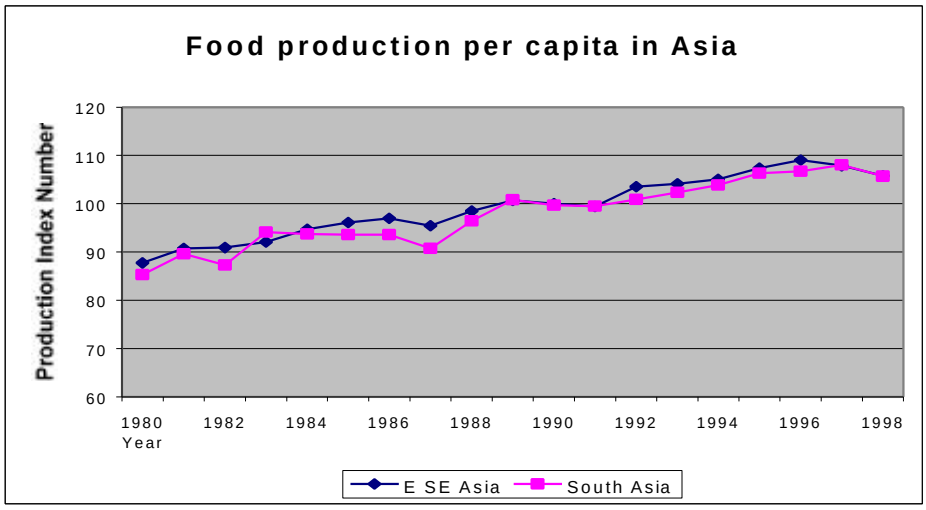
In addition to overall agricultural production, the rates of increase in food production over the past decade have been decreasing at a time when the region is undergoing rapid economic and

[3] Refer to annex A for a list of countries included in these categories.

[4] Calculated from 1990 to 1997 using FAOSTAT figures.

population growth. These two factors will result not only in a further increase in the demand for food but also in changes in the kinds of food required (von Uexkull 1998).

As many have noted, eating habits change with increasing income. Moving from a subsistence base, there is an increase in the consumption of root crops or coarse grains, followed by substitution by rice or wheat. Then there is a change from ordinary to high-quality rice and processed wheat and increased consumption of meat products. H.R. von Uexkull in the informative article *Constraints to Agricultural Production and Food Security in Asia: Challenges and Opportunities* states: "Unfortunately, agriculture in the region is presently ill prepared to meet the change in food demand that results from economic progress."



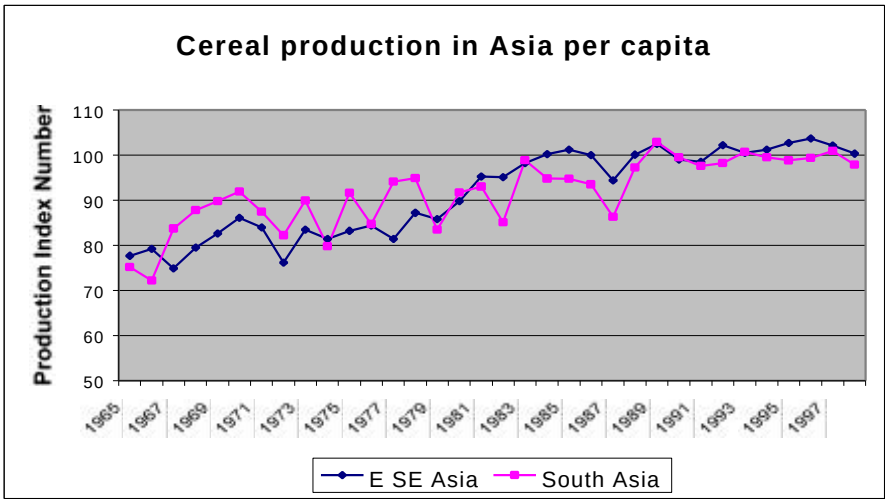
Source: FAO

A further decline in agricultural growth in Asia could jeopardize national food security and increase child malnutrition in many countries, cause significant increases in unemployment and poverty, and slow nonagricultural growth (ADB 2000).

However, before examining the different factors that affect production, let us first consider changes in production as experienced in the different agricultural subsectors.

1.1.1 Cereals

The production of cereals, which is the main component of agricultural production, has not grown more than 3 percent annually between 1985–95 (Pyakural 1999). In fact, the expansion in the area planted to cereals, once a major source of production gains, has slowed dramatically across the region as a whole, and while cereal yields will continue to rise at a lesser rate, cereals area has actually begun to decline in certain countries (Morris and Byerlee 1998).



Source: FAO

Given that cereals occupy 50–80 percent of the net cropped areas in Asia (Ahmed 1995), this leveling-off of production growth is bound to shape the future agriculture in the region.

It is predicted that Asian countries will increasingly need to start importing cereal, particularly South Asia where production is not keeping up with population growth (P. Pinstrup-Andersen et al. 1999).

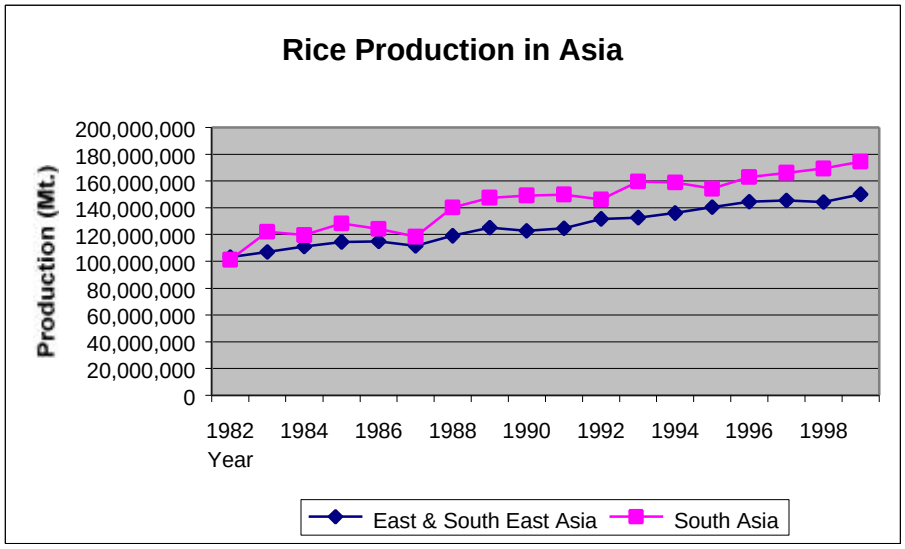
However, given the dietary changes that Asia is experiencing, some shift in production is bound to occur. And it is interesting to note that cereals are actually less efficient utilizers of land, water, sunlight, and fertilizer than many horticultural food crops are (Ahmed 1995); crops, as we shall see, are playing an increasingly important role in Asia.

1.1.2 Rice

With 54 percent of the world's rice produced in South and South East Asia (FAOSTAT 1998), rice is by far the most important crop in Asia. Rice is also the main staple in the Asia and the Pacific region, providing almost 40 percent of its calories (CGIAR).

Though net production of rice in Asia has grown, albeit at a steady rate, per capita rice production has decreased in the Asia region since 1990 (CGIAR)[5].

[5] http://www.worldbank.org/html/cgiar/report1.html#R



Source: FAO

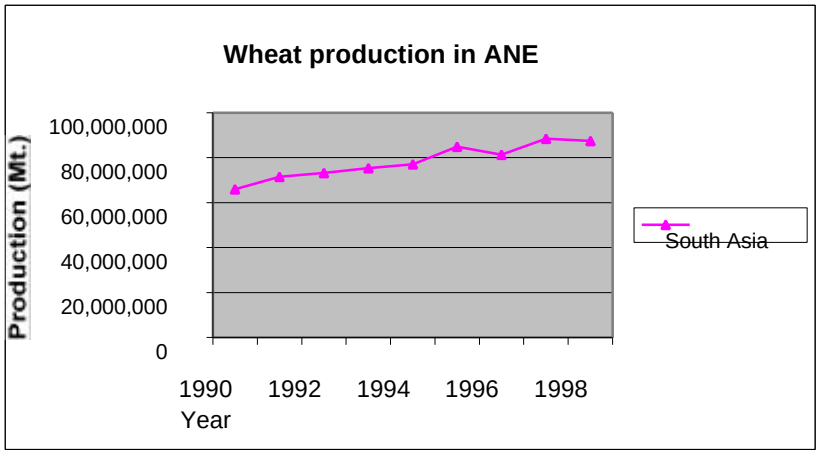
While this leveling-off of rice production might be symptomatic of a larger decrease in agricultural production in the region, it is hard to say whether or not this represents a negative trend given that the rate of demand for rice is predicted to decrease with changing urban diets (von Uexkull 1998) and given that the world rice price has been on a declining trend in real terms since 1900, a decline that sharpened in the 1980s (Pingali 1998).

1.1.3 Wheat

Although wheat is a distant second to rice in importance, Asia is still one the world's largest producers and consumers of this important cereal (von Uexkull 1998). Excluding the developed Asian countries and Central Asia, Asia produces 25 percent of the world's wheat, South Asia alone producing about 15 percent of the world's total (FAOSTAT 1998).

Wheat consumption has been growing much faster than rice. It now makes up 19.2 percent of total calorie supply. Although the area harvested in wheat did not expand substantially in the past 20 years, production increased enormously. Yields rose close to 3 percent per year, with high fertilizer inputs (CGIAR)[6].

[6] http://www.worldbank.org/html/cgiar/report1.html



Source: FAO

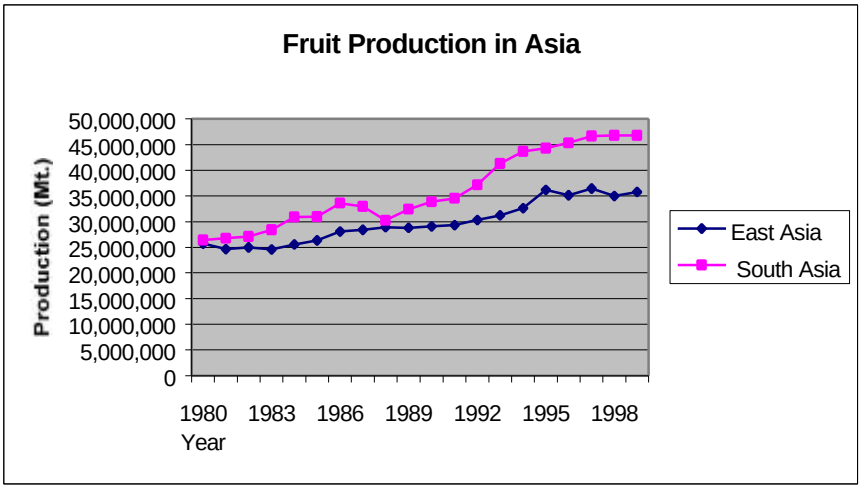
Given the increased consumption of wheat due to changing diets, it is predicted that there will be an increased dependence on imports in most Asian countries (H.R. von Uexkull 1998).

1.1.4 Maize

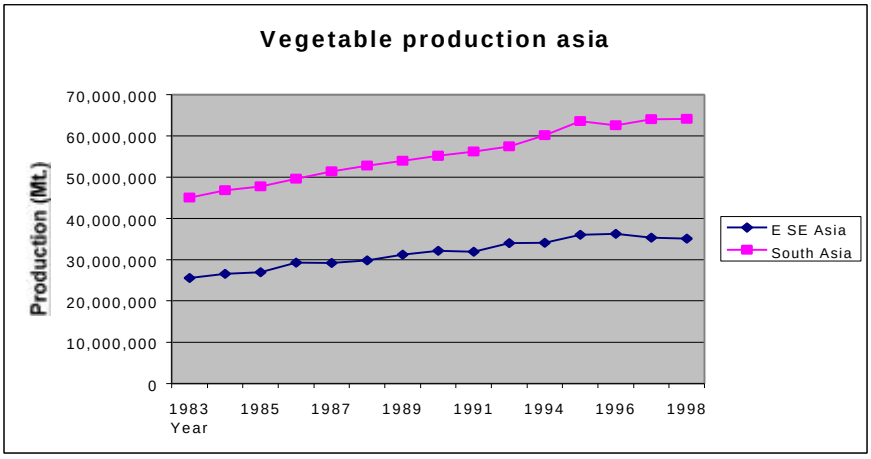
Maize is Asia's third most important grain. Yields are rising almost as fast as those of wheat, while area expansion is continuing at a reduced rate (CGIAR). Most experts agree that Asia will come to depend more and more on maize, as livestock production becomes an increasingly important source of income (Uexkull 1998; Delgado et al. 1999). Currently, approximately 60 percent of the maize grown in Asia is used as animal feed (CGIAR).

1.1.5 Vegetables and Fruits

Horticultural production in Asia has increased dramatically over the past 20 years. From 1975 to 1994, the total export value of fruits increased from US$161.2 million to US$937.2 million. Developing countries in Asia are the most important exporters of fruits, accounting for over 90 percent of the total export value of all of Asia (Onchan 1997). Growth in South Asian countries has been dramatic over the past decade, as can be seen in the graph below.



As for vegetables, the value of export in Asia also increased markedly from 1975 to 1994, rising from US$308.2 million to US$1,108.5 million. Again, developing countries in Asia were the main exporters, accounting for 96 percent of the total export value (Onchan 1997).



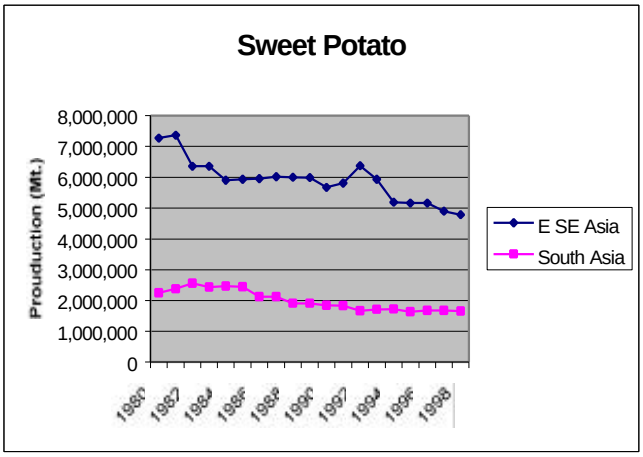
While fruits and vegetables have become increasingly important in the agricultural trade, their value is still relatively low relative to other traditional farm products (Onchan 1997).

The rise in horticultural products is most likely accounted for by the changing diets brought on by rising affluence (Ahmed 1995; Onchan 1997) and due to an increased focus on exports and the world market.

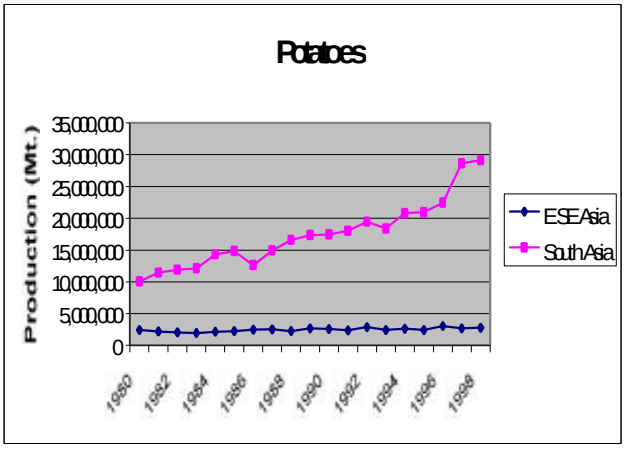
1.1.6 Tubers

Viewed as a whole, tubers are either declining modestly in East and South East Asia or increasing modestly in South Asia. These figures however mask rather dramatic changes in certain tuber crops. There has been a sharp decrease in sweet potato production, particularly in South East Asia. There was a less dramatic decrease in cassava production in the East and South Asia region where domestic consumption has decreased, though exports have increased (CGIAR). These changes are in line with dietary changes experienced by economic growth outlined earlier by H.R. von Uexkull.

There has however been a dramatic increase in potato production in the South Asia region: 29 percent of the world's potatoes were harvested in Asia in 1996, up from 19 percent in 1983 (Scott et al. 2000). Potatoes are quickly becoming a major food staple in Asia (CGIAR).



Source: FAO

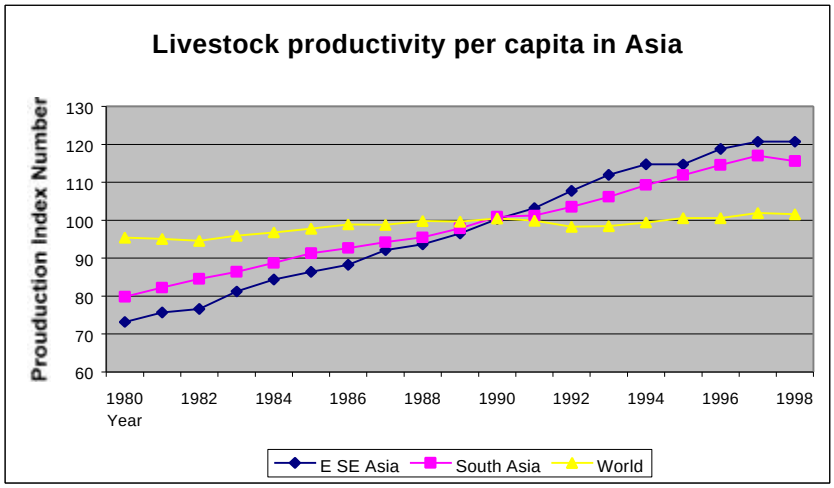


Source: FAO

1.1.7 Livestock

Livestock production appears to be an increasingly important issue in Asia. As C. Delgado et al. note in their IFPRI document *Livestock to 2020 The Next Food Revolution:* "Livestock production may provide one of the major operational themes in effective rural poverty alleviation during the next 20 years, but things could also go the other way. Failure to address how policies have tended to favor overly large production units, and a failure to promote the vertical coordination of small operators with processors, will lead to a major missed opportunity."

With a rate of consumption that grew by 5.4 percent per annum from 1982 to 1994 (C. Delgado et al. 1999), the highest production growth rates for livestock products in the world are currently in Asia. This growth rate is fueled by an ever-increasing per capita consumption of animal food products.



Source: FAO

Livestock production is growing particularly in the moister parts of the region of South East Asia and, for transport reasons, is moving closer to urban settlements (Hoffmann 1999).

As demand for livestock foods expanded rapidly in Asia during the 1990s, feed requirements could not be met from domestic supplies of cereals, and large amounts of feedgrains had been imported, primarily from developed countries (C. Delgado et al. 1999).

It is felt that in the future the increased use of grain as feed will be met primarily through an expansion of the cultivation of feed grains in South and East Asia. Feed-grain cultivation has been of relatively minor importance in South and East Asia, but in recent years maize production has increased rapidly, while rice production has slowed (C. Delgado et al. 1999).

The majority of livestock in Asia is still kept by smallholders. Livestock kept under the prevailing conditions of small-scale production in the region have a low level of productivity, and as cropping systems take over pasture, grazing systems have less and less scope for expansion (Hoffmann 1999). Thus, in order to focus on improving the efficiency of feed utilization, animal productivity, and the transportation of produce, there is a shift towards mechanized, capital-intensive livestock production in East and South East Asia. Mechanization also facilitates the shift from ruminants to animals such as pigs and chickens that require less time and space for production (C. Delgado et al. 1999).

The disadvantage of the industrial livestock sector currently developing in Asia is that it generates little employment, threatens degradation of natural resources, and challenges human and animal health (Hoffmann 1999). However, government policies that encourage subsidies for energy and credit result in favoring industrial production over less-intensive, and more equitable, mixed farm livestock production (Hoffmann 1999).

As Hoffman notes in his document *Asian Livestock to the Year 2000 and Beyond*:

> We are therefore witnessing a dualistic mode of development, with two conflicting components. First, a modern, demand driven and capital-intensive sector, producing poultry meat, eggs, pork and sometimes milk…. It is rapidly expanding to meet urban

demand but it is also susceptible to market upheavals; it generates little employment, threatens great environmental degradation, and challenges human and veterinary public health. At the same time, a traditional, resource driven and labor-intensive sector continues to provide a multitude of services to subsistence-oriented farms. While not efficient in terms of introduced inputs, this sector uses resources which have little or no alternative values, and for this reason, its potential to expand beyond moderate growth rates is constrained by low technology uptake, insufficient market facilities and infrastructure, and small economies of scale.

1.2 Factors affecting production

In order to look at how agricultural production can be increased, it is necessary to look at the factors that affect production: land availability, fertilizers, water, pest control, farm efficiency, and biotechnology innovations.

In their article *Governmental Spending on Asian Agriculture: Trends and Production Consequences*, Shenggen Fan and Philip Parday discuss the factors that have most affected the agricultural growth in Asia from 1972 to 1993. The major factors they noted were the increased use of fertilizers (and irrigation which is highly correlated with fertilizer use) which accounted for 30–40 percent of the growth of agricultural production; public investments in agriculture which accounted for about 20–30 percent of the agricultural growth in most countries; and general public and private infrastructure investments not earmarked for agriculture which accounted for about 20–30 percent of the growth. Interestingly, Fan and Parday noted that increased labor input is still a source of production growth, accounting for more than 10 percent of total production growth in a number of Asian countries. They add that the growth in land input generally played only a very minor role in growth of agricultural output in Asia (Fan and Pardey 1998).

1.2.1 Land Availability

Asian farmers currently feed nearly 60 percent of the world population with only 25 percent of the world land surface available for agriculture (von Uexkull 1998). As has been noted earlier, the expansion of land under agriculture contributed little to output growth in Asia.

However, the amount of labor in agriculture increased more rapidly than land area for many Asian countries, and land-to-labor ratios declined throughout the region from an average of about 0.7 ha/agricultural worker to 0.49 ha/worker in 1993 (Fan and Pardey 1998). Or to employ another commonly used indicator, Asia has approximately 0.18 ha of agricultural land per capita, the least amount for any region in the world (WRI 1998). In some countries, farm sizes are becoming so small that some consolidation may soon be necessary to enhance efficiency and growth (ADB 2000).

Asia already has 90 percent of the potential arable land in the region under cultivation, compared to 18 percent in Latin America and 19 percent in Africa, so further expansion is unlikely (von Uexkull 1998).

The migration of labor from rural to urban regions in the 1990s has certainly begun to offset the natural rate of growth of the rural population, with a consequent reduction in agricultural labor of 0.65 percent per annum (Fan and Pardey 1998). This in turn should result in larger farm sizes as small farmers find it more profitable to sell or lease their holdings rather than cultivate them (Pingali 1998).

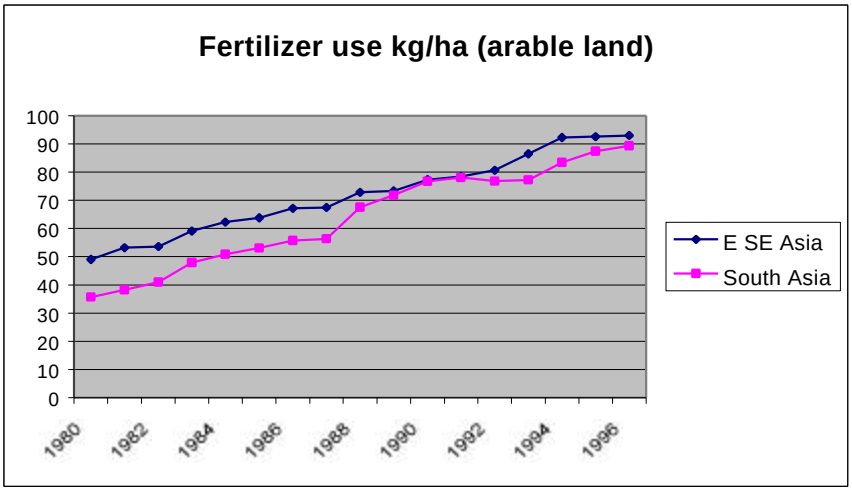
How this natural restructuring of land holding develops will determine how successful the rural development process will be. In the article *Current Issues in Agricultural Structure in Asian Developing Countries*, Kiran Pyakuryal comments:

> The issue in this changing paradigm is how to shift the rural labor force from the agricultural sectors without physically moving them to other areas. The point to ponder in this regard would be that the absorptive capacity of many metropolitan areas are already extremely stretched and incremental population would only worsen the situation.

1.2.2 Fertilizers

Asia has the highest rate of fertilizer use in the developing world (von Uexkull 1998). Since 1990, though, the growth of fertilizer consumption has slowed considerably (Fan and Pardey 1998). While it is felt that the demand for fertilizers in irrigated rice areas is reaching its maximum, there still exists a large potential for increased fertilizer consumption in rainfed areas (Hossain and Singh 1995). And as Fan and Pardey noted, it was the main contributing factor to the extraordinary growth of Asian agriculture experienced from the 1970s to the 1990s.

In general, cereal crops account for over two-thirds of the total fertilizer intake (Hossain and Singh 1995). Given that it will be difficult to bring additional land under cereal grains, as most good quality cropland is already under cultivation, demand for fertilizer will need to increase in order to achieve higher yields (Hossain and Singh 1995).



Source: FAO

It has been said that in order to sustain food security, land-scarce Asian countries will need to increase fertilizer intake to more than 250 kg of fertilizer per hectare by 2020, from the present level of less than 100 kg per hectare (Hossain and Singh 1995).

Others suggest that fertilizer use is already excessive and emphasize fertilizer efficiency, which in Asia is generally low, around 30–40 percent. Excess fertilizer or poor fertilizer efficiency can cause both economic and environmental loss (Maene 1998). However, attempts at improving fertilizer efficiency through better timing and placement of inorganic fertilizers and wider use of organic sources of nutrients will be difficult to realize, given the decline of fertilizer prices relative to labor and the high cost of providing site-specific information on nutrient management to a large number of small-scale farmers (Byerlee and Pingali 1994). Improving fertilizer efficiency is an issue that will have to be addressed through various multidisciplinary approaches. Furthermore, an emphasis will have to be placed on the management of other inputs (such as land, water, labor, and seeds) to improve the efficiency of their use (Hossain and Singh 1995).

In the early 1970s, the governments of most Asian countries created policies designed to subsidize fertilizer use by farmers, resulting in the overuse of fertilizers (Ahmed 1995). More recently, however, governments have reduced the role of the public sector and liberalized the fertilizer sector, thus encouraging fertilizer efficiency (Hossain and Singh 1995). However, while substantial progress has been made with the liberalization of fertilizers, barriers still exist that distort market forces. Because of these barriers, localized shortages and price fluctuations are still a common feature in many Asian countries (Hossain and Singh 1995). Most experts agree that the most efficient way to promote fertilizer efficiency would be to eliminate all market distorting factors (Ahmed 1995; Pingali 1998; Hossain and Singh 1995). As Prabhu Pingali notes in the article *Confronting the Ecological Consequences of the Rice Green Revolution in Tropical Asia*:

> Input subsidies directly affect crop management practices at the farm level; they reduce farmer incentives for improving input use efficiency. Improving farm-level technical efficiencies require farmer investment in learning about the technology and how best to use it. Where input prices are kept low through government intervention, farmers do not have the incentive to spend the time to learn about methods of increasing technical efficiency.

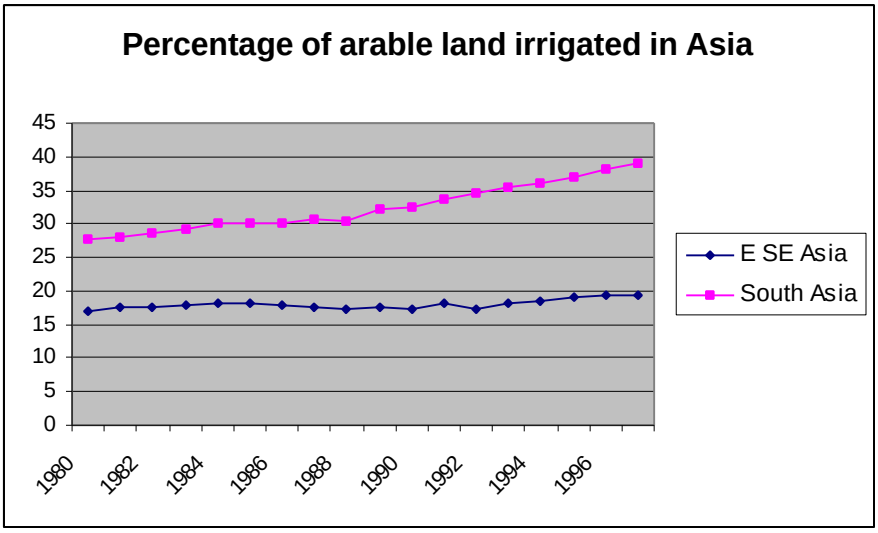
1.2.3 Water

Asia accounts for approximately 50 percent of the world's water withdrawal for agricultural use (FAO 1999)[7]. In total, 37 percent of the land under cultivation in the region is irrigated, and 84 percent of the water withdrawal is used for agricultural purposes, compared to 71 percent for the rest of the world (FAO 1999).

However, prospects for expanding low-cost irrigation are increasingly limited (Yudelman 1992). Not only is water becoming scarcer, but also declines in world rice and wheat prices (rice

[7] http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGL/aglw/aquastat/aquastat.htm

represents about 45 percent of all irrigated crop areas) and increasing capital costs have resulted in reduced potential for investment in irrigation infrastructure (Rosegrant 1992).

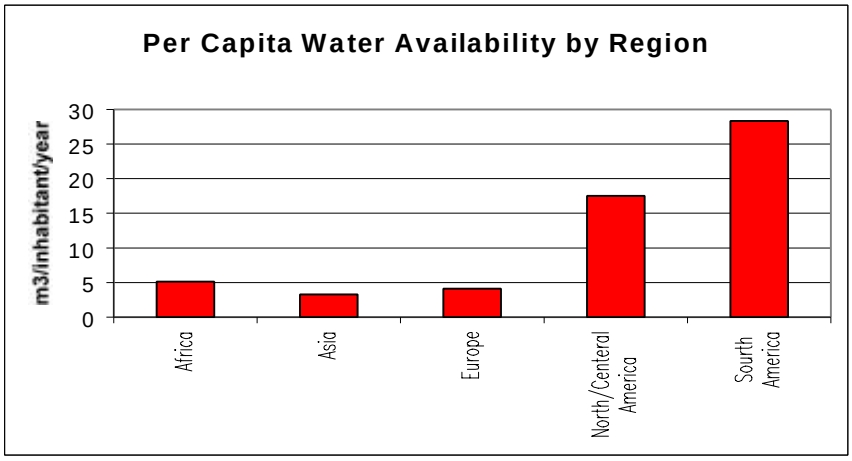


Calculated from FAO statistics

Per capita water availability in Asia is the lowest regional figure worldwide, estimated at between 3300 m^3/inhabitant per year (Rosengrant 1997) and 3825 m^3/inhabitant per year (FAO Aquastat),[8] though it must be noted that these figures hide a fair deal of regional variation. FAO states that the figure of 2000 m3/inhabitant per year is usually used as an indicator of water scarcity[9]. Water scarcity is increasing, and within the next twenty years, many Asian countries will approach crisis levels. A deterioration in water quality is also predicted to aggravate water shortage problems (ADB 2000).

[8] These figures depend on how one defines the region.

[9] Others claim that 1000 m^3/inhabitant/year is the indicator of water scarcity.



Source: Rosengrant1997

Particularly given the growing levels of land and water scarcity and the low expected returns of future expansion of irrigation, operations and maintenance of irrigation systems in Asia are becoming increasingly important, as the older public irrigation schemes (often 30–40 years old) are in need of rehabilitation (FAO Aquastat).

Most countries in the region see increased participation of users in the management of irrigation schemes as a solution to the need for sustainability in irrigation operations (FAO 1999). As the ADB states in the document *Rural Asia: Beyond the Green Revolution*:

> Irrigation water in nearly all of Asia has been provided essentially free. Farmers therefore have little incentive to economize on its use. Two major degradation problems in intensified areas—salinity build up and waterlogging—are directly related to the virtually free provision of water to farmers. Increasing water use efficiency through opportunity cost pricing or market valuation of water would have substantial environmental benefits and would not adversely affect yields; yet this leverage for improving the sustainability of the resource base has rarely been utilized in Asia.

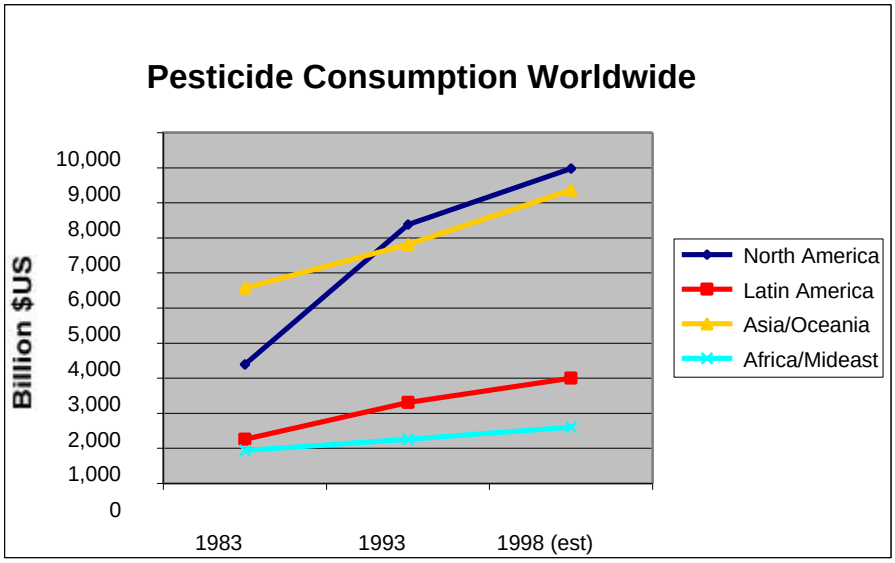
The incentives of water markets to encourage farmers to use water more efficiently could be combined with the benefits of increased user management, where user groups would be responsible for internal allocation of water and could resell water that was saved through efficient use (ADB 2000).

Despite these potential benefits, there are constraints to water market approaches. Irrigation networks in Asia are huge systems serving many farmers. Thus, developing a system to measure and charge farmers and user groups for the water they have used will require a considerable technological investment. Because of this, establishment of water markets will likely be a longer-term solution in much of Asia (ADB 2000). Despite these challenges, it appears that this is the approach many Asian countries are taking to manage their water resources more sustainably.

1.2.4 Pesticides

In the 1990s, Asia experienced a steady growth in pesticide use, increasing by about 4.4 percent per annum since 1993 (Yudelman et al. 1998). In India, for example, pesticide use has doubled

over the past five years; this growth was spurred by increasing farmer profits and falling oil prices (Schillhorn van Veen 1999)[10]. However, rates of pesticide use are highest in the region's highly industrialized countries, which make most of the pesticides they use (FFTC 1998)[11].



Source: Schillhorn van Veen,1999

In a study carried out in 1995, it was shown that crop losses due to pest damage[12] in Asia totaled 47 percent of potential production, with the largest losses experienced by rice. It was estimated that Asia experienced the greatest absolute loss worldwide, but that proportionally its loss was second, slightly behind Africa, which registered a 49 percent loss. Both regions experience much higher levels than the rest of the world (Yudelman et al. 1998).

Again, given the limited land for agricultural expansion in Asia, improvements in pest management would seem to be an important means of increasing production (Yudelman et al. 1998).

While on a regional basis pesticide use is increasing, it appears that worldwide the volume of pesticides used by farmers is falling, as application becomes increasingly efficient. Globally, the application rate for herbicides has dropped from about 3 kg/ha in the 1960s to 100 g/ha in the late 1980s, while insecticide application rates dropped during the same period, from approximately 2.5 kg/ha to 25g/ha (Schillhorn van Veen 1999). However, such efficiency is not universal. Yudelman, Ratta, and Nygaard reported that farmers in parts of Asia were spraying as much as 800 times the original recommended dosage of pesticides.

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[10] http://www.agnet.org/library/article/eb466.html#0

[11] http://www.agnet.org/library/article/ac998e.html

[12] Due to pathogens, insects, and weeds.

As with water and fertilizers, the question of efficiency is key. And like these other agricultural inputs, pesticide efficiency will depend on the world economy, trade policies, promotion by industry, the success of the move towards integrated pest management (IPM), and biotechnological advances (Yudelman et al. 1992; Schillhorn van Veen 1999).

There have been considerable biotechnological advances over the past five years, notably the development of Bt and "Round-Up Resistant" strains of crops, which would allow farmers to control pests with little, if any, pesticides. However, the controversy surrounding biotechnological interventions is unlikely to allow for immediate adoption in developing countries, particularly in Asia which has been tentative in its approach to biotechnology. This is further compounded by long-term costs, which make it likely that biotechnology will play only a limited role in pest control in developing countries over the course of the next 10 years. Some Asian countries have experimented with Bt varieties of certain crops, but as of yet it is unclear whether these biotechnologies will offer an effective alternative to traditional pesticides.

For both economic and health reasons, many experts are promoting more efficient use of pesticides through IPM systems. IPM is now a very popular concept in pest control. Even the Asian Development Bank and other multilateral development banks have begun to see IPM as a key step in the development of any new agricultural program because of its importance to sustainability (Yudelman et al. 1998). Though the concept of IPM is very attractive, in practice IPM programs can be difficult to implement for a number of reasons (FFTC 1998). First, the kinds of technology which make up IPM differ widely from site to site and are not easily packaged. Second, to apply IPM, farmers need to be well informed and must coordinate their pesticide use over a wide area (FFTC 1998). Third, they need good leadership and technical support, and many IPM trainers find conventional extension training methods inadequate for carrying out IPM-related training (Yudelman et al. 1998). Finally, IPM programs rely heavily on support from the public sector and international development agencies rather than from private entrepreneurs (Yudelman et al. 1998). Thus, only a small percentage of farmers are involved in IPM programs (FFTC 1998), particularly small-scale farmers (Yudelman et al. 1998). Because of these difficulties, while there has been much work on IPM, only a small percentage of farmers, in most countries, are involved in them (FFTC 1998).

Like fertilizers, pesticides have traditionally been oversubsidized by Asian governments. As Prabhu Pingali states in the article, *Confronting the Ecological Consequences of the Rice Green Revolution in Tropical Asia*: "injudicious and indiscriminate pesticide application is related to policies that have made these chemicals easily and cheaply accessible." During the 1990s, most Asian governments have left production and marketing to the private sector, which should increase efficiency at one level. However it is important to note that this also leaves farmers at the mercy of the pesticide industry, which has no interest in minimizing pesticide use (FFTC 1998). Unlike fertilizers, pesticide use will probably not be completely controlled by the market, and there will be some need to implement regulations and restrictions on pesticide use (FFTC 1998).

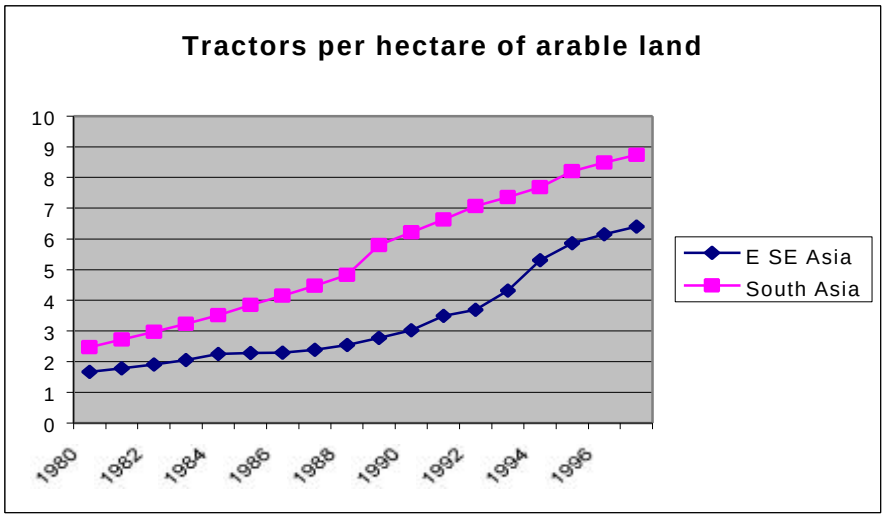
However, the FFTC also suggests that Asia should concentrate on developing its own biopesticides, as they have many advantages over chemical pesticides: they are cheap to develop and have little, if any, impact on nontarget species (FFTC 1998).

Asian farmers are showing a growing interest in organic farming and biological control. This is due more to the growing worldwide demand for organic products than it is to organic farming methods offering a more effective kind of pest control (FFTC 1998ii); however, in the long run, this is perhaps one of the more sustainable methods of keeping pesticide levels in check.

1.2.5 Mechanization

There has been a sharp increase in the use of tractors per hectare in Asia over the past decade, as can be seen from the graph below. While tractor use is certainly not representative of all aspects of agricultural mechanization, it is an indicator of mechanization progress. Comparisons with other regions such as the Near East (see section 2.2.5), where agriculture plays a less significant role in the regional economy, show that Asia's agriculture is still relatively undermechanized.

Mechanization of agriculture traditionally occurs when labor moves from the agricultural sector to the industrial sector. While Asia seems to be on the cusp of such a transition, the region still has relatively high agricultural populations. For this reason, mechanization in Asia occurred to resolve seasonal labor shortages (Asian Productivity Organization 1996).



Many experts feel that mechanization offers potential for increasing production and lowering costs in Asia (Asian Productivity Organization 1996). Interestingly, Fan and Parday demonstrated that investments in mechanization accounted for only about 1–3 percent of the agricultural growth experienced by most Asian countries. Given the limited, relatively low levels of mechanization in Asia until the early 1990s, this is probably not all that surprising.

1.2.6 Infrastructure

There is little statistical information on the state of infrastructure development in Asia, yet most experts seem to suggest that infrastructure is of key importance to agriculture in the region. Fan

and Pardey showed that infrastructure investments not earmarked for agriculture accounted for about 20–30 percent of the growth of agriculture in Asia from 1972 to 1993.

The ADB states in *Rural Asia: Beyond the Green Revolution* that "the importance of farmer-to-market roads in determining marketing margins, agricultural profitability, and farm diversification cannot be overemphasized." They add that "[s]ince the transaction costs of poor infrastructure are borne unequally by the poor, improvements help level the playing field for the most disadvantaged" (ADB 2000).

Increased infrastructure development will remain the responsibility of the government, as there is generally insufficient incentive for the private sector to provide rural infrastructure service.

The impact of infrastructure development, particularly roads, on the environment is well documented. Thus any infrastructure promotion program must pay attention to the risks involved. However, it is also true that poverty is one of the great aggravators of environmental degradation, and the shift to more intensive farming systems, which would be encouraged by increased access to markets of more isolated areas, has traditionally helped relieve the pressure on the environment (ADB 2000).

1.2.7 Biotechnology

In Asia, there is some opposition to genetically modified crops and products on the part of both farmers and consumers (Bothai et al. 1999; *Bangkok Post* 2000a). Most countries are carrying out further tests on transgenic crops and waiting to see how Europe and the United States react to the ongoing debate.

China is the only Asian country currently planting transgenic crops in significant numbers and had 0.1 million hectares of Bt cotton planted in 1998, representing 1 percent of the total area planted with transgenic crops worldwide (James 1999)[13].

Monsanto has been testing Bt cotton in Thailand since 1996 and is only awaiting the Agriculture Ministry's decision for local distribution. Monsanto's Bt corn, Roundup Ready corn, and Stacked Ready corn are currently being tested at Kasetsart University and in Phitsanulok under the supervision of the Agricultural Extension Department. In Indonesia, Monsanto and Pioneer Hi-Bred have just finished their field testing of Bt corn. In the Philippines, Pioneer and Monsanto are awaiting approval for their Bt corn to be field-tested in collaboration with the Institute of Plant Breeding (Bothai et al. 1999).[14] Indonesia has developed the technology to genetically modify a number of crops. However, distribution of these products has yet to be approved by the government (*Jakarta Post* March 8, 2000). In India, a number of transgenic crops have been tested, though as yet no transgenic plant has been approved for commercial agriculture in India (Girimaji March 28, 2000). Data from trials in India have demonstrated an

[13] http://www.isaaa.org/Global%20Review%201999/briefs12cj.htm

[14] http://www.grain.org/publications/reports/takeover.htm

average increase in productivity by 40 percent in 40 location studies with cotton, and a 16 percent average increase in mustard in 15 location studies (Girimaji March 28, 2000).

While it is often argued that biotechnology will help feed the poor, in reality biotech research has currently had very little impact on the poor. There is a general hesitancy in developing biotechnology for the poor, partly because improvements to staples that feed the poor often provide little potential profit to the large biotech companies. Secondly, global public uproar has scared off sources of research funding which might have encouraged biotechnology investment in the developing world. Finally, another barrier to developing modified crops to help the poor comes from intellectual property rights attached to the products, which deter farmers from saving seed and discourage developing countries from biotechnology research (Tangley March 13, 2000[15]; National Academy Press 2000[16]; Nuffield Council on Bioethics 1999[17]).

The National Academy Press in its recent document *Transgenic Plants and World Agriculture* says:

> The long-term decline of public agricultural research, the increasing privatization of [Genetically Modified] GM technologies and the growing emphasis on crops and priorities of the industrialized nations does not bode well for feeding the increasing populations of the developing world…. Without changed incentives for sharing access to GM technologies, the world is unlikely to direct much of its research for improved nutrition and employment-based access to staples for the poor.

In an effort to overcome negative press, Monsanto waived patent rights to "golden rice," a variety of rice that was genetically altered to help prevent vitamin A deficiency (Marquis August 4, 2000). Whatever the origins of the gesture, it is evident that the large biotech corporations at least understand the importance of property rights in the push to develop transgenic crops that will assist the developing world.

As Koppel mentioned in his essay (1995) *Old images and New Challenges: Rethinking the mission of Agricultural Support Systems in Asia*:

> What will the hybridization of basic food crop seeds mean for Asia's small farmers, the vast majority of whom do not buy seeds? Will many farmers be motivated by expected economic benefits to buy seed or will income inequalities within agrarian Asia be exacerbated? The broad changes associated with biotechnology have fundamental implications for the roles of public agricultural research and extension and for types and consequences of privatization that may occur in Asian agriculture. Who will be the agents and the benefactors of the more proprietary technology dissemination systems? What will the increasing privatization of germplasm-base research mean for the "publicly" supported agricultural support system? For international cooperation in technological improvements for Asia's agriculture?

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[15] http://www.usnews.com/usnews/issue/000313/food.htm

[16] http://books.nap.edu/html/transgenic

[17] http://www.nuffield.org/bioethics/publication/modifiedcrops/rep0008006.html

These questions have yet to be answered.

1.3 Agricultural Support

1.3.1 Research

The success of the Green Revolution encouraged investment in agricultural research in the 1960s and 1970s. By the 1980s, there were over 50,000 agricultural researchers working in the National Agricultural Research Systems of Asia, representing two thirds of the total number of agricultural researchers in the developing world. Altogether, almost US$3,000 million was being invested annually in the region. By the late 1980s, however, the expansion of agricultural research was slowing down, and by the early 1990s, a shortage of funds led to a reduction in research activities in a number of countries. The current research investment is relatively low by world standards—0.3 to 0.4 percent of agricultural value-added—(Byerlee and Pingali 1994) though this is largely due to the substantial growth in agricultural GDP in Asia (Pardey et al. 1998). In spite of this change, the effects in Asia have generally been less dramatic than the shortages experienced by developing countries in other regions (Byerlee and Pingali 1994).

Given the decreased levels of funding for agricultural research in Asia, many are asking themselves how to consolidate their funding. Some suggest that some degree of institution restructuring is necessary to consolidate and streamline plant breeding programs' research, with a few centralized research institutions with a critical mass in terms of disciplines and resources (Byerlee and Pingali 1994).

Meanwhile, others are looking for alternate sources of funding. Many look to the private sector, as "the increasing commercialization of agriculture in many Asian countries has encouraged greater private investment in agricultural research" (Morris and Byerlee 1998). However, even those who look to the private sector realize that private sector research tends to be too narrowly targeted to cover all research needs (Morris and Byerlee 1998) and that industry-based funding arrangements, once quite common throughout colonial Asia, have become increasingly rare in more recent years (Pardey et al. 1998). Others have suggested that as agricultural research becomes more decentralized and more strongly farmer-oriented (Morris and Byerlee 1998), methods of encouraging farmer financing should be explored (Byerlee and Pingali 1994). Ultimately, taxpayers still foot most of the bill for funding agricultural research conducted by public agencies in Asia (Pardey et al. 1998).

There is some debate on the subject of research on the use of marginal lands for agricultural production. Most of the research in Asian agriculture has concentrated on irrigated rice, because it paid the largest and quickest dividend and due to the political security it provided (von Uexkull 1998). However, some note that given the poverty and environmental degradation that is often linked to agriculture in marginal areas, more research needs to be focused on marginal rainfed zones to promote equity and further environmental protection. This group suggests that Asian governments should encourage the private sector to perform agricultural research for irrigated and high potential areas and to redirect funding for public research to the problems of poorer people and regions, which are much less attractive to private firms (ADB 2000). However, others suggest that the investment in crop-breeding research for marginal zones has been, in many

cases, considerably greater than the share of marginal areas in total agricultural value-added and that progress in research for the most marginal areas with severe drought is typical very slow (Byerlee and Pingali 1994). This latter group suggests that work on resource management might have a higher pay-off.

Most commentators agree that research on agricultural input efficiency as a new focus should be explored: fertilizer timing/placement, water use, and pesticide applications are some of the areas in which increased efficiency can reduce environmental degradation and the cost of production (Byerlee and Pingali 1994). However, as discussed earlier, some of these efficiency issues might best be addressed through the removal of input subsidies (Byerlee and Pingali 1994).

While many look towards research and biotechnology to create another Green Revolution, Byerlee and Pingali feel that research is unlikely to provide "quick answers for reversing the current negative trend in productivity growth" (Byerlee and Pingali 1994). Despite this understandable note of caution, Fan and Pardey did find that public investments in agricultural research accounted for 20–30 percent of the agricultural growth in the region from 1972–1993, though this was during the heyday of agricultural research (Fan and Pardey 1998).

1.3.2 Extension

During the 1960s and 1970s, agricultural extension was part of the primary push behind the Green Revolution. In the 1980s, extension systems were expected to function as normal, despite facing declining financial support and falling participation by farmers (Koppel 1995). In the 1990s, this decline continued, and it was estimated that countries spent about 0.9 percent of their AgGDP on agricultural extension services, with considerable support from international donor agencies (Jalil 1993). With the collapse of the Training and Visit (T&V) model of extension, the chosen medium of the Green Revolution, not only did international funding decline drastically but also extension services in Asia were left searching for a new identity (Garforth and Lawrence 1997).

In a qualitative assessment of Asian extension services, outlined in an Asian Productivity Organization (APO) meeting on Agricultural extension systems in Asia and the Pacific, most indicated only a low-to-average performance (Asian Productivity Organization 1993). Most commentators agree that extension services have been hampered by weak linkages between research and extension services and by the dependence on top–down, "cookie-cutter" technologies (Morris and Byerlee 1998; Garforth and Lawrence 1997; Koppel 1995). However, there is considerable disagreement as to how Asian extension services can best serve their clients.

There are currently two different directions in which experts suggest extension could move. One theory suggests that extension should be handled by the private sector, with an eye on Internet use and an accompanied focus on education and literacy training. The other theory suggests that extension should be farmer-driven and to some extent farmer-funded, suggesting that extension services must shift from a commodity focus to an ecological and systemic focus, with an accompanied participatory approach.

Morris and Byerlee illustrate the first approach in their article *Maintaining Productivity Gains in Post-Green Revolution Asian Agriculture,* when they state:

> In the area of technology dissemination, the emphasis will have to shift from communication to education. Instead of merely seeking to deliver specific messages to farmers, extension agents will have to concentrate on providing farmers the knowledge and skills needed to better manage information-intensive technologies such as integrated pest management. The goal must be to increase farmers' demand for information by strengthening their ability to seek and process information from diverse sources and to adapt it to their own specific circumstances. The use of sophisticated computer-base technologies and decision aids will increase. The fact that information-base technologies will place a premium on literacy and education levels could increase inequalities among farmers much more than occurred during the Green Revolution. Because education is unequally distributed in the farming population, wealthier farmers are likely to benefit disproportionally from information based technologies, because of their greater ability to access information.

In another article by Byerlee (this time with Sajidin Hussain), the author states that "education may increasingly take the place of extension" (Byerlee and Hussain 1995)—refer to section 1.3.3 for more on this subject. This theory somewhat pessimistically accepts Kuznet's law and takes for granted the growing inequities facing Asian farmers.

Garforth and Lawrence take a different stance in their article *Supporting Sustainable Agriculture Through Extension in Asia.* Like Bruce Koppel in his paper *Old Images and New Challenges: Rethinking the Mission of Agricultural Support Systems in Asia,* they suggest that, with the shift towards sustainability and equity, extension needs to be more participatory, more flexible, and more intensive than it was before.

> Sustainable farming and natural resource management is relatively knowledge intensive requiring the application of general ecological principles to a specific situation. Joint problem solving with clients, leading to an enhanced ability to identify and solve problems, will be an appropriate way of influencing their behavior (Garforth and Lawrence 1997).

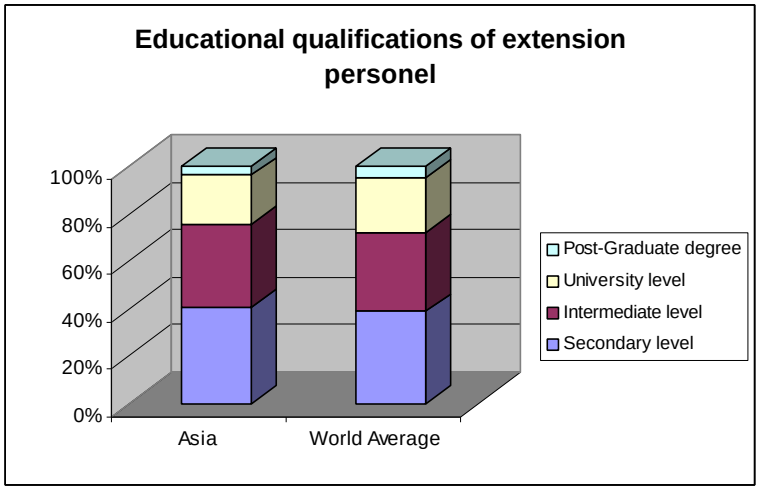
Garforth and Lawrence disagree with the "Education" paradigm, which suggests that "investment in rural education may make extension more cost effective by allowing much greater use of written material," noting that "there is relatively little information available through the mass media to help farmers decide how to improve the sustainability of their farming practice" (Garforth and Lawrence 1997).

Of course, any intensification of an extension system in this period of extension cutbacks brings up the question of cost. Interestingly, Garforth and Lawrence suggest that if the extension intervention is in the longer-term interest of the farmer, then the farmer should bear at least some of the cost; while if the intervention is in society's interest, then the state should bear the cost.

1.3.3 Education

Agricultural education can occur at many levels: from primary/secondary levels up to postgraduate levels, with the goal of creating extension agents, agricultural administration, and agricultural researchers.

As a whole, Asian extension agents possess high levels of education and match up to the worldwide average, as can be seen in a somewhat dated FAO study quoted by Abdul Jalil in his article *Current Status of Agricultural Extension Systems in Asia and the Pacific* (1993).



Most countries in Asia do not have a formal system of agricultural education at the secondary level. Though Dr. Shigeo Tajima in his detailed article *The State of Agricultural Education in Selected Asian Countries* suggests that this might be an effective area of intervention, as the graduates from this type of school often have a greater capacity to reach farmers (1999). Hussain and Byerlee take another perspective on primary/secondary education and agriculture; unlike Tajima, they did not look at agricultural content in primary or secondary school programs but at the fact that a number of research studies in Asian countries have shown that general education "had a positive and significant effect on farm productivity ranging up to 30 percent," with increases of productivity quoted as 1–4 percent per year of school attended (Hussain and Byerlee 1995). It would seem that, given the findings in both articles, the role of secondary education in the education of both farmer and extension agent might be a subject that warrants further research.

More typically, agricultural education refers to education at higher levels in order to train extension agents or agricultural researchers. Tajima demonstrated the evolution and state of agricultural education at the university level in several Asian countries in the table below. While it is by no means exhaustive, it does give us an impression of the state of agricultural education in Asia. Interestingly, there seem to be two trends: first, there is a rough inverse correlation that seems to emerge, with countries possessing greater ratios of agricultural graduates often being those with the lower agricultural GDP growth rates. Second, there seems to have been a sharp decline in the number of agricultural education institutions created during the 1990s.

Country	Schools created before 1970s	Schools created in 1970s	Schools created in 1980s	Schools created in 1990s	Total	Student Number	Farmer population/student
Bangladesh	2	1	3	1	7	7,200	10,769
China	3	0	3	0	6	10,204	393
Iran	6	7	65	6	84	51,230	307
Japan	46	2	0	2	50	68,494	90
Nepal	0	1	0	0	1	482	34,163
Pakistan	1	2	1	2	6	8,284	8,399
Sri Lanka	1	2	1	0	4	1,323	6,990
Vietnam	6	3	0	0	9	11,729	3,558
Total	65	18	73	11	167		

Traditionally, a great deal of importance has been placed on intermediate and university-level agricultural education in order to fill the ranks of the agricultural extension services. However, with the rise of biotechnology and the need for Asian competitiveness, the apparent move towards farm consolidation, agricultural commercialization and the breakdown of extension services, it would in fact seem that an emphasis on primary/secondary education and postgraduate education might be more fruitful.

As Dr Mancebo in his article *Agricultural Education Systems in Asia: Issues for the Future* (1999) points out:

> The need for education [in Asia] at all levels is more apparent in the field of agriculture and its related disciplines than in any other field and yet it is suffering from declining enrollment.... Modern agriculture relies more and more on knowledge and information. Thus, nations that have the capacity to use knowledge and information will remain competitive and will increase their agricultural productivity.

1.4 Agriculture and the Environment

1.4.1 Agricultural Sustainability

The effects of machinery on the soil structure, of fertilizers on the soil chemistry, of pesticides on the agricultural ecosystem, and of overirrigation on soil loss have raised concern that overuse of agricultural inputs could actually lower Asia's potential to increase productivity over the long term. There are some in fact that say this might be the cause of the much-discussed downturn in Asia's agricultural productivity. As Pingali states in the essay *Confronting the Ecological Consequences of the Rice Green Revolution in Tropical Asia*: "Ironically, the very policies that

encouraged increased food supply through intensive monoculture systems also contributed to the declining sustainability of these systems" (1998).

Sustainability in any context is a vague concept. However, in this case we will use the following definition: sustainable agriculture is an agriculture that balances the need for essential agricultural commodities with the necessity of protecting the physical environment and public health, the foundation of agriculture (Tinsley 1997)[18]. However, it is important to note that a proper definition of sustainability does not mean that every resource must be conserved, it simply requires that the future capacity to produce goods not be diminished (Siamwalla 1996)[19].

While sustainability is increasingly a guiding principle of agricultural development in Asia, it is important to note that farmer inclination towards sustainability is often driven more by financial rather than abstract environmental motives (Garforth and Lawrence 1997). This is illustrated by the earlier example of Asia's move toward organic farming, which was more due to the demand for organic products than to organic farming methods offering a more effective kind of pest control (FFTC 1998). The ability to transform these abstract notions of sustainability into practical terms that farmers can appreciate is a challenge for both policymakers and field workers.

1.4.2 Erosion/Soil Degradation

As soil is eroded or fertility lost, it becomes more difficult to maintain high levels of production. Regional studies show that soil degradation has had a significant effect on agricultural production in Asia, with an estimated loss of 1 to 7 percent of the agricultural GDP. It is estimated that by 1999 30–40 percent of the total land area in Asian countries was degraded (see table below), with 11 percent seriously degraded (Scherr 1999).

Given the rising need for increased production and the fact that 90 percent of the arable land is currently under production, these losses are potentially quite debilitating.

[18] http://www.fadinap.org/Nib/Reflections.htm

[19] http://www.fao.org/WAICENT/FAOINFO/SUSTDEV/EPdirect/EPan0007.htm

Soil Degradation in Asia

Type of degradation	Percent of degraded land
Loss of topsoil with water erosion	15.7
Terrain deformation from water erosion	4.9
Off-site effects from water erosion	0.3
Topsoil loss from wind erosion	5.4
Terrain deformation from wind erosion	4.2
Off-site effects from wind erosion	0.8
Fertility decline	6.3
Salinization	2.1
Dystrification	0.7
Aridification	1.3
Compaction	0.1
Waterlogging	1.4
Total	43.2

Source: Scherr 1999 (from van Lynden and Oldeman 1997)

Degradation of irrigated lands, due to salinization and waterlogging, is considered to be one of the most serious soil degradation problems worldwide, even though it affects only a limited area. This is largely because the lands that are affected are often highly productive agricultural areas. Strikingly, 69 percent of all salinized and waterlogged lands are found in Asia—mostly in India, Pakistan, and China—three of the five major irrigators in the world (Scherr 1999).

However, reversing salinity is both difficult and expensive: salts have to be flushed out of the soil and drained out of the area, and retiring saline lands from agriculture may be more cost effective than trying to fix them (Pingali 1998).

In spite of the difficulties involved in reversing salinity, Scherr suggests adopting a more preventative and flexible approach to irrigation: "diversifying to higher-value crops, to justify reinvestments in irrigation systems and higher-priced water, working to research low-cost methods to control or reverse salinization, and identifying effective water management regimes to avoid any future problems" (Scherr 1999).

1.4.3 Environmental health

1.4.3.1 Pesticides

There is little specific evidence on Asian farmer casualties resulting from pesticides. However, there have been a series of scattered studies that have indicated health problems arising from excessive pesticide exposure. One study on rice farmers in the Philippines in the 1980s indicated that around half of the farmers claimed sickness due to pesticide use (Yudelman et al. 1998).

It is estimated that approximately 50 percent of all pesticide poisoning and 80 percent of all deaths through out the 1980s occurred in developing countries, despite the fact that they consumed only 20 percent of world's pesticides (Yudelman et al. 1998).

1.4.3.2 Fertilizers

Saleem Ahmed in his paper *Agriculture–Fertilizer Interface in Asia Pacific Region: Issues of Growth, Sustainability and Vulnerability* notes that while excess fertilizer use is not as dangerous an environmental threat as excess pesticide use, excessive or improper use of fertilizers may lead to nitrite toxicity in drinking water, eutrophication of lakes, buildup of heavy metals such as cadmium, and possible buildup of nitrous oxides in the atmosphere (1995). This warning does not even take into consideration the negative effects improper fertilizer application has had on soil structure and fertility in Asia (Pingali 1998).

While many feel that Asia still has greater needs for fertilizers, many offer up a note of caution.

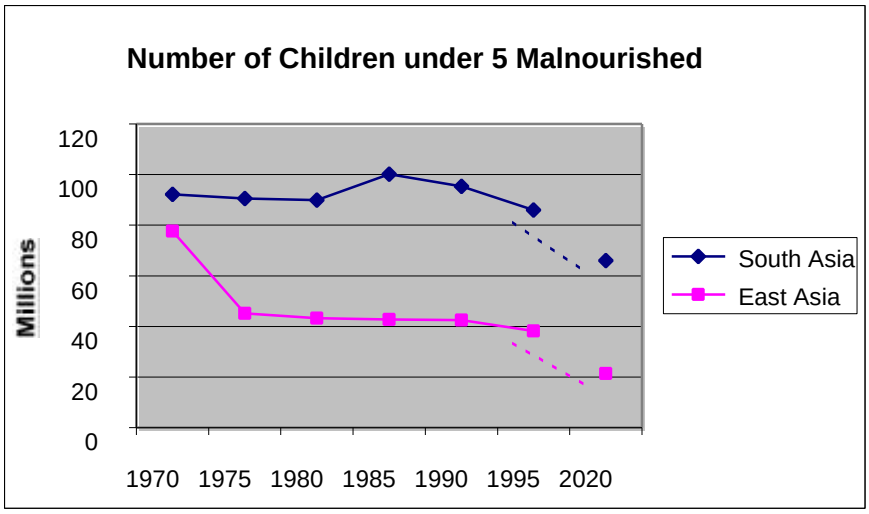
1.4.3.3 Livestock Waste

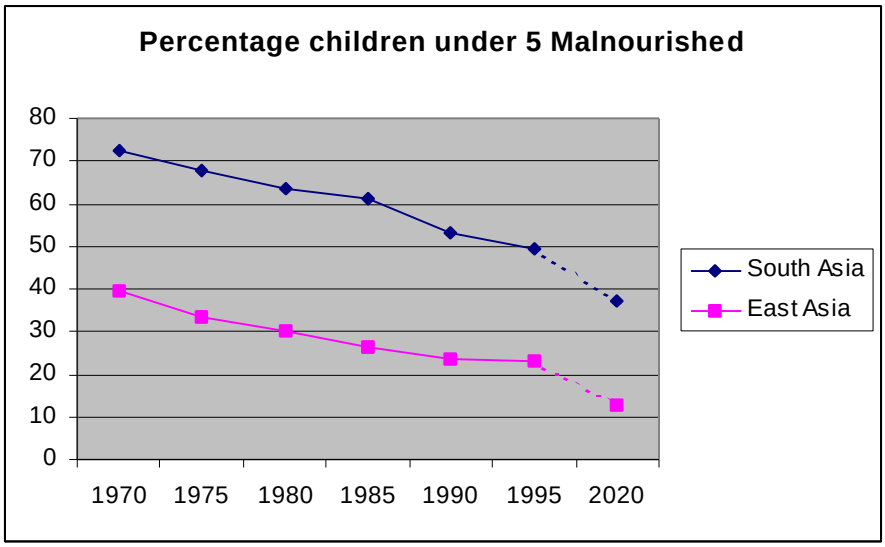
The rapid growth of livestock production in Asia is leading to situations where livestock concentrations are out of balance with the waste absorption capacity of the ecosystem (Delgado et al. 1999). Under some conditions, waste by-products can be recycled, but when animal concentrations are too high, animal waste can become a serious pollution problem (ADB 2000).

This problem is further compounded by the fact that in Asia intensive livestock systems tend to be located near densely populated urban centers, which magnifies any pollution risks. In addition, high concentrations of animal production can also become breeding grounds for disease. For example, salmonella infections are on the rise and threaten to become a major public concern in big Asian cities where there is a large demand for food and fecal contamination is difficult to control (Delgado et al. 1999).

1.5 Child malnutrition

Much research has shown that Asia has surprisingly high levels of child malnutrition. Indeed, 78 percent of the malnourished children in the developing world live in Asia. South Asia is particularly hard hit, with 50 percent of its children under the age of five malnourished—the highest rate in the world.





Source: Smith and Haddad

Researchers predict that South Asia will remain the region with the highest prevalence and numbers of malnourished children in the world in the near future. However, over the 1995–2020 period, it is predicted that the prevalence of malnourished children will fall from 49.3 percent to 37.4 percent, and that the numbers of malnourished children will fall from 86 million to 66 million. While in the East Asia region both prevalence and numbers of malnourished children are expected to decline dramatically over the next 20 years, it is predicted that prevalence will drop to about 12 percent, with the numbers of malnourished children falling from 38.2 to around 21 million (Smith & Haddad 2000).

The causes of child malnutrition are complex. Lisa Smith and Lawrence Haddad in their publications *Overcoming Child Malnutrition in Developing Countries* and *Explaining Child Malnutrition in Developing Countries* list the major factors of child nutrition as being women's education, health environment, women's status relative to men, and food availability. In East Asia, women's education is by far the most potent force for reducing child malnutrition. However, food availability and women's relative status are secondary factors and should also be

prioritized (Smith & Haddad 2000). In South Asia, however, food availability is considered to be the most potent force in reducing child malnutrition (Smith & Haddad 2000). This is important because it directly links agriculture with child malnutrition, at least in South Asia.

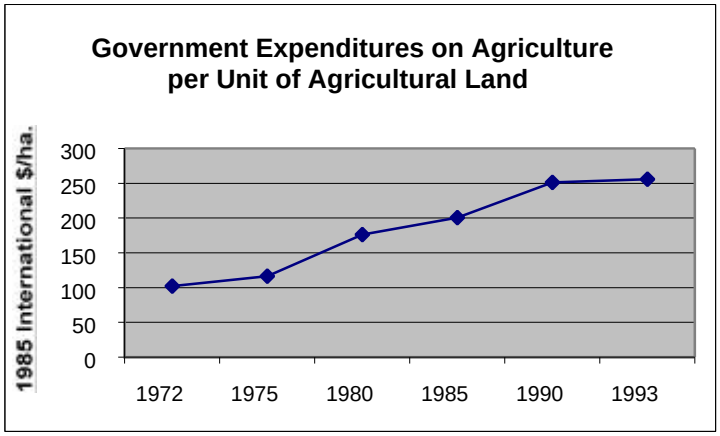
The cause of the high prevalence of child malnutrition in South Asia is still somewhat of a mystery, often referred to as the "Asian enigma." Even if all of the underlying determinant variables listed by Smith and Haddad were raised to their desirable levels, South Asian malnutrition prevalence would still remain at 23.8 percent. Deeply entrenched factors specific to South Asian countries are the key to solving the Asian enigma. If child malnutrition is to be overcome in the region, these factors must be determined and policies implemented to address them (Smith & Haddad 2000).

1.6 Investment Flows in Agriculture

Overall, governmental investment in agriculture in Asia is leveling off while private sector investment has not yet taken off. The countries with the biggest decreases in agricultural investment are often those most dependent on agriculture.

1.6.1 Government Spending

During the 1990s, overall public spending on Asian agriculture increased only marginally (0.59 percent per annum) with almost half the countries experiencing a reduction in real spending. On average, Asian governments spent US$257 per hectare of agricultural land in 1993—two and a half times less than was spent just two decades earlier (Fan and Pardey 1998). Oddly, it is the slower-growing economies, those most dependent on agriculture—such as Bangladesh, Myanmar, Nepal, Pakistan, and Sri Lanka—that have most significantly reduced the share of their overall government spending going to agriculture (Fan and Pardey 1998), despite the fact that there is a demonstrated correlation between government spending on agriculture and agricultural productivity (Fan and Pardey 1998).



Source: Fan and Pardey 1998

Evidence shows that 20 to 60 percent of total government spending on agriculture in Asia is spent on subsidies, which, as has been noted, actually lowers production potential and detracts

from both efficiency and sustainability (Fan and Pardey 1998). Many experts suggest that if the investments on subsidies were instead spent on research, extension, irrigation, and rural infrastructure, not only would there be a tendency towards sustainability, but there would be a concurrent effect on agricultural productivity, without necessarily increasing the amount spent.

Fan and Pardey also suggest that government spending on research, irrigation, and infrastructure may also promote additional private investment, leading to further production and productivity improvements.

1.6.2 Private investment

Private sector investment comes from two sources: investments by farmers aimed at increasing their productivity and investments by the private sector in the input supply, processing, and marketing subsectors (Fan and Pardey 1998).

Many had assumed that given the growth of agricultural production and increasing personal savings farmer investment would be considerable, despite government cutbacks. Unfortunately, this has not proved to be the case in the 1990s, perhaps because farmers still believe that this investment is the responsibility of the state (Fan and Pardey 1998).

In addition, private sector involvement in the agroindustry and agricultural services sectors is also currently limited. It is predicted, however, that as economies grow there will be a greater demand for agricultural inputs and services that should bring about greater private sector involvement. At the moment though, private sector involvement is minimal, particularly in the area of postharvest technology, where there is great need of investment (Fan and Pardey 1998).

Many experts believe that governments should seek to encourage private investment. However, at the same time, they caution that there has been a naïve belief that privatization is an easy and appropriate solution to all problems. While there is much that governments can do to enhance the private role in the agriculture sector, to do so requires a directed policy action, and even if policy measures to encourage private investment are successful, private action may not be enough to deal with issues of high social or environmental importance (Fan and Pardey 1998). Ultimately, private and government investments support different elements of agricultural economy.

1.7 Agricultural Policy

After independence, many Asian countries adopted the policies listed below in an attempt to encourage rapid industrialization and avoid a reliance solely on primary production, as they had largely done under the colonial powers (Bautista 1993).

1) Countries attempted to encourage the growth of the industrial sector through inward-looking policies such as import substitution and protection of imports competing with domestic production. This ultimately discriminated against other manufacturing industries and the agricultural sector (Bautista 1993; Than 1998).

2) Countries attempted to suppress producer prices of agricultural commodities through government procurement policies, export taxation and export quotas, in an attempt to favor industry over agriculture (Bautista 1993; Than 1998).

3) Countries encouraged overvalued exchange rates through exchange-control regimes and import licensing reducing the local currency return on agricultural exports and encouraging lower cost imports (Bautista 1993; Than 1998).

4) Governments attempted to offset part or all of the disincentive effect on the producers by subsidizing input costs, in an attempt to counterbalance the negative effects of the previous policies and promote what was perceived as food security. This caused many Asian agricultural economies to drift away from the world market (Bautista 1993; Than 1998).

Many developing countries did initially achieve high GDP growth rates as a result of these pro-industry policies, but these advances proved difficult to sustain. Agricultural performance, given the biases against it, was generally disappointing. Although agriculture was in fact growing, there was too little productivity growth to prevent mounting rural poverty and malnutrition given increasing population levels (Haug and Øygard).

Gradually, it became apparent that agricultural growth was necessary for overall economic growth. As a result, much of the developments in agricultural policy in Asia during the course of this past decade have been to undo these early attempts at economic autonomy, in a move to erase the so-called "bias against agriculture" and help promote a healthier rate of agricultural and overall economic growth. As Romeo Bautista points out in his seminal article *Development Strategies, Industrial Policies, and Agricultural Incentives in Asia*: "Malaysia kept tariff protection for domestic industry low, even in the early years of its industrial development, did not impose exchange controls, and rarely adopted quantitative restrictions." This liberal trade policy "was important in the continuing expansion of Malaysia's primary exports and contributed to the rise of significant export manufacturing sector" (1993).

1.7.1 Trade liberalization

The 1990s have seen the rise of globalization and the trade liberalization paradigm.

One of the goals of liberalization is to reduce agricultural protection in industrialized countries to the levels applied to manufacturers and decrease the anti-agriculture bias in developing countries induced by industrialization strategies promoting high-tariff walls and quotas (Hoekman and Anderson 1999)[20]. In South Asia, tariffs against imports generally average around 70 percent (DeRosa and Govindan 1995). It is important to note that for trade liberalization to work, as Hoekman and Anderson imply, exporter and importer must work together.

The objectives of these reforms are twofold: first, to attract foreign direct investment in the hope of promoting new technologies; and second, to allow market forces to determine the price (Pyakural 1999). It is estimated that the rise in world prices for agricultural commodities arising

[20] http://www.u-fondet.no/diskusjon/mai/messages/14.html

from trade liberalization is fairly modest, ranging from 2 to 5 percent as a whole, with the highest levels for wheat, sugar, and dairy products at 5 to 10 percent (Robinson and DeRosa 1995).

While agriculture is only an element of any trade liberalization agreement, it is traditionally the most disputed sector of any agreement, because of the importance of food security in boosting political stability (Scollay and Gilbert 1999). However, with the rise of trade liberalization, the concept of food security, once the cornerstone of Asian agricultural policy, is changing from a focus on self-reliance at the country level to a focus on global trading systems (Pyakural 1999).

In an apparent effort to promote trade liberalization, many of the Asian subregions have developed regional trading agreements. The Association of South East Asian Nations (ASEAN) has developed AFTA (ASEAN Free Trade Area), and the South Asian Association for Regional Cooperation (SAARC) has developed SAFTA (SAARC Free Trade Area—also referred to as SAARC Preferential Trading Agreement or SAPTA). The Asia-Pacific Co-operation (APEC) is also promoting trade liberalization but has taken a less regional approach to trade liberalization.

SAPTA is intended to be a regional trade agreement which would set preferential tariff rates for all imports, including agricultural products, from other South Asian countries but not for imports from countries outside the Indian subcontinent. There has been some delay in the implementation of this agreement, but it is scheduled to go into effect by 2001. There is a feeling by some that SAARC would achieve much larger gains in trade by intensifying their efforts to integrate the South Asian economies with the world or the APEC region, rather than limiting itself to just the South Asian subregion (DeRosa and Govindan 1995). Progress on SAPTA has been hampered by the ongoing disputes between Pakistan and India.

Likewise, AFTA is intended to be a regional trade bloc. AFTA is more developed than SAFTA, due to greater levels of economic growth and less political dispute. Under AFTA, the six most developed members must cut all tariffs to between 0 and 5 percent by 2003. Interestingly, 80 percent of the reductions have been implemented as of January 1, 2000. There have nevertheless been a recent number of disputed issues, and there is the sentiment that AFTA will never get off the ground (*Asia Week* August 18, 2000).

In 1994, APEC agreed to liberalize trade in the Asia–Pacific region by 2010 for industrialized economies and 2020 for developing economies. Though there was much discussion about whether agricultural products should be included in this free agreement, it was eventually included in the interest of "comprehensiveness." A recent set of studies indicate that agricultural liberalization would account for 50–70 percent of the total potential welfare gains available from APEC liberalization (Scollay and Gilbert 1999). Some optimistically suggest that a free trade scheme in APEC could make APEC an expanding market for cereal crop and also expand the markets for meat, dairy, and other consumer-ready products (Chang and Hsu 1999). Others pessimistically note that although the APEC trade liberalization program may produce only modest results, that is no dynamic for substantial liberalization among its members (Oxley 1998).

Despite the benefits of trade liberalization, there are barriers to its effective implementation. First, even when tariff barriers are eliminated, non-tariff measures may become more prominent

in restricting the products (Onchan 1997). In particular, attempts by developed countries to create environmental or social standards have become particularly controversial in recent years (Hoekman and Anderson 1999) and developing countries would need to guard against this. Likewise, the issue of sanitary requirements may have an adverse effect on the expansion of agricultural exports, as these can be somewhat subjective factors (Onchan 1997). Developing countries will need to continue to argue against import restrictions being allowed on products produced by methods not liked by importing countries; otherwise, there would be no end to restrictions being imposed on such grounds (Hoekman and Anderson 1999). Second, trade liberalization cannot occur in a vacuum; it requires that developed countries decrease the levels of agricultural protectionism. As Hoekman and Anderson underline: "As far as multilateral trade [liberalization] agenda is concerned the focus should be on reducing further agricultural protection in industrialized countries so as to give developing country farmers better access to export markets" (Hoekman and Anderson 1999).

Thus, given the inherent deceptiveness of any tariff agreement and the necessity for bilateral agreement, trade liberalization requires levels of analytical and negotiating resources that developing countries often lack. This has made a number of countries hesitant about a comprehensive new trade round and is one reason why further negotiations should be expected to take a substantial amount of time (Hoekman and Anderson 1999).

Ruth Haug and Ragnar Øygard in their white paper *Trade Liberalization in Agriculture: Consequences for Growth, Poverty Reduction and Environment in Developing Countries*[21] make the following conclusions:

> Multilateral trade liberalization is no panacea to the ills of poverty and environmental degradation. In many countries reforms are underway that imply more open trade regimes and less discrimination of agriculture. As these reforms lead to increased supply from agriculture, the access to export markets and international trade regimes becomes more important to the developing countries. The short-term effects of further multilateral liberalization may, however, be negative for net food importing developing countries. The initial outcome may be increase staple food prices, increased food import bills and reduced food aid. Those developing countries, which presently enjoy trade preferences, will see the value of these being eroded when general trade restrictions are reduced. Moreover, producers in the least developed countries face numerous constraints that restrict their ability to respond rapidly to new relative prices. Their potential for becoming net agricultural exporters may therefore be slow in materializing.

1.7.2 Agricultural Subsidies

In the past, Asian countries subsidized agricultural inputs such as fertilizers and pesticides in order to counterbalance the discrimination of trade against agricultural production (Bautista 1993). As Parday and Fan noted, on average 20–60 percent of the government's investment in agriculture was devoted to these forms of subsidies. Although subsidies continue to play an important role in Asian agriculture, an accumulating body of evidence suggests that these kinds

[21] http://www.agronor.org/en/Haug.htm

of policy measures have outlived their usefulness (Morris and Byerlee 1998). Agricultural subsidies reduce farmer incentives for improving input use efficiency. Where prices for fertilizers or pesticides are kept low through government intervention, farmers do not have the incentive to spend the time to learn about methods of increasing technical efficiency (Pingali 1998). Subsidies help to keep the cost of production and food prices low but encourage high levels of input use, which may be economically and environmentally unsustainable.

There has been considerable headway made on this subject during the 1990s, and the focus of agricultural policy has shifted from generating food surpluses to maximizing farm household incomes (Pingali 1998).

While decreased subsidies may lead to the increased levels of economic and environmental sustainability of agriculture, Garforth and Lawrence suggest that reduction of input subsidies alone is unlikely to ensure environmental sustainability: "Where subsidies have been reduced or removed, the driving force has been a move towards liberalization of markets and removal of distortions in trade rather than to encourage a more environmentally appropriate use of agricultural inputs."

1.8 Trade

An overview of the trends in agricultural exports during the 1990s can been seen from the tables below, which come from the WTO publication, *Agricultural Trade Performance by Developing Countries 1990–1998* (WTO 2000).[22]

From these tables, it is evident that trade with the developed world, while accounting for about 55 percent of agricultural trade in developing Asia, grew by 23.7 percent.[23] Trade with the developing world increased by 69.3 percent, though intraregional trade accounted for most of this. Agricultural trade with most regions, except the transition economies, gradually increased in the 1990s. The only other exception to this growth was a decrease in exports to Japan and developing Asia during the crisis years, which would nonetheless have had an impact given that these two regions account for 66 percent of Asia's exports. In fact, agricultural exports dropped by 12.9 percent overall from 1996 to 1998.

[22] http://www.wto.org/ddf/ep/E2/E2147e.doc

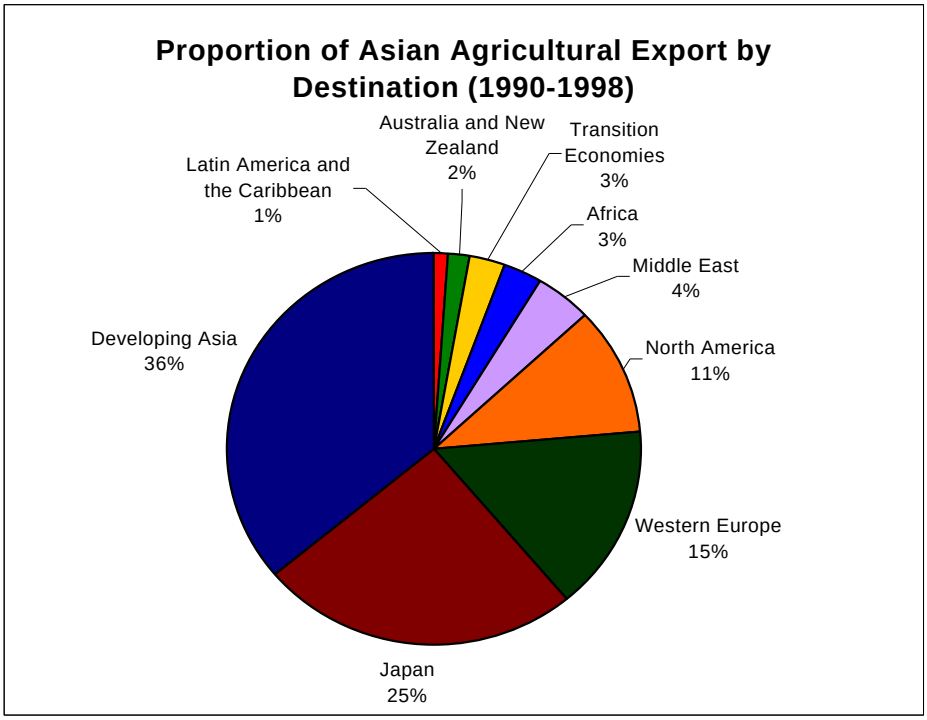
[23] Though trade from developing Asia increased by 64.9 percent to North America from 1990 to 1998. Accounting for 10 percent of Asian exports in 1990, it now accounts for 12 percent.

Exports of Agricultural Products by Destination (Million US$)

Year	North America	Western Europe	Japan	Australia and New Zealand	Transition Economies
1990	5,160	8,710	12,890	790	3,070
1991	5,700	9,080	14,580	800	1,970
1992	6,360	9,520	15,130	880	1,730
1993	6,350	8,940	16,370	900	1,840
1994	7,140	10,340	19,180	1,100	1,470
1995	7,920	11,580	20,330	1,210	1,870
1996	8,320	11,350	20,130	1,160	1,790
1997	8,370	11,410	17,510	1,160	2,060
1998	8,510	11,930	14,620	1,190	1,630

Year	Africa	Developing Asia	Latin America and the Caribbean	Middle East
1990	1,370	16,060	640	2,190
1991	1,690	17,330	690	2,580
1992	1,730	19,100	650	2,900
1993	1,820	19,180	630	2,740
1994	1,910	25,380	710	2,570
1995	2,390	30,830	870	3,380
1996	2,150	31,300	900	3,500
1997	2,210	30,810	960	3,430
1998	2,320	26,740	930	3,330

Breaking these figures down, we can see that developing Asia exports mostly to itself and to Japan, with exports to Western Europe and North America of secondary importance.



Source: WTO 2000

1.9 Marketing

In the paper, *Role of Wholesale Markets in Agricultural Development in Asia and the Pacific*, T.C. Ti suggests that the growth and improvement of marketing systems in Asia have been uneven. In many cases, Asian markets have lagged behind advances in both production and demand. The results of this have been the buildup of public food grain stocks while average consumption remained low, scarcities of food grains in deficit areas in spite of the pervasive presence of public distribution systems, alternating gluts and shortages of many culturally essential commodities in the Asian diet, limited access to markets, and high post-harvest losses (Ti 1997).

Given the move towards liberalization of agricultural markets, the open market systems will need to play a bigger role in price determination and investment flows. In order to achieve this, Ti suggests that marketing efficiency should be targeted and Asian governments should strengthen "the legal frame work; increase regulation of markets; improve and safeguard competition through anti-trust laws; promote private enterprise and ensure ease of entry into trade; invest in the physical infrastructure and improve marketing services" (1997).

1.10 Other trends

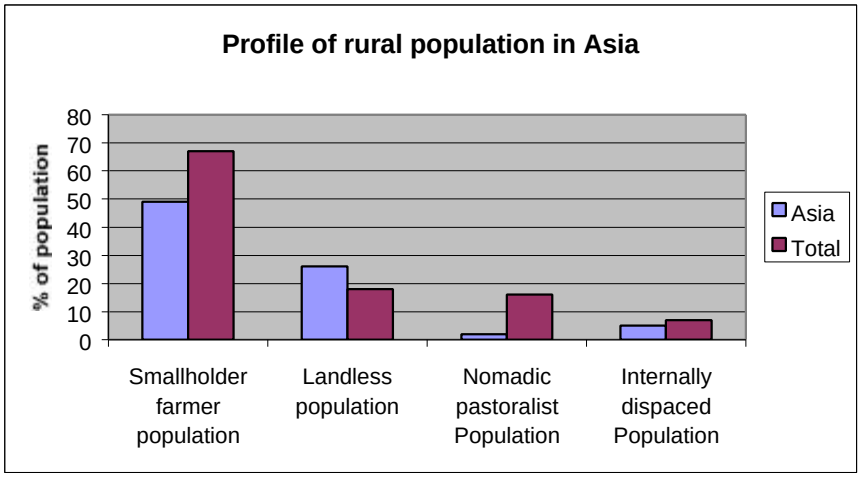
1.10.1 Land Tenure

Owner cultivation is the most prevalent form of land tenure in Asia and accounts for approximately 70–85 percent of land holdings, the remaining 15–30 percent is lease-in land (S. Lastarrua-Cornheil and J. Melmed-Sanjak 1999)[24].

It is generally agreed that farmers will apply agricultural inputs more intensively under share owner cultivation than tenancy (S. Lastarrua-Cornheil and J. Melmed-Sanjak 1999). Though some agricultural inputs can be detrimental if used in excess, in general the use of agricultural inputs implies that farmers are managing the land with the future in mind. Interestingly, this generalization that sharecroppers apply less agricultural inputs does not always apply in Asia. This discrepancy appears to be due to the fact that much tenancy is intrafamilial, and kin sharecroppers are more likely to apply greater inputs into leased land than would non-kin sharecroppers (S. Lastarrua-Cornheil and J. Melmed-Sanjak 1999). Thus, given the high levels of owner cultivation and intrafamilial tenancy in Asia, this appears to add an element of sustainability to agriculture.

For a profile of the nature of landholdings in Asia, refer to the table below.

[24] http://www.wisc.edu/ltc/wp27.html



Source: Abdouli 1994

1.10.2 Upland agriculture

One of the biggest challenges facing Asian agriculture in the new millennium is developing highly productive agricultural systems on Asia's presently underdeveloped rainfed uplands (Uexkull 1998). The Green Revolution strategy of increasing productivity has focused on the rice-growing lowlands. While the demand for rice in relative terms is diminishing, demand for coarse grains, pulses, animal products, and vegetables is increasing. At the same time, given the large potential for food production in the uplands, the greater levels of social inequity found in these regions, and the inflexibility of rice cropping systems to adapt to other cultures, it would seem that the uplands might represent a new frontier for Asian agriculture (Uexkull 1998).

There is evidence that tropical uplands can produce yields of 4 t/ha rice and 1.5 t/ha soybean annually. Other upland systems including tree crops and horticulture offer similar production potentials which would allow sustainable family incomes of US$2000–4000 per annum for smallholders in areas that are currently marginalized (Uexkull 1998).

It is important to note, however, that upland soils are often acidic and highly susceptible to erosion. Thus, before any agricultural upland expansion can take place, strong soil conservation measures must be in place to avoid losses in surface runoff and in eroded soil (Uexkull 1998). Case studies in the Hindu Kush and Philippines show that upland agriculture can be sustainable (Tulachan 1999[25]; Burton 1993[26]). They show that agricultural transformation of some of the mountain areas have shown how farming of high-value cash crops has increased food security and employment, thus improving the living conditions of mountain people; however, great

[25] http://www.icimod.org.sg/publications/IMD/imd99-2.htm

[26] http:/www.pressasia.org/PFA/archive/BURTON.html

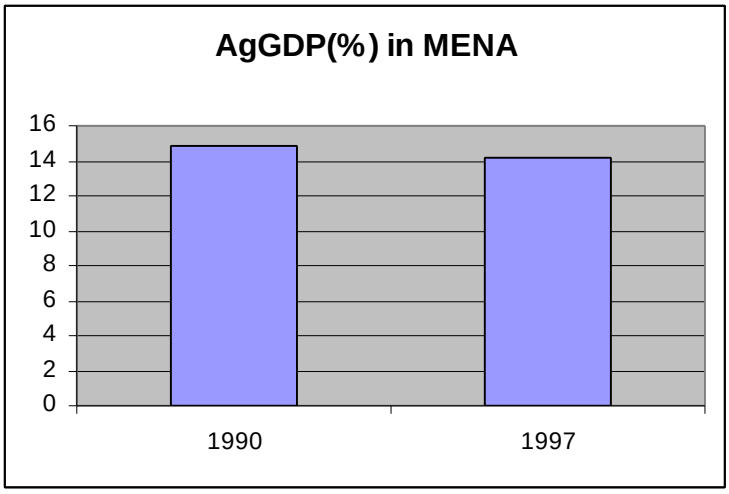
attention needs to be paid to avoid planting on marginal land without soil enhancement—otherwise, productivity will decline over time (Tulachan 1999).

Unfortunately, there has been very little government support for agriculture in the uplands and thus low professional and financial prospects for research working in these areas (Uexkull 1998). Given increasing population numbers in Asia and the lack of land currently available for agriculture, it is likely that there will be a move to the uplands one way or the other. If it is haphazard, it could lead to environmental degradation with very little increase in agricultural production. But with a shift in policy and concomitant focus on upland research, the uplands could perhaps serve as a valuable means of expansion.

II. MIDDLE EAST AND NEAR EAST

2.1 Agricultural Production

Despite the prominence of petroleum in the Middle East and North Africa (MENA) economies, the agricultural and rural population still accounts for 40 to 60 percent of the inhabitants in the MENA countries. Furthermore, a substantial share of overall employment—even though the share of agriculture in gross domestic output is fairly low (DeRosa 1997)—is currently about 14 percent.



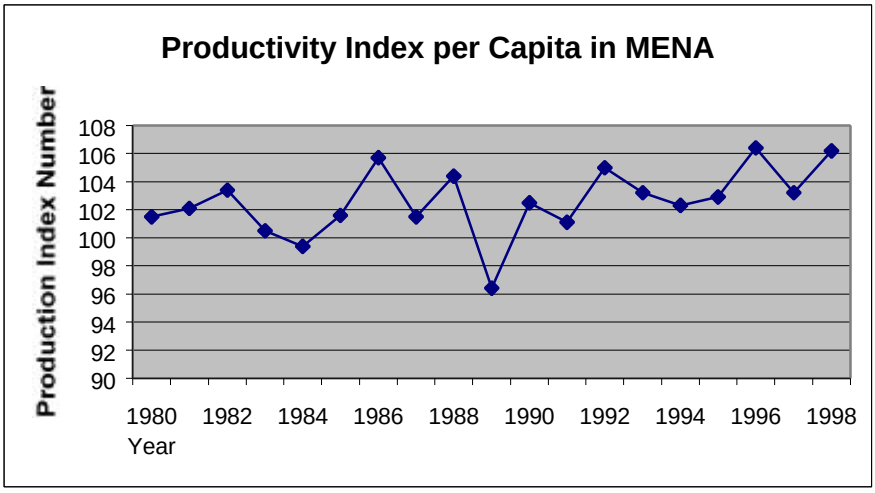
Source: World Bank Country Tables

The primary regions of agricultural production in MENA are Turkey, Iran, Syria, and Iraq in the Middle East and Egypt, Morocco, and Sudan in North Africa (DeRosa 1997).

While most MENA countries have recorded sizeable expansion in agricultural production over the past decade, when this is translated into per capita terms, agricultural performance appears less positive. Only Iran and Egypt have achieved clear and relatively consistent gains in per capita production (FAO 1998)[27]. Overall, agricultural production increased at an average annual rate of more than 3 percent. But amid sharp weather-induced yearly fluctuations, affecting particularly some Northern African countries, overall production has been erratic (FAO 1999b)[28].

[27] http://www.fao.org/docrep/w9500e/w9500e10.htm

[28] http://www.fao.org/docrep/meeting/X3150e.htm



Source: FAO

The combination of increasing demand for food and decreasing resources for agriculture has overwhelmed the region's capacity to meet its demand for more and different foods. Although agricultural growth has kept up with overall economic growth in the region, it has not grown by more than 2 percent above the population rate, which as was noted earlier is a level considered necessary to contribute to both the national and rural economies (DeRosa 1997). In fact, the region's agricultural growth appears to have barely kept ahead of its population growth in the 1990s, and the difference is remarkably lower than the other Asian subregions[29].

	Annual Agriculture growth rate	Annual Population growth	Difference
Near East	2.55	2.46	0.09
South Asia	2.86	1.70	1.17

Calculated from FAO figures

As a result of the "less than robust performance of the agriculture sector" (DeRosa 1997), food and agricultural imports in MENA grew 3.6 percent per year during the 1990s (Kurtzig 1999)[30]. The region has traditionally had the highest rate of per capita food imports in the world (Abdouli 1994) and most MENA countries except Israel and Morocco are structurally dependent on food imports.

[29] Calculated from 1990 to 1997 using FAOSTAT figures. Even using the 3 percent growth rate quoted from a 1999 report, the difference would still be "less than robust."

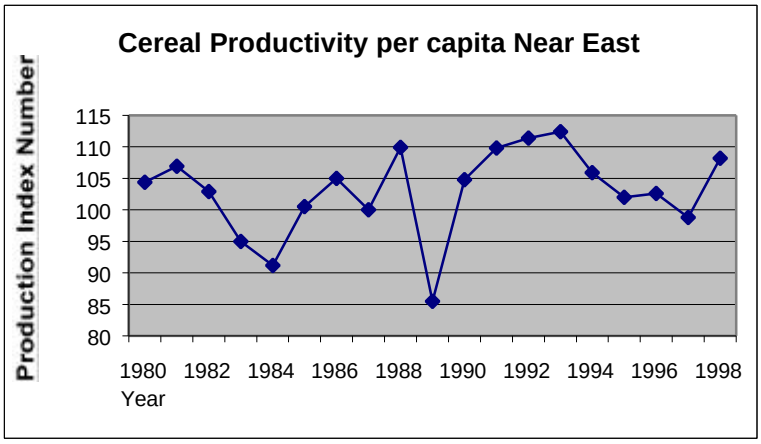
[30] http://www.awo.net/newpub/pubs/tradelin/990906a.asp

Hence, countries in MENA are vulnerable to fluctuations in price of foodstuffs, due to the market changes for importing countries or the weather in producing countries (El-Erian et al. 1996)[31].

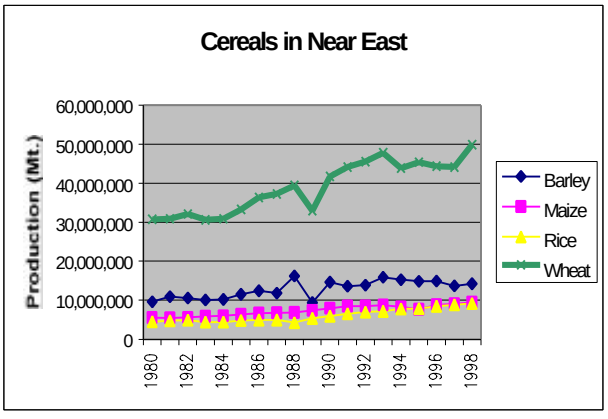
2.1.1 Cereals

Cereals account for 38 percent of all agricultural production in the region, which makes them, along with fruits and vegetables, the major agricultural commodity (DeRosa 1997). Saudi Arabia, Turkey, Egypt, and Sudan are the primary cereal exporters (DeRosa 1997).

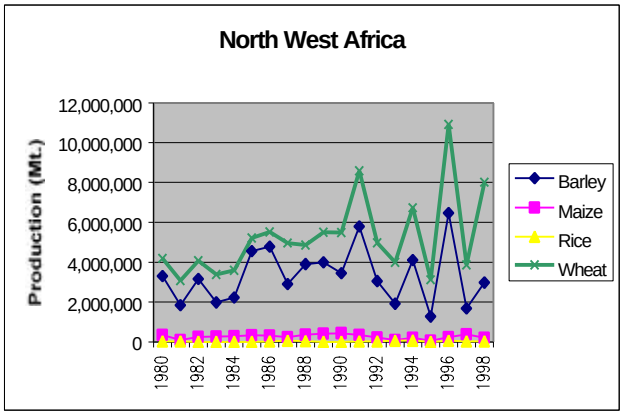
Despite their importance, per capita cereal yields have been erratic over the past 20 years, and there has been a notable decline during the 1990s.



The decrease in cereal productivity per capita during the 1990s is largely due to a leveling off in performance and an accompanying rise in population, as can be seen in the graphs below.



Source: FAO



Source: FAO

[31] http://www.imf.org/external/pubs/ft/mena/00mena.htm

Wheat is the dominant cereal crop of this region, and production since 1980 grew almost as quickly as in Asia. MENA does not produce enough wheat to feed the region—wheat provides 44.3 percent of the region's total food supply—and must rely on imports (CGIAR).

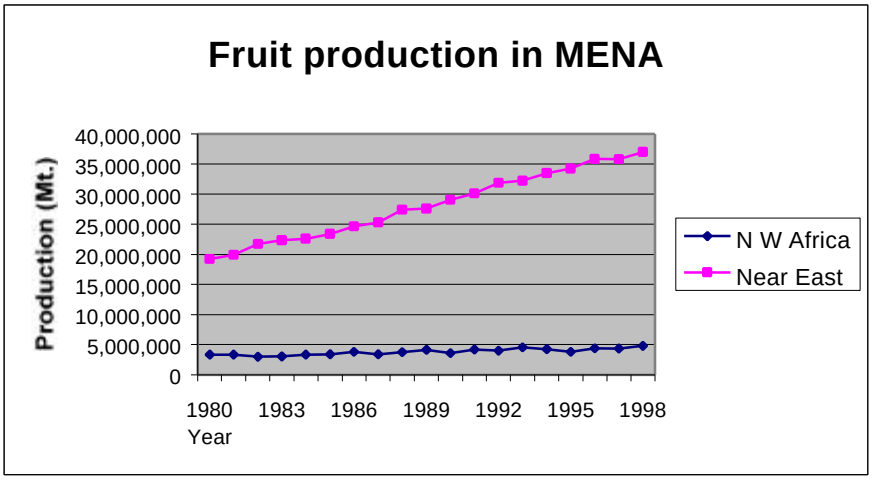
Barley is the second most important crop of the region, and MENA remains the world's primary producer of barley. However, per capita output remained basically unchanged between 1990 and 1998 as the already low share of domestic food consumption continued to decline, in favor of more feed use (CGIAR).

Although rice and maize are of lesser importance in MENA's agricultural economy, they have nonetheless shown increased levels of production over the past 20 years. Production of maize has more than doubled over the past 20 years, mainly due to yield increases. Rice production increased by a more modest 50 percent, but yields were very respectable. Maize and rice provide 4.9 and 6.3 percent respectively of the region's calorie supply (CGIAR).

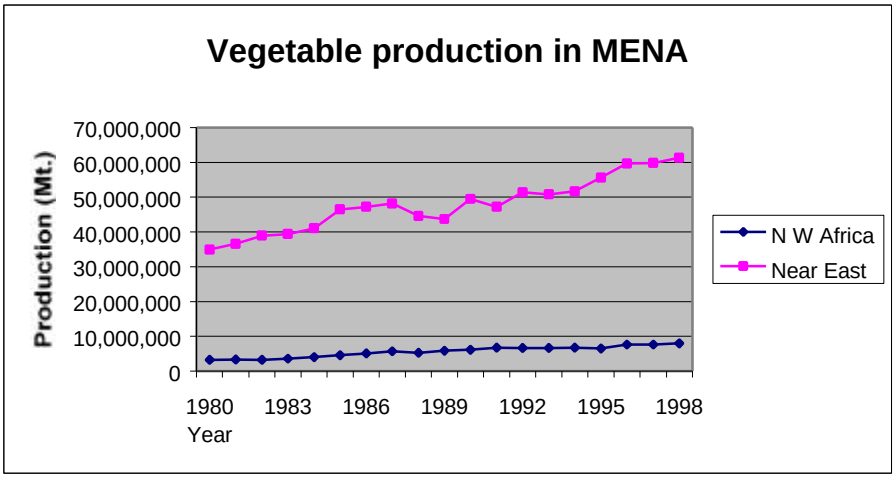
2.1.2 Vegetables and Fruits

Fruits and vegetables—high-value products—account for about 38 percent of the agricultural production in the MENA region and command a larger share of total agricultural output in MENA than in all other regions of the world. The largest exporters of fruits and vegetables are Iran, Israel, Turkey, Egypt, and Morocco. However, with the exception of Iraq, Kuwait, Algeria, and Libya, most MENA countries exhibit strong comparative advantage in fruits and vegetables (DeRosa 1997).

Despite the fact that there is little intraregional trade in MENA, approximately 50 percent of all fruits and vegetables are imported from within the region (DeRosa 1997), thus not only providing growth for the exporting countries but also strengthening regional trade.



Source: FAO

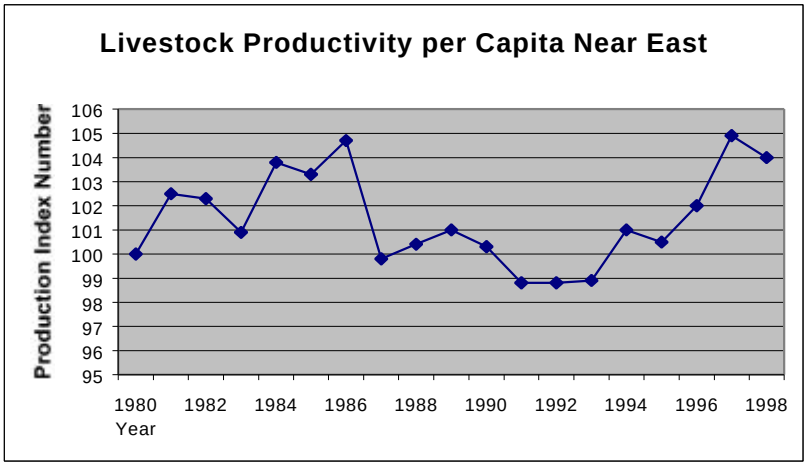


Source: FAO

2.1.3 Livestock

Meat and dairy products account for about 12 percent of the agricultural production of the region, primarily as milk and poultry products (De Rosa 1997). Livestock production per capita, as shown in the graph below, has risen steadily over the decade from a low point in 1990.

While most countries in the region have experienced a modest increase in per capita consumption of meat over the last 10 years (FAO 2000), there is expected to be some resumption of the growth of meat consumption, particularly poultry, in the near future (FAO 2000).



Source: FAO

Though pastoralism traditionally dominated MENA's agricultural sector, its role has now greatly diminished. Traditional pastoralism and mixed farming continue to exist, but economic expansion has fostered a new reliance on industrial production (Delgado et al. 1999) based on

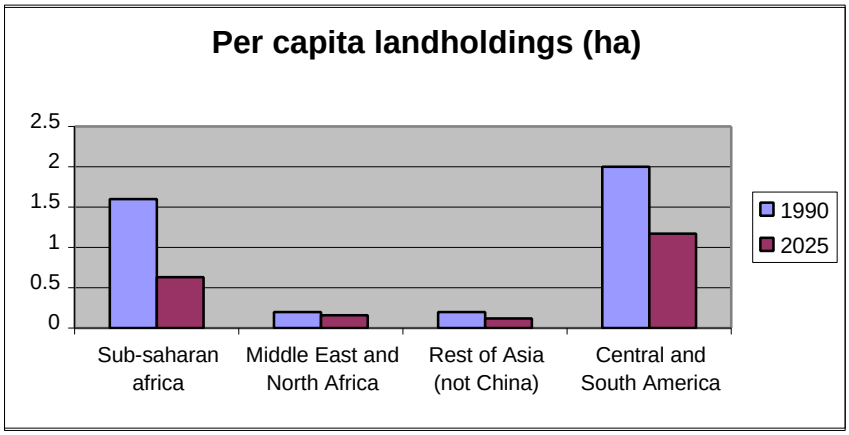
imported feedgrain—most MENA countries lack the capacity to produce substantial amounts of feedgrain at competitive prices (Delgado et al. 1999). It would seem likely that this transition period partially explains the drop in production from 1987 to 1993.

2.2 Factors affecting production

2.2.1 Land Availability

Only 30 percent of the surface area in MENA is suitable for agriculture (Furtado et al. 1995); the rest is covered by desert and arid stretches (Abdouli 1994). Without further irrigation, there is virtually no spare land available for agricultural expansion in Near East/North Africa regions (FAO 2000). Limited access to land is further exacerbated by land degradation and desertification in the majority of the Near Eastern and North African countries (Abdouli 1994).

Average farm size in MENA is small. In 1990, the average farm size was 0.20 hectares; this was estimated to drop 0.16 hectares by 2025, as can be seen in the graph below (Scherr 1999). While slightly larger than farm sizes in East and South East Asia, farms in the MENA region are nonetheless remarkably small. Decreasing farm size and fragmentation brings up the question of farm efficiency.



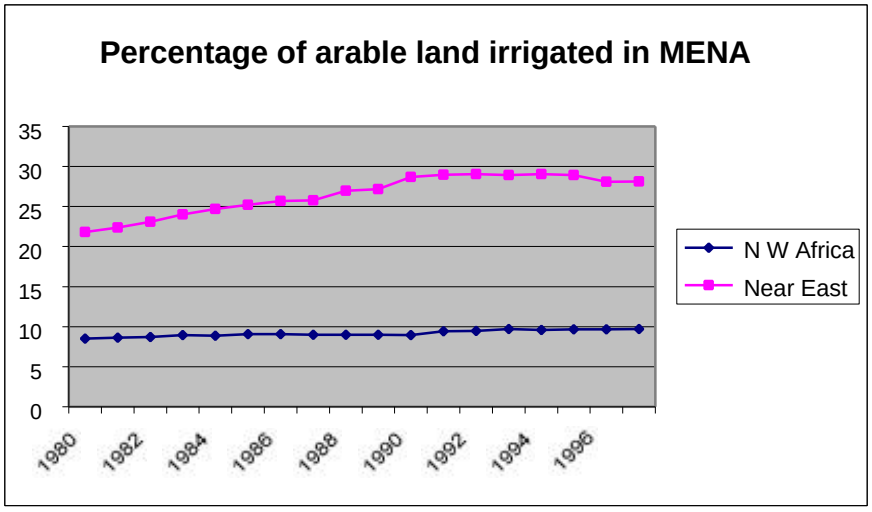
2.2.2 Water

Water—not land—is the limiting factor for agriculture in the MENA region.

Agriculture consumes more than 85 percent of the water demand in MENA countries, yet all countries except Turkey had an internal renewable water resource per inhabitant below 2000 m3/inhabitant/year (FAO AQUASTAT)[32]. Two thousand m3/inhabitant/year is considered by the

[32] http://www.fao.org/ag/AGL/aglw/aquastat/N_eastE.htm

FAO to be an indicator for water scarcity. Thus new irrigation development in the region has been limited in recent years (CGIAR 1996) as the accessible water sources have already been tapped and the remaining sources are expensive to develop (FAO AQUASTAT). Consequently, without improving water efficiency, any extension of existing irrigation would require fossil or nonconventional water (FAO AQUASTAT).



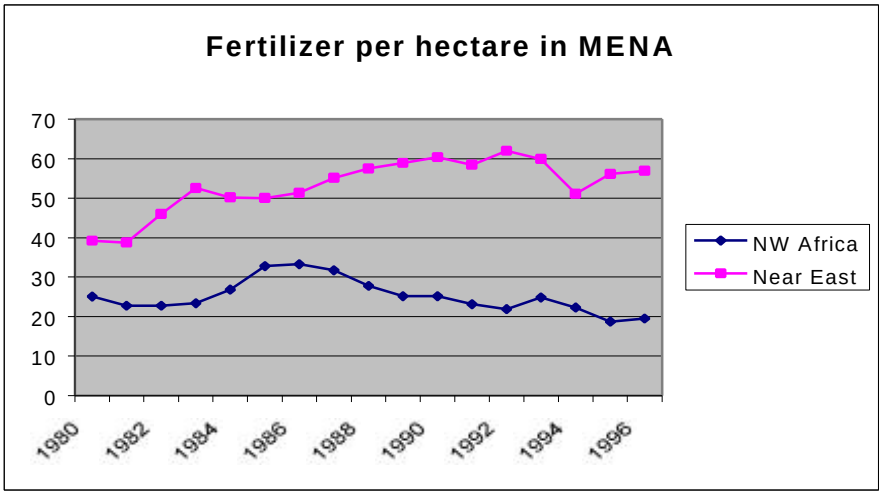
Source: FAO

Even if irrigation levels could increase, it was estimated by the FAO "that the amount of water which would be required to produce the net amount of food imported in the region in 1994 would be comparable to the total annual flow of the Nile River at Aswan" (FAO 1999c).

Given that farm irrigation is typically only 50 percent efficient, most experts seem to agree that improving efficiency of water use, not increasing the amount of irrigation, should be the goal (van Tuijl 1993). It is expected that demand management and micro-irrigation will play an important role in improving irrigation in water-scarce regions (FAO 1999c).

2.2.3 Fertilizers

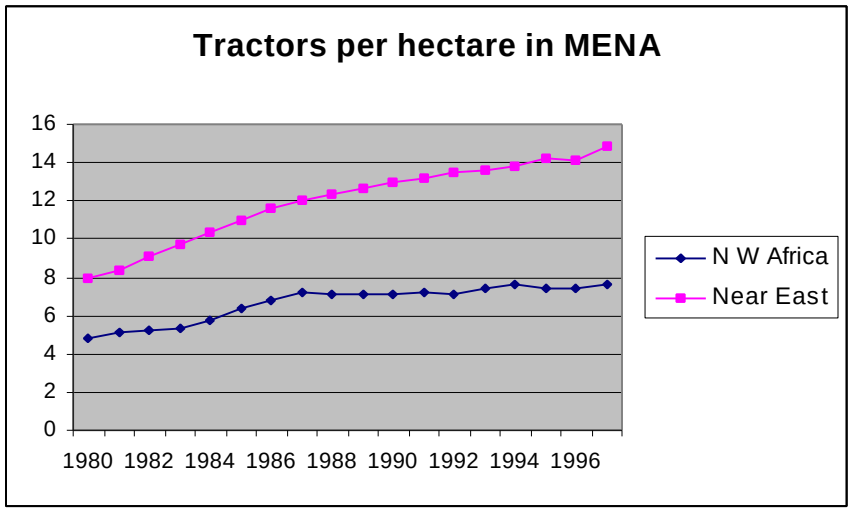
Though there is little information on the subject, fertilizer rates are significantly lower than those of Asia. See chart below.



Source: FAO

2.2.4 Mechanization

The number of tractors per arable hectare has been growing steadily in the Near East region and is considerably higher than levels in Asia, suggesting that the region is evolving to deal with reduced labor levels.



Source: FAO

2.2.5 Infrastructure

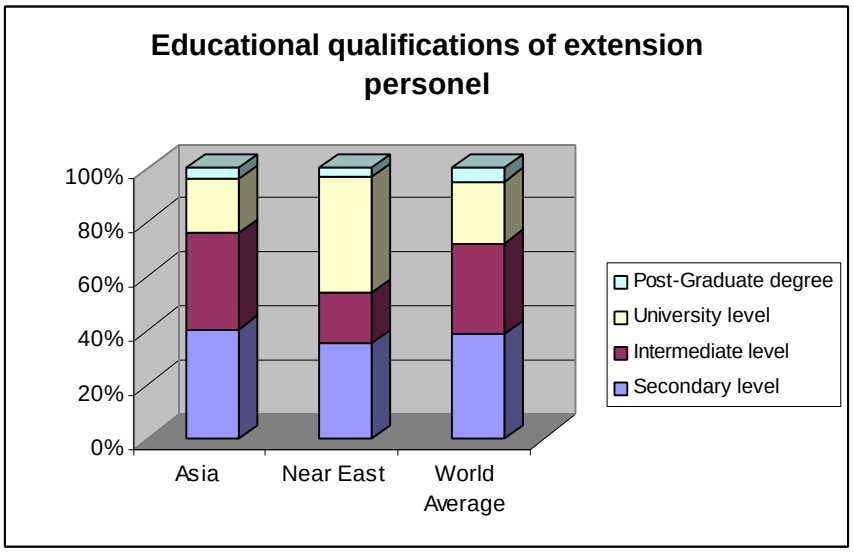
While there has been a healthy development of the infrastructure in most MENA countries, in general this development has excluded the rural areas and has focused mostly on urban centers

(Abdouli 1994). Poor rural infrastructure reduces the efficiency of moving agriculture produce to the market and providing agricultural inputs to the farmers.

2.3 Agricultural Support

Agricultural extension services are generally weak in MENA countries, partly because most government agencies follow a narrow discipline-oriented approach and partly because these services are poorly linked to research and local communities (Furtado et al. 1995).

However, extension agents are often better educated than their Asian counterparts, with many more extension agents in possession of a university-level degree (Jalil 1993).



Source: Jalil 1993

Furtado, van Schoonhaven, and Hamed in their document *Sustainable Agricultural Development in the Dry Areas of West Asia and North Africa* recommend that "[r]esearch priorities, educational curricula and the nature of agricultural advice thus needs to be revised especially on the basis of interactions between economics and ecology," and they go on to add that "comprehensive extension services using appropriate technologies with adequate international support could help address some of the challenges in agricultural development and environmental management" (Furtado et al. 1995).

2.4 Agriculture and the Environment

Along with water shortages, soil degradation has been a dominant problem in recent years. Much of the land in MENA is either desertified or vulnerable to desertification. Degradation is taking place at an alarming rate, due to climatic changes, overgrazing, inappropriate agricultural practices, and poor soil and water conservation techniques (UNEP 2000). Forty percent of the

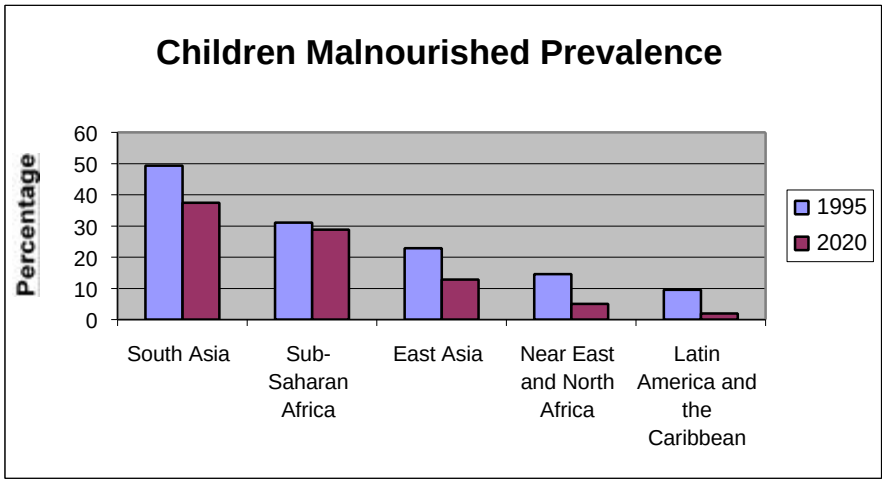
irrigated land, 70–85 percent of the rainfed cropland, and 85 percent of the rangelands are affected by desertification to varying degrees (Furtado 1995).

Deterioration of rangeland and farm productivity is forcing farmers either to cultivate on increasingly marginal land that was until recently not cultivated or to abandon agricultural land and migrate to cities. And in turn "[f]ertile agricultural land around major cities has been lost to urbanization, industrial establishments and transportation infrastructure" (UNEP 2000).

Given the high levels of irrigation in the region, MENA has the highest levels of salinization in the world (FAO 2000).

2.5 Child malnutrition

Child malnutrition is much less of a problem in MENA than it is in the rest of Asia, and prevalence was only around 15 percent in 1995 and is expected to drop to 5 percent by the year 2020.



It is also notable that women's education level—not food availability—remains the most potent force for reducing child malnutrition in the region (Smith & Haddad 2000).

2.6 Investment Flows in Agriculture

There is little information on the state of agricultural investment in the MENA region. However, in a paper presented in the World Food Summit, *Investment in Agriculture: Evolution and Prospects*[33], the FAO predicted that investment in primary agriculture in MENA would drop from 1988–92 levels of $5.3 billion per year to $2.5 billion per year during 1993–2013, a drop of about 50 percent (FAO 1996). Compared to Asia's registered decline in

[33] http://www.fao.org/wfs/final/e/volume2/t10tb3-e.htm

agricultural investment and predicted 7 percent drop[34], this would make MENA the region with the largest drop in agricultural investment in the developing world.[35]

2.7 Agricultural Policy

Like Asia, MENA countries have typically tried to enforce higher rates of protection for manufactured goods (DeRosa 1997). Most of the region has average tariff rates exceeding 20 percent and average non-tariff barrier (NTB) rates widely exceeding 30 percent (DeRosa 1997). Import substitution policies and inflationary monetary and fiscal policies, with the objective of shifting resources to production of manufactured goods and away from agriculture, are common (DeRosa 1997).

In addition, MENA countries also tend to enforce high rates of protection for food, frequently by administering protection measures, reflecting national concerns for food security. However, as has been seen in Asia, efforts to achieve food self-sufficiency drain resources from more internationally competitive subsectors of agriculture (DeRosa 1997).

Of all the developing regions, MENA has participated the least in the move towards the globalization process (El-Erian 1996). As of 1997, however, most countries in the region have in fact started pursuing market liberalization and deregulation policies. But progress has been uneven, and in some cases governments have reintroduced or reinforced previous protectionist practices (FAO 1998).

However, De Rosa in his paper *Agricultural Trade and Rural Development in the Middle East and North Africa: Recent Developments and Prospects* states that "trade liberalization in MENA that encompasses trade with the European and the region's other principal trading partners is likely to hold the promise of substantially larger and dependably significant gains to MENA agriculture and surrounding rural economies" (DeRosa 1997).

2.8 Trade

Agricultural imports in MENA have grown from an estimated $26.7 billion in 1990 to $34.5 billion in 1997, rising on average 3.6 percent per year (Kurtzig 1999). On average, food imports represented 15–20 percent of total imports for the region over the past two decades, with some countries importing considerably more (Kurtzig 1999).

An overview of the trends in agricultural exports during the 1990s can been seen from the tables below, taken from *Agricultural Trade Performance by Developing Countries 1990–1998* [36].

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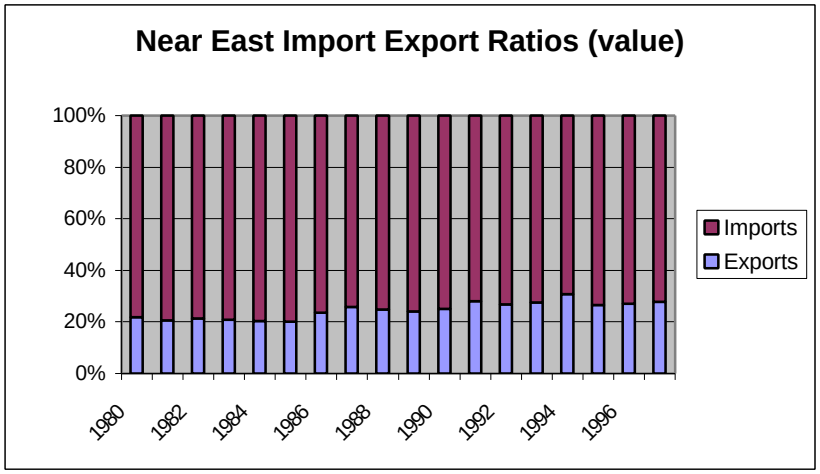
[34] http://www.fao.org/wfs/final/e/volume2/t10tb3-e.htm

[35] It is important to note that the agricultural investment discussed in this paper includes private and public investment and thus cannot be compared with the levels quoted by Fan and Parday.

[36] http://www.wto.org/ddf/ep/E2/E2147e.doc



Source: FAO

These tables illustrate that trade to the developed world, while accounting for about 52 percent of agricultural trade in developing Asia, decreased by 14.57 percent. Trade to the developing world increased by 136.56 percent, though, as with Asia, intraregional trade accounted for most of this growth. Agricultural trade to most regions, except for the transition economies, gradually increased in the 1990s. Trade to transition economies, which accounted for 15 percent of agricultural exports in 1990, dropped to 3 percent by 1998.

Exports of Agricultural Products by Destination (Million US$)

Year	North America	Western Europe	Japan	Australia and New Zealand	Transition Economies
1990	130	2,130	80	20	660
1991	120	1,930	80	10	330
1992	130	1,950	80	10	290
1993	140	1,790	80	20	280
1994	130	2,200	110	20	260
1995	150	2,380	130	20	280
1996	170	2,470	130	20	290
1997	190	2,200	130	20	210
1998	220	2,060	110	10	180

Year	Africa	Developing Asia	Latin America and the Caribbean	Middle East
1990	100	190	40	1,010
1991	180	240	40	940
1992	150	350	50	1,550
1993	110	430	40	1,700
1994	210	490	70	1,880
1995	250	490	50	1,990
1996	280	400	60	2,140
1997	300	490	50	2,330
1998	260	400	60	2,450

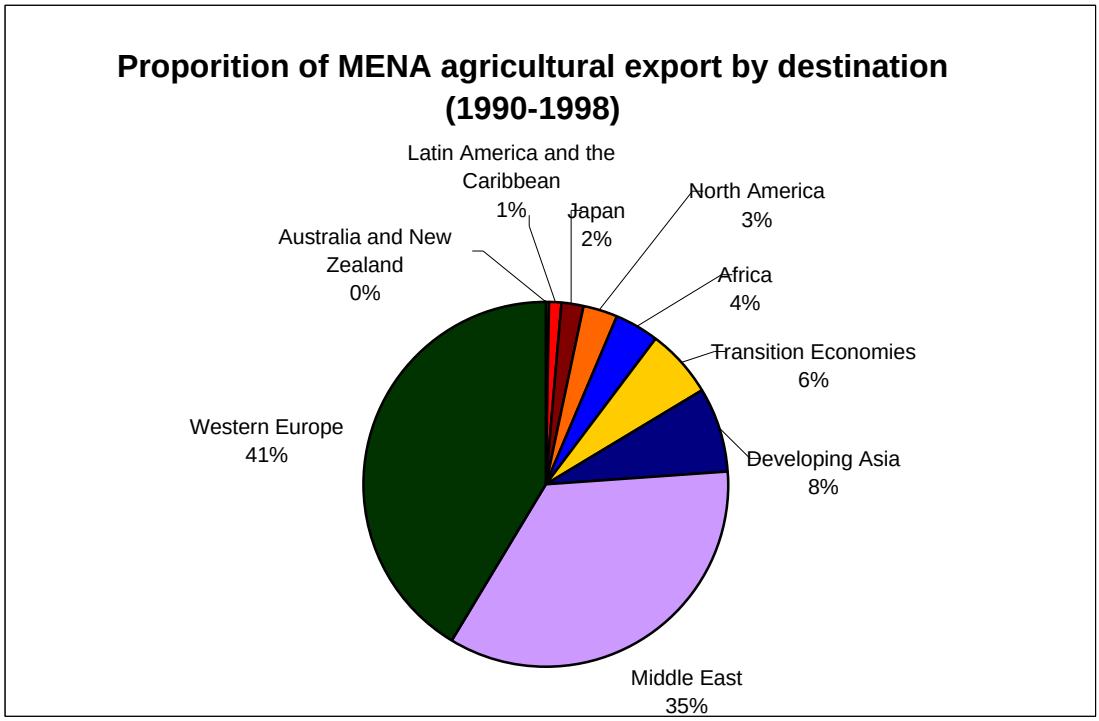
Source: WTO, 2000

From these figures, illustrated in the chart below, it is apparent that MENA exports mostly to Western Europe and MENA (Kurtzig 1999)[37]. Economic relations with Europe are of fundamental importance (FAO 1998), though the role of the European market has declined over the decade, falling from 50 percent of agricultural trade in 1990 to 36 percent in 1998.

Despite the fact that intraregional trade constituted only 9.5 percent of MENA's total trade (Beshara 1999)[38], it accounts for nearly 50 percent of all fruits and vegetables imported (De Rosa 1996). In fact, intraregional trade has grown from 23 percent of all agricultural trade in 1990 to 42 percent in 1998, averaging 35 percent from 1990–1998. Some suggest that agriculture might greatly benefit from this growing intraregional cooperation with increased regional cooperation of infrastructure development, management of water resources, and other economic activities (DeRosa 1997).

[37] http://www.awo.net/newspub/pubs/tradelin/990806a.asp

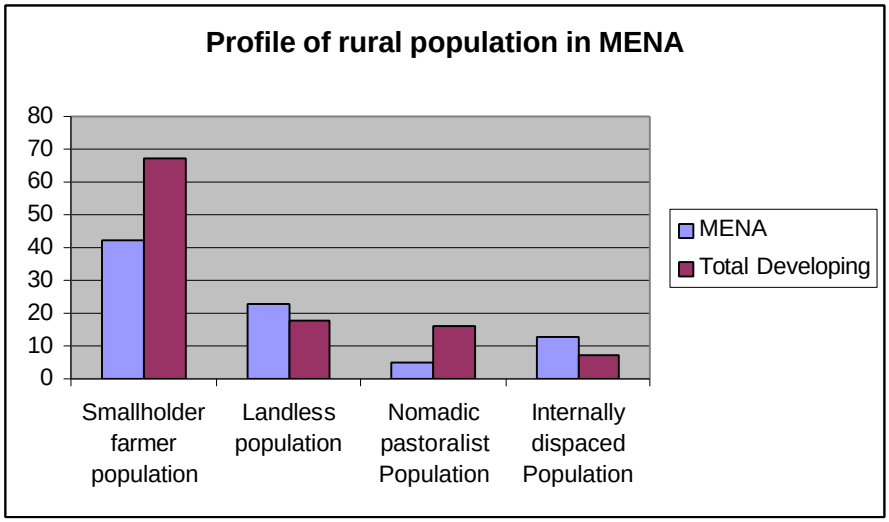
[38] http://www.mideasti.org/html/besharab.html



Source: WTO 2000

2.9 Land Tenure

In *The State of the World Rural Poverty: A Profile of the Near East and North Africa* (1994), Abdouli notes that MENA has relatively sizeable internally displaced and landless populations, while having smaller-than-average smallholder and nomadic populations.



Source: Abdouli 1994

III. DEVELOPMENT ASSISTANCE AND AGRICULTURE IN THE ANE REGION

3.1 Agricultural ODA Worldwide

Worldwide agricultural Official Development Assistance (ODA) has been declining both in absolute and relative terms, dropping from 25 percent to only 14 percent of total ODA over the past 12 years.

As can be seen from the table below, the decline in agricultural ODA has been much quicker than the decline in the AgGDP of developing countries (FAO 1999).

Official Development Assistance, 1980–1997	**(3-year annual averages)**					
	80–82	83–85	86–88	89–91	92–94	95–97
Total ODA (billions of 1995 US$)	50.9	58.1	59.7	63.8	64.6	53.8
ODA to agriculture (billions of 1995 US$)	12.3	14.1	14.8	11.2	9.5	7.5
Agricultural ODA as % of total ODA	24	24	25	18	15	14
Share of agriculture in developing country GDP, %	19	18	17	16	14	14
Share of rural population in developing country population %	71			66		62

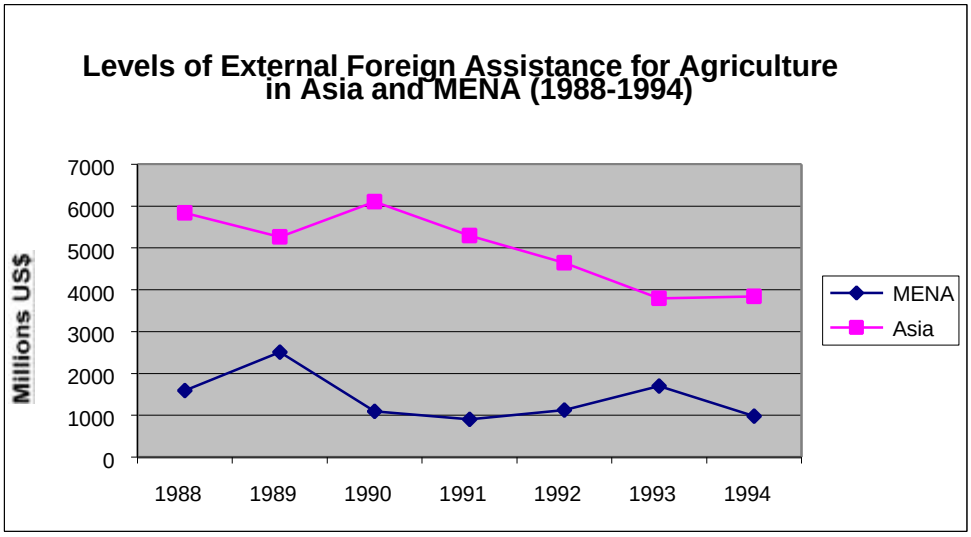
Source: FAO[39]

3.2 Agricultural Development in ANE

It is difficult to track specific spending on agriculture by region, as the Development Assistance Committee (DAC) tends to track spending by region or by sector, but not by both.

However, in the FAO report *Investment in Agriculture: Evolution and Prospects* mentioned earlier, there is some discussion of levels of agricultural funding by region. Though this information is now somewhat out of date, it does seem to demonstrate that the decline seen in the table above is reflected at the regional level, with ODA to MENA dropping by 38.6 percent from 1988 to 1994, and ODA to Asia dropping by 34.2 percent.

[39] http://www.fao.org/docrep/meeting/X3150e.htm

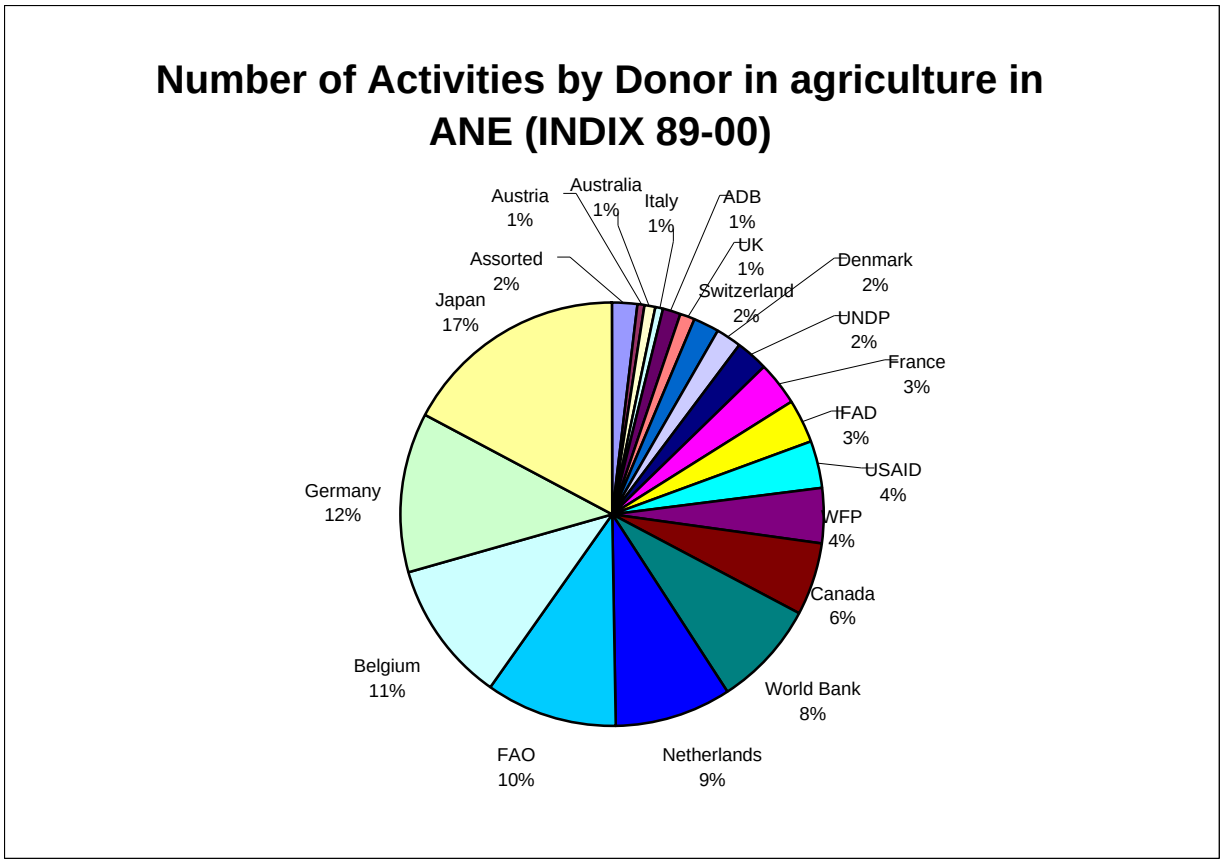


Source: FAO

3.2.1 Agricultural ODA in ANE by Donor

In an attempt to get a better picture of the main donors in agriculture in the Asia and Near East region, the author has turned to International Network for Development Information Exchange (INDIX), a vast database that catalogues international development activities[40]. It is important to note that entries in INDIX are by no means complete, and as the information contained in each activity description is limited and varies from donor to donor, the only piece of information that can be relied upon and compared is the number and type of agricultural activities carried out in the region, not the levels of financial investment. Thus, while it appears that Belgium has funded a number of agricultural interventions in the ANE region, it is very dubious whether the actual financial contributions added up to more than those less-represented but more-sizeable donors. Regardless of the imprecision of this data, it does give us an idea of who is doing what in the region, and that is a valuable piece of information.

[40] http://www.minweb.idrc.ca/dailog.htm

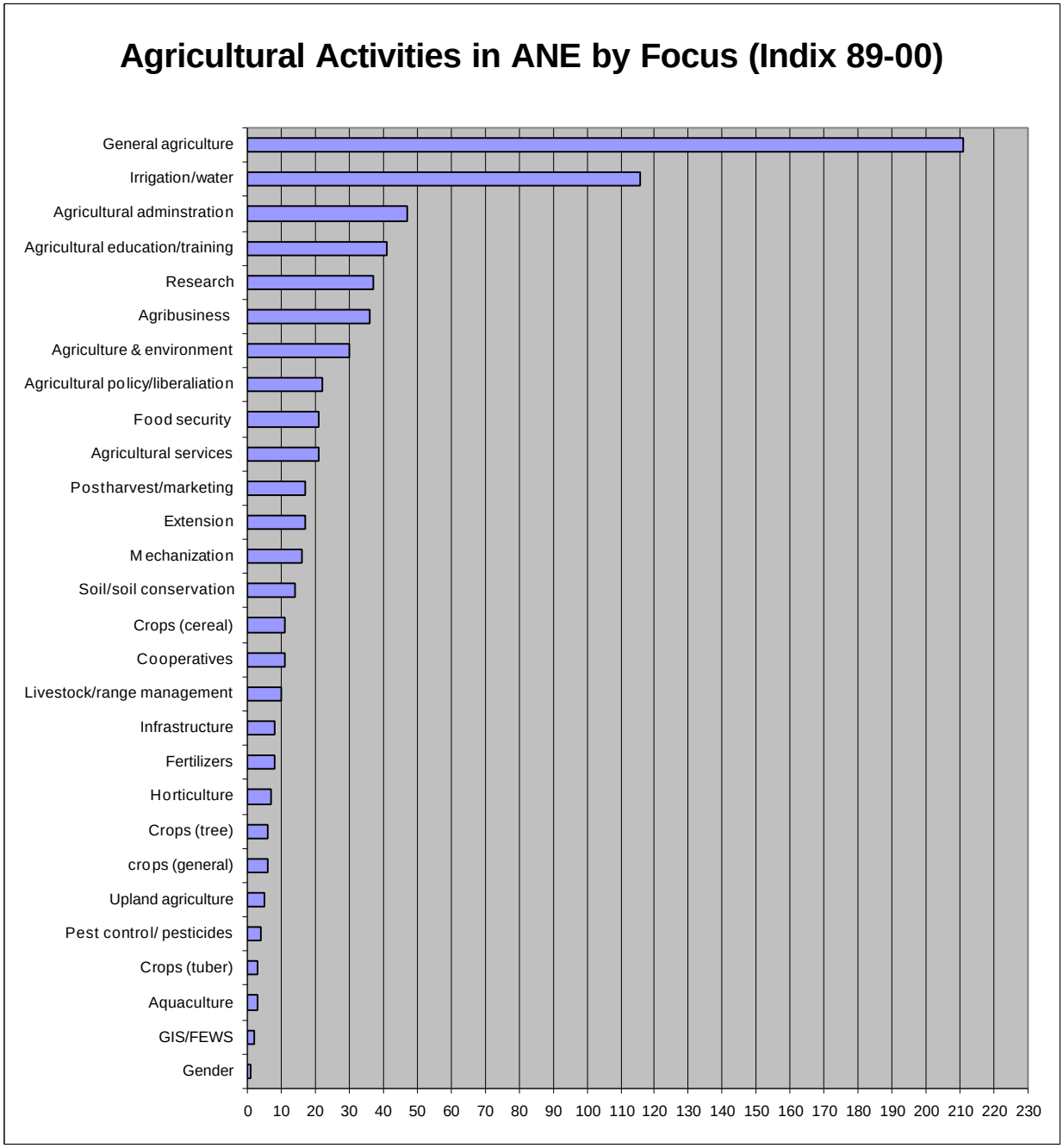


Looking at the chart above, it is apparent that Japan, Germany, and FAO were the major agricultural donors in the ANE region. While it is unclear just how important Belgium's role has been as a donor, it is clear that they have funded a number of smaller agricultural activities, particularly in South East Asia.

3.2.2 Agricultural ODA in ANE by Activity Type

INDIX also provides an idea of what type of project is being carried out. All the agricultural activities that are listed in INDIX are listed in the chart below and give an idea of some of the large issues involved in agriculture in the ANE region over the past decade.[41]

[41] It should be noted that in some cases INDIX entries furnished so little information that one could not ascertain the exact nature of the project. Those projects referred to as "Agricultural Development," or in such general terms as to be unclassifiable, or holistic or regional projects are referred to as "General Agriculture Projects." While this term is not descriptive, it is the best that can be done given the nature of the database.



General Agricultural projects were the dominant type of agricultural activity carried out in the ANE region from 1989 to 2000, accounting for 28.9 percent of all the projects in the region. But irrigation and water activities also feature prominently in the agricultural activities, accounting for approximately 15 percent of all projects, with administration, research, education, and agribusiness/credit each accounting for approximately 5 percent. Interestingly, "agriculture and environment" activities account for nearly 4 percent of all the agricultural activities in Asia, perhaps highlighting a move towards sustainability in agriculture in the past decade.

3.2.3 Patterns

3.2.3.1 Number of Activities per Country

According to INDIX, the countries with the most ODA agricultural activities during the past decade were India, Indonesia, Bangladesh, Egypt, Morocco, and the Philippines.

Country	Number of Activities
India	74
Indonesia	66
Bangladesh	56
Egypt	56
Morocco	51
Philippines	50

3.2.3.2 Sub-Regional Agricultural ODA Focuses

The hypothesis was that there would be significant differences in activity focus according to subregion; however, this was not found to be the case. For the most part, the breakdown of activities was relatively uniform across the regions. However, it should be noted that there were some activities that were more prevalent in one region or other.

MENA had more agricultural administration and food security ODA activities than the other subregion from 1988 to 2000, while South East Asia has had a greater focus on agricultural education/training and livestock projects, and South Asia has had a great focus on agricultural policy and irrigation. However, even these differences are remarkably slight.

3.2.1.3 Donor Bias by Subregion

There was considerably more variation according to donor presence in each region than by activity type. FAO, Germany, and USAID were more represented in the MENA region than in other subregions. Japan and Belgium were more represented in South East Asia and Canada and Switzerland in South Asia.

3.2.1.4 Donor Competitive Advantage

Also analyzed was whether specific donors seemed to concentrate on a particular agricultural activity, relative to the other donors. Below is a table that outlines those donors whose activity history in the region illustrates that they have a competitive advantage in a particular agricultural intervention.

Activity	Donors
Agribusiness/Credit	USAID, Germany, France
Agricultural Administration	FAO, UNDP
Agricultural Education	Belgium, Netherlands
Agricultural Policy	USAID, Switzerland
Agriculture & Environment	Netherlands
Fertilizers	Germany
Food Security	FAO, WFP
Infrastructure	World Bank, Japan
Irrigation	Germany, Japan, Netherlands, ADB, France
Mechanization	Japan, Germany
Research	World Bank, Netherlands

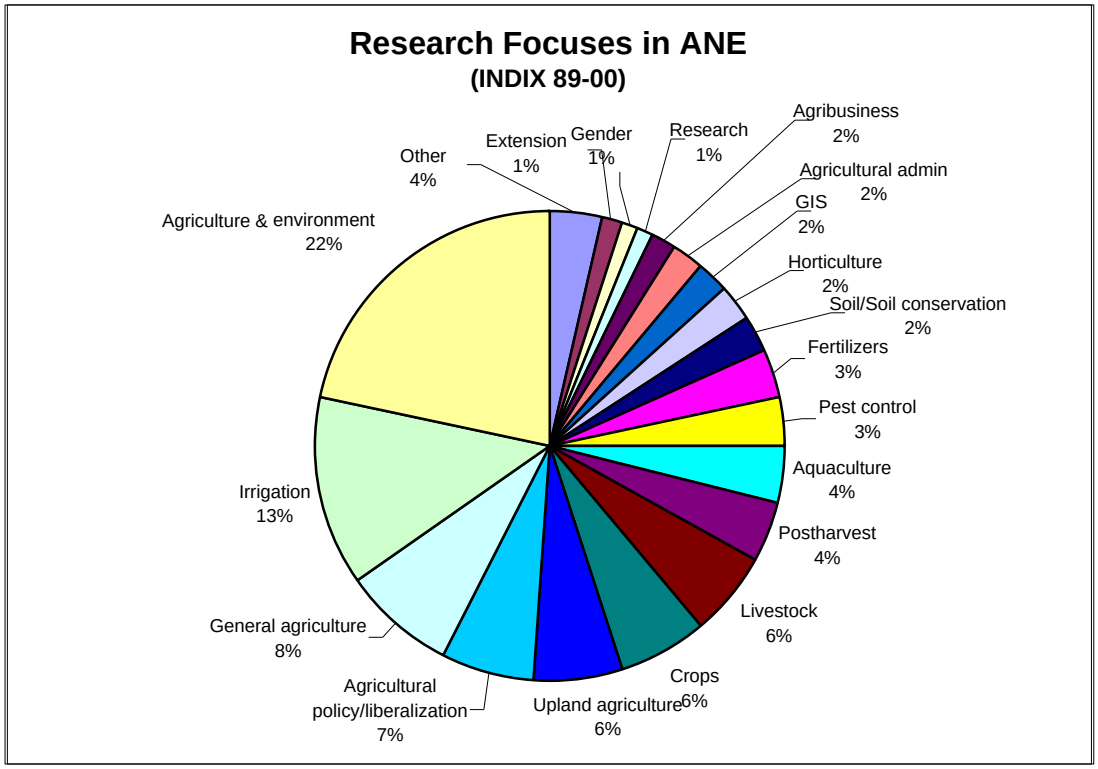
3.3 Research Trends

Not only does INDIX list ODA activities, they also list research activities and feasibility studies. This list has been catalogued and inserted in the above table to give an idea of the agricultural research carried out in the ANE region and perhaps an idea of future agricultural trends in the region.

While "agriculture and environment" accounted for only about 4 percent of the ODA activities/projects, it accounted for a great deal of the regional research (22 percent) carried out during the 1990s. This is a positive trend, given the real need for agricultural sustainability in the ANE region.

Other research trends include an increased level of attention to livestock and upland agricultural issues underlining the importance of these issues to the region, as many of the experts have mentioned.

Research in irrigation seems to have slightly decreased the importance of irrigation, though not significantly. Unfortunately, these figures do not demonstrate whether there has been an accompanying shift from irrigation infrastructure to irrigation management.



3.3.1 Regional Research Differences

The most important research activities for MENA are agriculture and environment, irrigation, horticulture, and soil conservation. In South East Asia, irrigation is the most important research issue, followed by agriculture and environment, upland agriculture, livestock, and aquaculture. In South Asia, research activities are more balanced; however, the primary focus is also agriculture and environment, followed by irrigation (though at markedly lower levels than in other regions), and notably, agricultural policy.

These research priorities seem to match up very closely with the trends and needs of each subregion.

IV. USAID AND AGRICULTURE IN THE ANE REGION

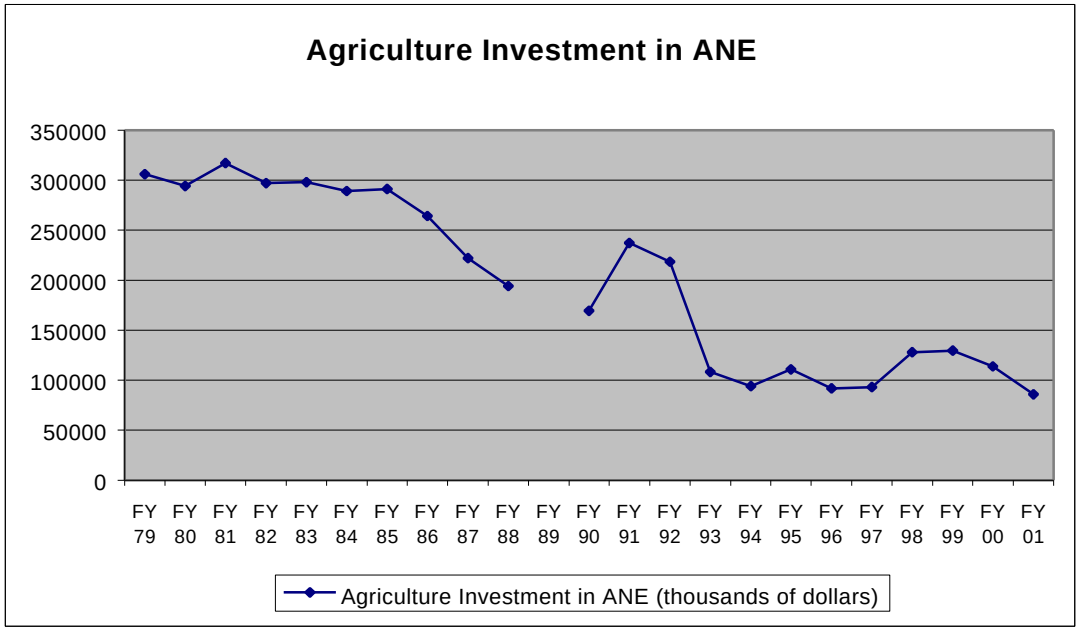
4.1 USAID's Investment in Agriculture Worldwide

Globally, USAID's investment in agriculture has declined considerably over the past decade, falling from $1.2 billion in 1986 to $240 million in 1997, a drop of 80 percent in just an 11-year period (Mellor 1999). At the same time, total global levels during the same period have declined by less than 50 percent (FAO 1999).

Meanwhile, agricultural ODA, which accounted for approximately 14 percent of all global ODA in 1997 (FAO 1999), accounted for only 3 percent of USAID spending in 1998. In 1998, the United States was ranked only fourth in bilateral spending on agriculture, after Japan, Germany, and France (DAC 2000).

4.2 USAID Investment in Agriculture in ANE

USAID spending on agriculture in the ANE region has dropped considerably over the past decade. From 1985 to 1994, spending fell steadily from $291 million to $94 million, a drop of about 68 percent over a nine-year period.

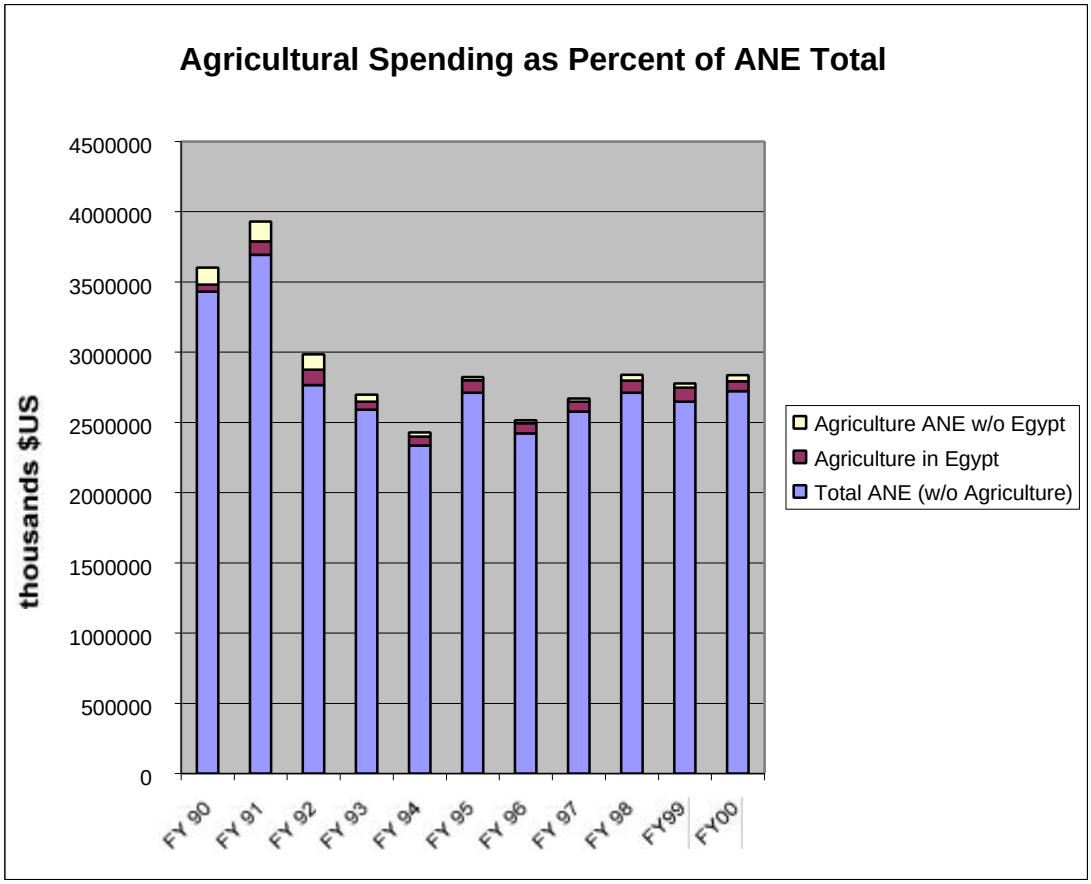


Source: USAID[42]

[42] Source: 1979–1988: page 3 *Agricultural and Rural Development in Asia and the Near East* (1988); FY 1990–2001 M/B: (1990–1996 PBDS System, 1997 NMS, 1998–2001 BPS2000 System).

During the 1990s, agriculture accounted for approximately 4.66 percent of ANE's budget, falling to only 4 percent after 1994.

However, these numbers hide a significant fact. Approximately 62 percent of the funds spent on agriculture in ANE from 1990 to 2001 have been on activities in Egypt. Thus, since 1990, 2.67 percent of ANE's budget was spent uniquely on agricultural activities in Egypt with slightly less than 2 percent reserved for all the other country programs. However, it is notable that not only has agriculture's role in ANE dropped since 1994, but Egypt's role has risen relatively. Thus since 1994, agriculture in Egypt accounted for 2.8 percent of ANE's budget, with only 1.2 percent remaining for all other ANE countries.



Source: USAID[43]

It is important to note, however, that agricultural activities often overlap with activities in other sectors, classified as environment or economic growth and thus have a potential to be undercounted.

By looking at agriculture-related activities not counted by the Agriculture and Food Security Emphasis Codes (AGFS), Stephen Haykin in his internal review *Program Synopsis: Agricultural*

[43] Source: FY 1990–2001 M/B: (1990–1996 PBDS System, 1997 NMS, 1998–2001 BPS2000 System).

Development noted that agriculture-related activities during 1997 were undercounted by approximately a third.

While it would be rash to assume that *de facto* agricultural activities have been universally undercounted by a third throughout the 1990s, this possibility should be considered. In this more "optimistic" scenario, agriculture would have accounted for approximately 6.2 percent of ANE's spending since 1990 (3.57 percent Egypt and 2.64 percent the rest) and 5.37 percent since 1994 (3.74 percent Egypt and 1.63 percent the rest).

4.3 ANE's Agricultural Strategy for the 1990s

In 1989, during the *Agricultural and Rural Development Officers Conference*, ANE/ARD outlined its strategy for the 1990s, suggesting that the following areas be the primary investment themes.

- Increased staple cereal production
- Growth in agro-processing
- Trade and market development
- Human capital development
- Agriculture and infrastructure planning and management
- Natural Resource Management

In the earlier *ANE Symposium on Agriculture in the 1990s*, similar but narrower priorities were mentioned. It was suggested that ANE agriculture programs should focus on:

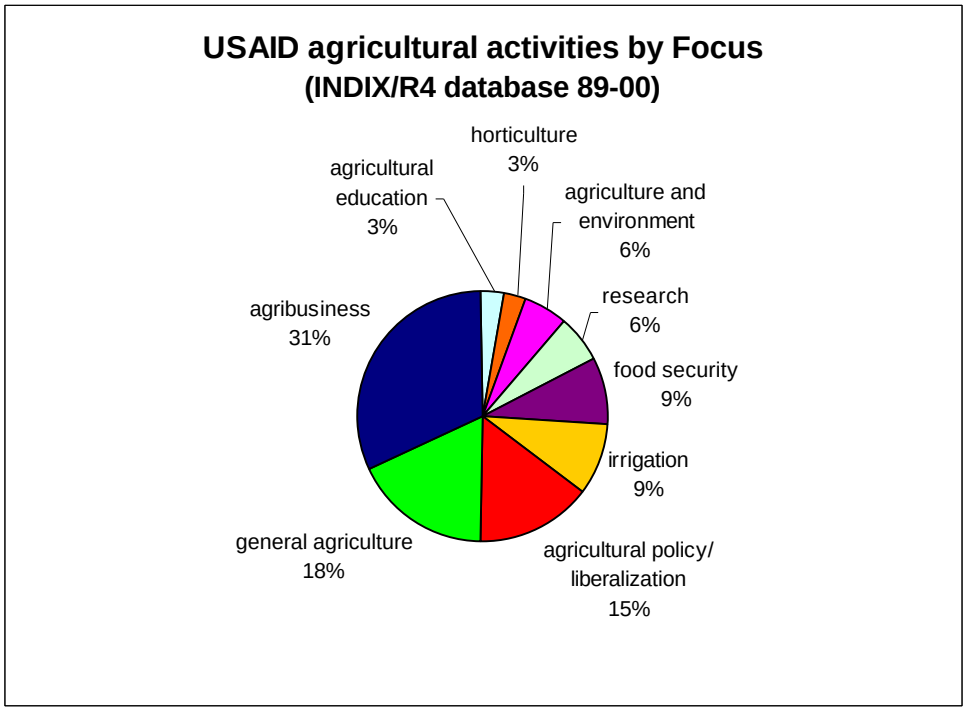
- Promoting human capital formation in areas relating to resource management and development in the agricultural sector
- Enhancing the capacity—in the United States and in the ANE region—for understanding the management of the macroeconomic and food and agricultural policy
- Playing a greater role in donor coordination of country programs and in assisting other donors in the design of development programs

4.4 Overview of USAID's Agricultural Focus in ANE

In fact, much of USAID's agricultural portfolio in ANE during the 1990s was centered around agribusiness and agricultural credit and agricultural policy trade liberalization.

Given the lack of budget data, broken down by activity code, an analysis of activity focus will have to rely on INDIX information up to 1995[44] and the R4 database after that. This does not mean that activity is weighted by financial contribution.

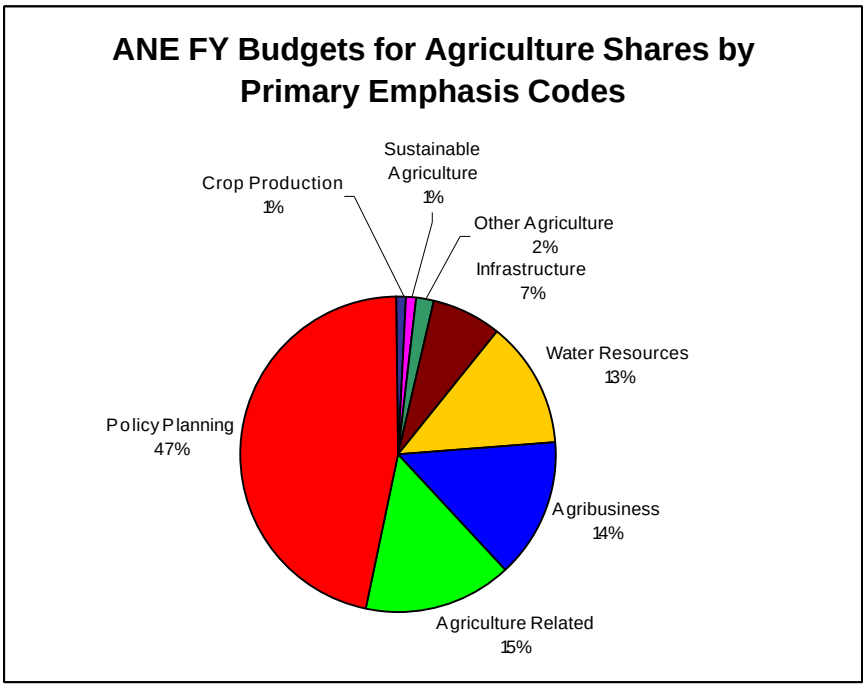
There was however much less investment in human capital formation, with few if any activities



focusing on agricultural extension or education. Research continued to play a modest but solid part of USAID's investment package, making up approximately 8 percent of the activities.

This can be contrasted with Stephen Haykin's breakdown of agricultural spending by emphasis code for the year 1997 as opposed to just the number of activities noted in the table above.

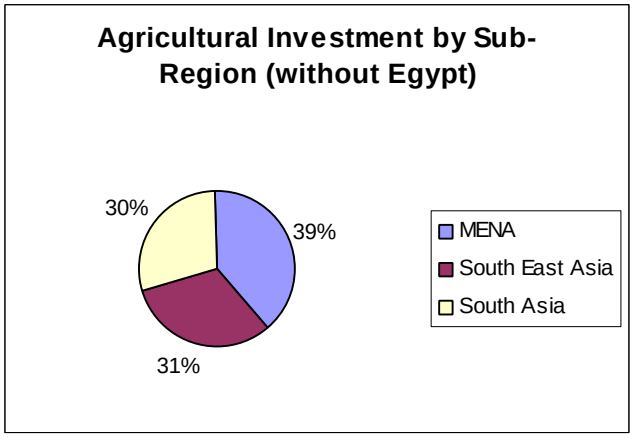
[44] Which is considered to be reliable (White, personal communication, 2000).

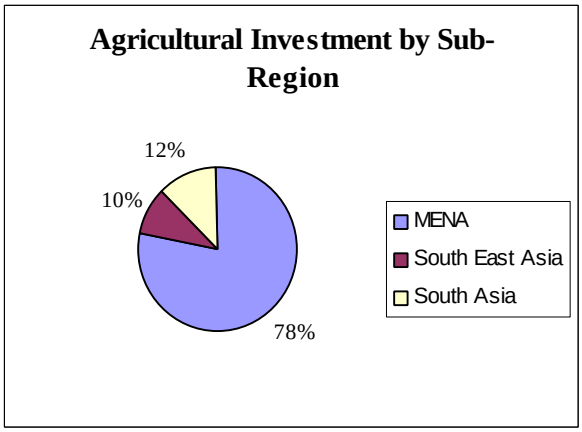


Despite the fact that one would not expect funding levels to match up exactly with the numbers of activities funded, given differing funding levels, not to mention the differing classification systems and timelines used, the figures are not all that divergent. While this in itself is not overly significant, it does suggest that the INDIX/R4 database data is not widely off the mark.

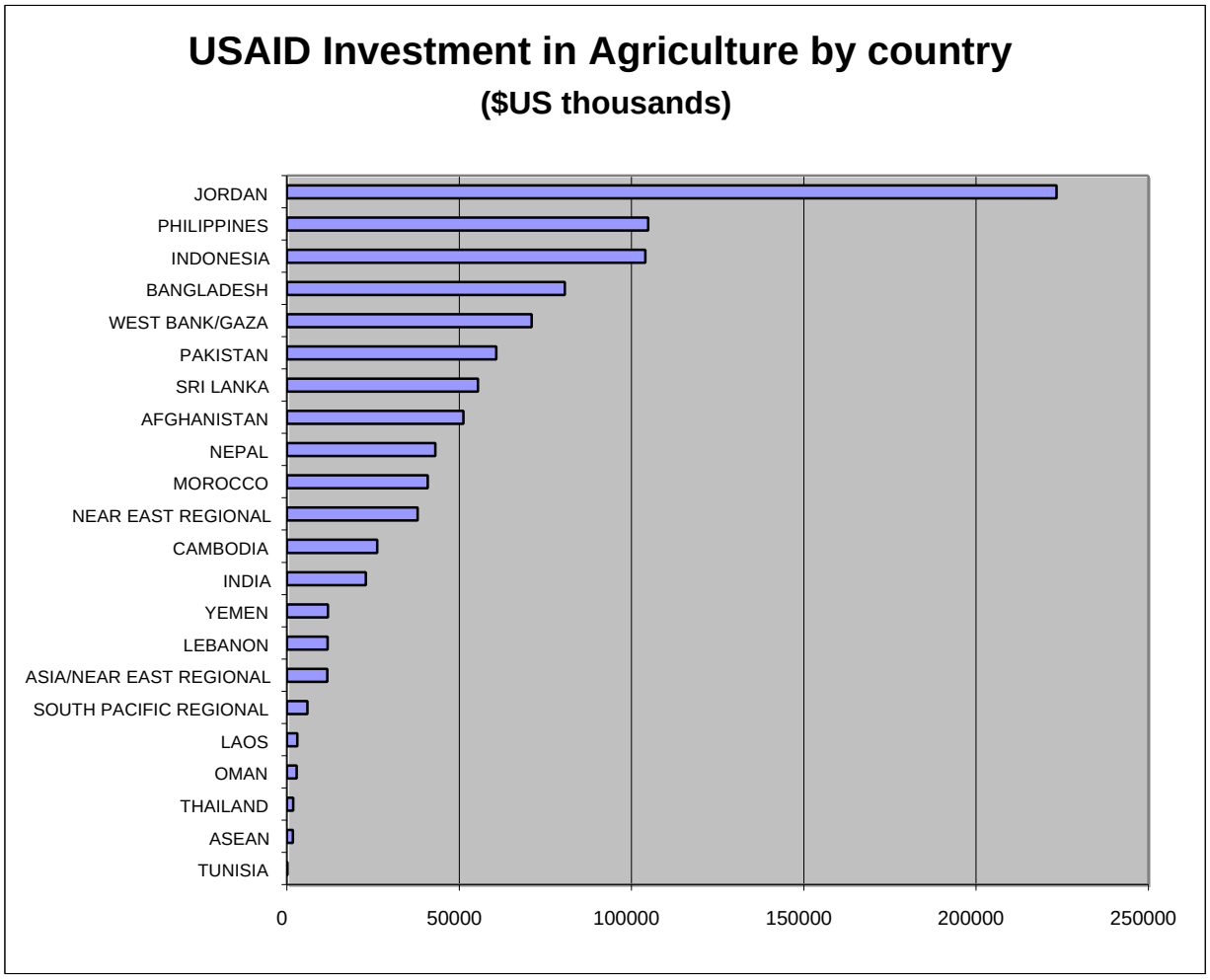
4.5 Overview of USAID's Country Focus in ANE

It is well known that USAID's focus in ANE is on the Middle Eastern countries (DAC 1995), and given that Egypt is its biggest agriculture program in ANE, it makes sense that MENA accounts for approximately 78 percent of USAID's funding in ANE. However, if Egypt is taken out of the calculation, funding is much more evenly distributed, though MENA is still the subregion receiving the greatest amount of agricultural funding in the ANE region.





To see how the USAID agricultural investment in ANE from 1990–2000 breaks down by country (not including Egypt), refer to the table below.



V. DISCUSSION

5.1 Importance of Agriculture in Growth

Despite the dramatic fall from grace of agriculture during the 1980s, experts are starting to realize that agriculture is in fact a very important factor for stimulating overall economic growth. Research using data from a number of developing countries reveals that, on average, a $1 increase in agricultural production generates $2.32 of growth in the overall economy (Pinstrup-Anderson et al. 1995). Additionally, agricultural growth has been shown to have a demonstrable effect on poverty reduction in a way that manufacturing does not. John Mellor writes in his article *Pro-Poor Growth—The Relation Between Growth in Agriculture and Poverty Reduction*: "it is notable that agricultural growth reduces inequality among the poor as well as lifting the poor above the poverty line" (1999).

The impact of this relationship can be shown in East and South East Asia where, prior to the economic setback in the 1990s, overall growth rates were high, but because agricultural growth rates have slowed, the pace of poverty reduction has declined (Mellor 1999).

Both government expenditure and foreign assistance are of importance in stimulating this process. Government expenditure is of special importance to the growth of small-scale agriculture, and foreign aid can help in strengthening national forces to understand the relationship between investing in agricultural growth and poverty reduction (Mellor 1999).

Mellor states that the point is "not that rural growth should be pursued in place of urban growth, but rather that agriculture and rural sector should not be neglected" (1999).

5.2 The Benefits of Investing in Agricultural Development in Asia

In the past, donors have been hesitant to support agriculture in developing countries because it is felt that this would undermine agriculture in the donor country. There is no evidence supporting this. In fact, research and real-world experience show the opposite—that a healthy agricultural economy leads to an increase in imports, which in turn often benefit donor countries.

In the report by Pinstrup-Anderson, Lundbert, and Garrett titled *Foreign Assistance to Agriculture: A Win–Win Proposition*, the authors show that each dollar invested in agricultural research in developing countries increases their imports by more than $4.39. These levels vary by region. As can be seen in the table below, import levels are raised higher in East Asia, followed by MENA, with the least effect in South Asia (Pinstrup-Anderson et al. 1995).

Value of imports generated by $1 of agricultural research in the long term

Region	Total Imports	Agricultural Imports	Cereal Imports
MENA	$ 3.48	$ 0.61	$ 0.15
South Asia	$ 0.76	$ 0.15	$ 1.06
East Asia and the Pacific	$ 5.15	$ 6.96	$ 2.27

Source: Pinstrup-Anderson et al. 1995

Thus, investing in agricultural research in developing countries not only benefits developing countries themselves but also expands the world market and benefits countries like the United States which maintain high levels of exports to Asia.

In addition, there is little or no evidence that foreign assistance has led to decreased levels of U.S. agricultural exports (Pinstrup-Anderson et al. 1995). South East and East Asia account for approximately 40 percent of U.S. agricultural exports. Of this, one-fourth is to the less-developed countries of Asia. Thus, developing Asian countries consist of approximately $6 billion in 1997, roughly 10 percent of U.S. agricultural exports (Schumacher 1998)[45]. The United States are also a major supplier of agricultural commodities to the Near East Region, with shipments averaging $4.1 billion per year during 1996–98 (Kurtzig 1999) or about 7 percent of U.S. agricultural exports.[46] It is said that in the United States every $1 billion of exports creates 20,000 jobs, thus just through agricultural exports developing Asia and the Near East has contributed to approximately 200,000 U.S. jobs (Pinstrup-Anderson et al. 1995).

[45] http://ffas.usda.gov/info/speeches/CT020498.html

[46] Using percentages calculated from the Schumacher article.

VI. SUMMARY

6.1 The Issues Facing Agriculture in the ANE Region

Agricultural productivity in the ANE region continues to increase. However, due to the need for increasing levels of agricultural inputs and rising levels of soil degradation, the acceleration of productivity is slowing. And due to rising population levels and lagging agricultural growth, agricultural productivity per capita is falling.

With increasing levels of urbanization, diets have changed from tubers and simple cereals, to processed cereals, vegetables, and meat products. While production of some of these products has generally risen, the inflexibility of cropping systems and agricultural inertia has meant that demand tends to surpass supply.

With increasing intensification, agriculture has taken its toll on the environment, and the region seems to be experiencing problems with soil degradation, lowered levels of soil fertility, and increased levels of pollution.

There is little or no extra arable land available to be used for agricultural expansion, and farm sizes are getting smaller and smaller, with the potential for rising levels of inefficiency.

Government expenditure on agriculture is leveling off, donor spending has dropped dramatically, and the private sector has not jumped in as expected. Funding levels for research, extension, and agricultural education have dropped.

Biotechnology seems to hold potential to increase levels of agricultural productivity in the region. However, given the hesitancy of the region to embrace biotechnology, the lack of biotechnology research facilities in Asia (other than China), the lack of focus on the part of biotechnology firms on developing world issues, and the thorny issue of property rights, biotechnology is unlikely to provide a solution to Asia's drop in productivity in the short term.

Due to policies designed to promote industry and downplay agriculture, there has been a general bias against agriculture that has hindered both agricultural productivity and economic growth. As a reaction against these policies, trade liberalization policies are being adopted. These policies are valuable in that they seek to erase protectionist measures. Given recent and global dissatisfaction with the move towards globalization, the two-sided nature of trade liberalization reform and the sad fact that trade barriers can metamorphose, it is still unclear just how much effect trade liberalization will have on agricultural development in Asia.

6.2 New Directions in Agriculture in the ANE Region

Livestock production seems to hold great potential for the region, particularly in South East and East Asia. Increased livestock production means that the region can attempt to meet a growing need for meat products and increase production of a higher value commodity.

Horticulture also seems to hold great potential for the region, particularly in the Middle East and North Africa. Like livestock production, increased horticultural production means that the region can attempt to meet a growing need for horticultural products and increase production of a higher value commodity. In addition, they are often much more efficient utilizers of land, water, sunlight, and fertilizer than most cereal crops.

Irrigation management is an important issue, particularly in the Middle East and North Africa, due to the high levels of water used by agriculture and its associated inefficiency, the startling decrease in regional water availability, and a decreasing cost effectiveness of irrigation construction.

Upland agriculture holds some promise for a need for increased production and new diets, particularly in East and South East Asia. While there is unlikely to be increased production due to expansion, many researchers suggest that the uplands hold much potential—both socially (the farmers are often marginalized, with lower production levels) and agriculturally (as the uplands are considered to be more flexible than the already saturated lowlands). However, it also holds many risks, and great attention should be paid to avoid the ecological consequences of any expansion in this area.

Measures to control desertification would seem to be a real need, particularly in the Middle East and North Africa, where increasing land degradation is taking more and more land out of production.

Child malnutrition should be addressed, particularly in south Asia, where levels are the highest in the world and most associated with food availability—a factor determined by agricultural production.

Research should focus not only on increased production levels but also on proper levels and techniques of utilizing agricultural inputs such as fertilizers, irrigation water, and pesticides.

Education has been shown to have high levels of complementarity with agriculture. As both education and agriculture have been shown to be major factors in poverty reduction and considering the fact that increased levels of education also increase farmer productivity, discovering cross linkages and strengthening them might be a productive way ahead for agriculture in the region.

Trade liberalization holds great promise especially with the Near East, which has highly protective policies. While not offering a panacea for agricultural development, reduction in subsidies and tariffs would seem to be an effective precursor to agricultural growth.

Control of the labor transformation process seems to be a significant issue, especially in Asia. Guarding against random urbanization and trying to insure that displaced farmers find employment, particularly by strengthening rural economies, would seem of primary importance in any agricultural strategy readjustment.

Finally, the glue to this process should be increased levels of participation and renewed focus on equity issues. Extension, research, and increased sustainability all require increased levels of participation in order to increase their effectiveness. In addition, with the move towards large and

ethically charged issues such as biotechnology and trade liberalization, increased levels of rural democracy will make the transition smoother.

VII. CONCLUSION

As Winston Churchill once said, "want of foresight, unwillingness to act when action would be simple and effective, lack of clear thinking, confusion of counsel until the emergency comes, until self-preservation strikes its jarring gong—these are the features which constitute the endless repetition of history." While Churchill was discussing different issues, these words seem sadly applicable here as well.

With agricultural growth levels barely exceeding those of population growth, agricultural growth per capita in the Asia and Near East region has slowed during the 1990s. In addition, government expenditure is leveling off, foreign aid has dropped considerably, and the private sector has yet to pick up the slack. Given that agricultural growth is a stimulus for not only economic growth but also poverty reduction, rural poverty is rising in many Asian countries. Thus, it is feared that lowered levels of agricultural growth "could jeopardize national food security and increase child nutrition in many countries, cause significant new unemployment and poverty and slow nonagricultural growth" (ADB 2000).

Many experts seem to adopt a *laissez-faire* attitude to this issue by focusing primarily on growth. Alluding to Kuznet's law[47] they suggest that the move from subsistence agriculture to commercial agriculture in Asia and Near East "should not be expected to be a frictionless process and significant equity and environmental consequences should be anticipated" (Pingali 1997). Others take a more active role and suggest a push for a gentler and more holistic growth, suggesting that "a key challenge for policy makers is to continue to promote rapid growth in rural areas while at the same time making growth more pro-poor and more environmentally sustainable. Improvements in the quality of life for rural people require a high degree of complementarity among the three goals" (ADB 2000).

By looking at the nature of funding sources, we can see some trends emerge, and we can start to see how we can achieve holistic development despite the current drop in funding levels.

Government investment is typically regarded as a primary means of promoting agricultural growth, yet much of Asia's public investment (20 to 60 percent) has been diverted to the subsidization of agricultural inputs, which have been found to undermine agricultural efficiency and sustainability. Thus if this capital spent on subsidies were instead spent on research, extension, or infrastructure, many suggest that Asian economies might be able to reanimate their agricultural economy.

Foreign assistance plays an important role in agricultural development, particularly in facilitating national policies that would lead to increased government spending. Sadly, foreign assistance to agriculture in Asia has fallen during the past decade. Foreign assistance is as much determined by political decisions as it is by humanitarian decisions, and it would be naïve to recommend

[47] Kuznets's law postulates that income inequality first increases and then decreases during the development process.

increased levels of spending on Asian agriculture without looking at all factors that determine levels of funding—a subject beyond the scope of this paper. However, there is evidence that investment in agriculture not only aids the countries receiving assistance but also benefits the donor by increased trade levels. At the same time, previous fears that increased foreign agricultural assistance might negatively affect domestic agriculture are misplaced.

There has been much written on the eventuality of the private sector intervention in agriculture in Asia. Despite this, private investment has so far been disappointingly scarce. However, with increasing levels of trade liberalization, it is likely that there will be increasing levels of foreign investment in the Asian agricultural system. Other methods of promoting this private investment should of course be encouraged. However, though the potential for investment is high, the private sector is unlikely to invest in areas that have high social value but low profitability, as many commentators have noted.

It is ultimately in everyone's interest to invest in agriculture, though of course each interest is different and not inclusive of all elements of the subsector. It would seem that while different investors are attracted by different goals there seems to be a complementary element to their differences that works well for the subsector, so that both *laissez-faire* and holistic approaches can occur at the same time.

It seems likely that biotechnology firms will contribute significantly to the levels of private investment, which in turn will play an important role in the transformation from subsistence to commercial agriculture. Biotechnology firms could play a big role in the more commercial aspects of agriculture in Asia, namely lowland cereal production. Not only could they fund research but they could also provide extension, education, and support on agricultural inputs, and perhaps even lobby governments to remove tariffs and protectionist policies. In addition, severely neglected issues such as marketing and post-harvest processing are often best handled by the private sector.

This would leave public investment and foreign assistance as the means of promoting the environmental and social elements of this transformation, funding research issues pertinent to marginalized groups and regions, and working on both research and support of upland agriculture and nontraditional agricultural production (such as livestock and horticulture). In addition, governments and donors could work together on issues of sustainability, by working on both the research and support for IPM, soil conservation, and water conservation. Finally, governments and donors must insure participation in this process, not only to improve agricultural efficiency but also to reach all groups and insure all voices are heard in what could possibly be a difficult transition period.

Obviously, there would need to be a strong dialog between all parties involved, in order to limit conflicts and promote efficiency.

Agriculture in Asia has had much success over the past 30 years. But there are still many problems that need to be addressed. It would be a pity to adopt a *laissez-faire* approach to agriculture at a point when Asian agriculture is so vulnerable, undergoing the transformation from subsistence to commercial agriculture and at a point when many Asian economies require both an economic boost and a strong dose of poverty reduction.

Yes, the Green Revolution was successful in increasing agricultural production in Asia and the Near East, but now it is time to re-green the Green Revolution, and given the important role USAID has historically played in the conception of the Green Revolution, it would seem appropriate that the Agency would want to help see it through any growing pains and ease its transformation into a new era, an era when the human rather than the technical elements are featured and when there is a renewed focus on participation, local governance, gender, education, and equity in the realm of agriculture in Asia.

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ANNEX A

FAO Classifications

East & South East Asia
Brunei Darussalam
Cambodia
China, Hong Kong SAR
China, Macao SAR
Indonesia
Korea, Dem People's Rep
Korea, Republic of
Laos
Malaysia
Mongolia
Myanmar
Philippines
Singapore
Thailand
Viet Nam

South Asia
Bangladesh
Bhutan
India
Maldives
Nepal
Pakistan
Sri Lanka

Near East
Afghanistan
Bahrain
Cyprus
Egypt
Gaza Strip (Palestine)
Iran, Islamic Rep of
Iraq
Jordan
Kuwait
Lebanon
Libyan Arab Jamahiriya
Oman
Qatar
Saudi Arabia
Sudan
Syrian Arab Republic
Turkey
United Arab Emirates
West Bank
Yemen

North Western Africa
Algeria
Morocco
Tunisia

INDIX Countries

North Africa	Near East	South Asia	South East
1. Morocco	6. Yemen	19. Pakistan	25. Myanmar
2. Algeria	7. Oman	20. India	26. Cambodia
3. Tunisia	8. Saudi Arabia	21. Sri Lanka	27. Thailand
4. Libya	9. United Arab Emirates	22. Nepal	28. Malaysia
5. Egypt	10. Qatar	23. Bhutan	29. Laos
	11. Turkey	24. Bangladesh	30. Vietnam
	12. Israel		31. Philippines
	13. West Bank/ Gaza		32. Indonesia
	14. Lebanon		33. Mongolia
	15. Syria		
	16. Jordan		
	17. Iraq		
	18. Iran		
	18. Afghanistan		