ESAP CHAPTER 3
INFLUENCE OF TRADE REGIMES AND AGREEMENTS ON AGRICULTURE KNOWLEDGE, SCIENCE AND TECHNOLOGY

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Key Messages

1. While greater openness to international trade in the region has been associated with higher rates of growth of per capita income (and a reduction of inequality between developing Asia and the developed countries), there has also been an increase in income inequality within the Asian countries. With the stress on trade, there has been a neglect of investment in agriculture and rural development. Conversion of agricultural land to industrial or urban use, has resulted in the displacement of many rural inhabitants (with indigenous or tribal peoples, small farmers and the landless disproportionately represented) who are not the beneficiaries of the resulting industrial or other non-agricultural employment, increasing the rural-urban disparity. Development policies could be more balanced by increased investment to agriculture and rural development and more emphasis on non-tradable sectors.

2. Greater equity (through, for example, land rights for women) and a reduction of social exclusion can also increase productivity and therefore provide gains from international trade. In many countries, women have been drawn in large numbers into export-led manufacturing, with resulting improvement in incomes, but there are also problems of wage differentials, short-term industrial working life, occupational hazards and health risks. Trade policy can be made more inclusive to take into account the specific needs of marginalized segments of the community such as women, indigenous peoples and local small producers, as well as recognize them as holders of AKST.

3. There are vulnerabilities in international trade caused by rising energy costs, volatility of international markets and over dependence on imports for food and agricultural technology. The implications include worsening terms of trade, endangering of food security and changes in the nature and location of AKST generation and dissemination in the region. Alternative and domestic markets are also options for better and sustainable development, as these are the more easily attainable and locally relevant ways of dealing with issues of sustainability and food security. Comprehensive safety net measures and social welfare systems could help to protect well-being in a situation of growing risk and uncertainty. While South Asia, in particular, has yet to work out ways to effectively deal with the opening up of agricultural markets and reducing subsidies of various types, this is less of a problem in East and south-east Asia, where there has been more of a stress on achieving transitions to more productive methods of cultivation and higher value crops. Measures to increase productivity are superior to providing subsidies, which distort factor use and can be a fiscal burden.

4. OECD agricultural subsidies do not allow Asian small-scale producers to compete in external markets or domestic markets without tariff support and have detrimental

impacts on their livelihoods and food security. Furthermore, many of the developing countries in Asia, in particular the least developed countries, have limited fiscal capacity and are unable to provide the support allowed under WTO regulations. Along with eliminating agricultural subsidies in the OECD countries, there may be a case for providing support to producers in least developed countries. In addition, countries could consider the need for safeguard measures based on food security, livelihoods and rural development criteria. National trade policies could also balance the interest of net food buyers with the requirement for rural development. Overall, there is scope to promote increases in productivity, through enhanced provision of public goods, such as infrastructure, research, irrigation, etc., to enable agricultural producers to be competitive.

5. Anti-dumping measures have been used by developed countries to protect domestic producers against competition from developing country exports. Competition considerations in anti-dumping law and practice could be introduced, as well as restricting the use of anti-dumping measures only to situations where there is an evidence of predatory intent.

6. The secular decline and wide fluctuations in prices of primary commodities have severe negative impacts on the livelihoods of millions of small producers. Price stabilization measures can be combined with orderly changes in these prices, along with promotion of alternate uses of commodities and movements up the value chain.

7. Least developed countries, including the small Pacific islands, are unable to match the competitiveness of larger and more complex economies. Special, differential market access, for given time periods, both within ESAP and with industrialized countries, can help LDCs benefit from international trade. OECD countries, such as Japan and South Korea, face challenges in reducing protection of their agriculture. It needs to be considered whether agricultural subsidies are better used in promoting environmental improvements and enabling transitions to alternate livelihoods. Major agricultural exporters (Australia and New Zealand) face the challenge of integrating environmental concerns into price competitive agricultural systems. This involves developing new technologies (such as feeds that reduce methane emissions) and methods of pricing, in taking account of what are now externalities.

8. With developing Asia's characteristic of labor abundance relative to land and capital, there is a comparative advantage in crops, such as vegetables, fruits and flowers, which use more labor per unit of land and capital, as against, e.g., cereals. In order to utilize this comparative advantage both AKST and extension would require more attention to high value crops, such as fruits, vegetables, flowers.

9. Vertical integration/coordination of food systems has marginalized primary producers and the dominance of retail chains may further this trend. This does not mean that there can be no countervailing power, e.g. of organized primary producers, that would improve the share of primary producers. The most important requirements of small farmers in this changing environment are better access to knowledge, technology and capital, along with facilitation to overcome collective action problems in dealing with scale requirements. Management capacity, crucially centered around knowledge, is as important as physical capital but is the most difficult thing to produce.

10. Trade agreements do not sufficiently address environmental, social, labor and health dimensions. While sanitary and phytosanitary (SPS) measures may promote better human and animal health and environmental standards, they have been used as trade barriers, which have led to trade loss, diversion and higher costs for developing countries. Bilateral and regional free trade agreements also restrict policy space and make it more difficult for governments to implement and enforce environmental, social and health protective measures. Governments need the policy space to be able to take these measures. Other considerations, such as multilateral environmental agreements, labor standards and social development instruments, could be given at least equal weight.

11. Pesticide use has increased rapidly in the ESAP region with consequent health, environmental and social impacts. Pesticide residues and the use of banned chemicals lead to problems in meeting SPS standards for agriculture-based export protects. In order to utilize the potential for exports, more attention to AKST and extension is necessary to reduce pesticide use and eliminate banned chemical use. Various alternatives, such as Integrated Pest Management, organic agriculture and agroecology exist. The challenge is to mainstream and promote their adoption with necessary policy and investment support.

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

13. Increasing international trade in agricultural commodities has often led to over-exploitation of natural resources in ESAP countries. There are positive examples of learning

and technology development and systems of culture that have reduced pressures on natural stocks. The challenge is to address new problems such as environmental change and erosion of biodiversity. One option is to provide systems of compensation for the provision of environmental services, in order to increase the supply of environmental public goods that are often linked to particular forms of land use and cultivation.

14. In any intellectual property rights (IPR) regime there is a trade-off between rewarding development of knowledge and inhibiting the spread of knowledge and the capacity for reverse engineering, which are both crucial for development. IPR standards under trade agreements have contributed to a shift in AKST, by facilitating private sector dominated research and consequently privately-generated and owned AKST. IPRs may restrict access to research materials, tools and technologies, as well as to plant material for farmers, with consequences for food security. While some national level action has been taken to break monopolies and encourage competition, there is no international mechanism to deal with such issues. Increasing funding and support for public sector research that delivers publicly available outputs is an option to address the growing private sector dominance. Implementation of farmers' rights on seeds is critical to ensure conservation of agricultural biodiversity and associated AKST and can provide an important counterbalance to formal plant breeders' rights and patents. Recognition and protection of traditional/indigenous knowledge remains a challenge. There are questions about whether patentability and ownership of such knowledge are appropriate and what processes are needed to protect them and further to share the benefits of protection.

15. There, however, has been a concentration in agricultural research and development and extension, on a few major crops and tradeables, varieties and traits, to the neglect of locally relevant crops and technologies, which have been marginalized both in the private as well as the public sector. More investment in research on agroecosystems and locally adapted technologies could be used in order to develop approaches that promote food security and environmental sustainability.

16. The current restrictions in various countries, including those of the EU, on imports of transgenic crops, means that the export potential of transgenic crops is limited. At the same time, many developing countries in Asia lack regulatory and monitoring capacity to import transgenic crops. The precautionary principle and the principle of prior informed consent are the key elements in the Cartagena Protocol on Biosafety, but have not been implemented. Given all these considerations, more investment and research prioritization can be considered for independent biosafety and long-term risk-related research and for non-genetic engineering AKST.

17. Though per capita carbon emissions in ESAP developing countries are lower than those in the developed countries, it is likely that there will be pressures on these countries to reduce emissions and shift to low carbon economies. While biofuels may provide prospects for the development of new sources of energy from agriculture, there is the threat of converting natural forests and agricultural lands into monoculture plantations. Furthermore, there is the issue of corporate or community ownership of such initiatives. These developments may have implications for food security, biodiversity, sustainability and livelihoods. Establishing decentralized, locally-based, highly-efficient energy systems is one option to improve livelihoods and reduce carbon emissions.

18. While carbon and other GHG emissions use global public space (absorption space), a price on carbon emissions, along with necessary changes in consumption patterns, could help induce a technological shift to a low-carbon economy. A system of tradable emissions can be devised on an equitable basis, based on the Rio principle of "common but differentiated responsibility." In the event of some countries refusing to participate in a globally-mandated GHG protocol, such "free-riding" can be discouraged by allowing all participating countries to use WTO rules-sanctioned import duties, based on direct and indirect carbon content of products, on export from non-participating countries. Since the opportunity costs of not using forests in an extractive manner are very high, in terms of the foregone livelihoods of some of the poorest peoples, a system of international payments for "avoided deforestation" would combine justice with achieving a necessary measure for reducing global carbon emissions.

19. Hazardous waste is often exported for disposal in countries with lax or poor enforcement of environmental regulations. Without leading to a loss of jobs in developing countries, the disposal of hazardous wastes could be regulated by international coordination of these regulations, supported by civil society and other actions to secure their implementation.

3.1 Context

The influence of national, regional and international trade regimes, agreements, intellectual property rights and the regions' response to them and the role of AKST in addressing these is assessed in this chapter. After a broader context setting on trade agreements and regimes, the assessment on WTO and AKST elaborates on impact of biotechnology along with issues of intellectual property rights. The combination of the changing composition of demand for agricultural commodities in favor of higher quality foods, like fish and meat products and the comparative advantage of labor-abundant Asian developing countries in the production of labor-intensive agricultural commodities, have together brought a change in the composition of agricultural output. Globally as well as in this region, there has been concern about the effects of trade agreement on environment, health and other social dimensions (see 3.6).

The structure of world trade is changing. From the early trade of manufactured goods for raw materials, in the post-Second World War period there was a growth of inter-firm trade, as firms became transnational and set up vertically integrated production bases in different countries. More recently, however, there has been a globalization of production and supply chains, in general a globalization of value chains. With this, rather than vertical integration within a country or corporation, there is a splitting up of parts of a value chain across countries. Trade figures don't capture the change in trade within value chains, since, other than in transport equipment and machinery, a distinction is not made in trade between components and whole products. But there are many analyses of the growing importance of intra-industry trade, referred to as "outsourcing" (Feenstra, 1998) or "vertical specialization" (Yeats, 1998).

With this change in the structured of trade, in which Asia has participated perhaps more than any other region, there has been a double shift, one in the composition of trade and two, in the poles of world trade. In the composition of commodity trade there has been a shift from agricultural products (food and agricultural raw materials) which used to account for nearly 50% of exports in 1960 to just 7% in 2001 and a corresponding increase in exports of manufactured goods from les than 20% in 1960 to almost 70% in 2001 (Table 3.1).

[Insert Table 3.1]

The growth of the Asian economies and the greater importance of trade in their economies have together made Asia an important pole of world trade. The triad of world trade (US, EU and Japan) has turned into a quad, with "Asia other than Japan" joining in as a new pole of world trade (Gibbon and Ponte, 2005).

Within this pattern of world trade there is also a growth of South-South trade. In 2001 in developing Asia 41.5% of exports went to developing Asia itself (UNCTAD, 2004). But this trade is concentrated in the economies of East Asia. It is mainly of a production-sharing type, resulting in a "triangular trade" pattern, i.e. the more advanced economies within East Asia, e.g. Republic of Korea, export intermediate products to China, where they are inputs for production to be re-exported to developed countries (UNCTAD, 2005).

In the case of agricultural products, South-South trade is not of a triangular nature. It represents final export to meet growing demand, based on the growth of incomes in developing countries. In the middle- and low-income countries growth of income leads to a growth in demand for agricultural commodities, more than in developed countries, benefiting those economies that mainly export agricultural commodities (UNCTAD, 2005). Within Asia, for instance, Vietnam has increased its exports of rice, coffee and fish, both to markets within the region and to developed countries. But as in other developing countries of Asia, there has not been a one-sided reliance on exports of agricultural commodities, but also a push in exports of manufactures, labor-intensive manufactures, in particular.

The pattern of consumption of food differs from one country to another. But what is common is a falling share of grain and a switch to higher quality foods, like meat, fish and milk products. Such a switch, however, may be the result of growing inequalities in food consumption. The lower sections may have gross deficits even in basic calories while the upper sections diversify their food consumption into higher value foods.

3.1.1 Free trade agreements in ESAP

Of the 33 countries in the ESAP region, 22 are currently members of the World Trade Organization (WTO), with about 6 more countries in the process of accession negotiations. Thus, the rights and obligations under the multilateral trade regime, via the WTO, play an important role in ESAP countries.

Of particular concern are the FTAs between developing countries and developed countries like the United States. These North-South FTAs are very comprehensive in scope and extend into the realm of domestic policies (Gibbs and Wagle, 2005), covering areas beyond trade in goods, to include the opening up of services, government procurement, protection of intellectual property rights (IPRs) and creation of new investment privileges and protection (such as binding dispute settlement mechanisms that allow investor-state disputes). Bilateral and regional FTAs can be "WTO-plus", with provisions that go beyond WTO obligations (Gibbs and Wagle, 2005). Thus, the

"policy space" for developing countries to pursue national development and socioeconomic goals may be significantly reduced.

The U.S. FTAs in particular seem to be used to influence partners in larger or multilateral negotiations and "to establish precedents that consolidate the U.S. position on issues where it has serious differences with its trading partners (such as on GMOs, geographical indications or audio-visual services)" (Gibbs and Wagle, 2005). Foreign policy and security issues also play a part. Of relevance to agriculture, FTAs do not establish disciplines on agriculture subsidies in the major developed countries and this exposes farmers in the developing partner country to unfair competition (Gibbs and Wagle, 2005). The U.S. FTAs, for example, do not have commitments on anti-dumping or agricultural subsidies and cover all products (i.e. in terms of obtaining market access), with the exception of "sensitive" ones like sugar. This creates the potential for imbalances in the agreement.

As U.S. FTAs generally ask for agricultural tariffs to be lowered to zero, although with varying time periods of implementation, many developing country farmers would be unable to compete with the influx of subsidized U.S. agricultural products and may be adversely affected. For example, under the North American Free Trade Agreement (NAFTA), from 1993 to 2003, exports of U.S. agricultural produce to Mexico more than doubled, climbing from $3.6 billion to $7.9 billion. Over a similar period, Mexico lost nearly 2 million agricultural jobs, according to Mexico's National Employment Survey (The Washington Post, 2007). Ratification or accession to UPOV 1991 is a requirement in U.S. FTAs with Bahrain, the Central American countries - Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua - under CAFTA, Chile, Colombia, Morocco, Oman, Peru and Singapore.

Such obligations remove the flexibility afforded under the TRIPS Agreement that allows countries to choose the option of a sui generis system of plant variety protection, which could be tailored to protect farmers' rights (TWN, 2005). The UPOV 1991 system currently restricts farmers' rights to use and save seed and prohibits them from exchanging or selling seeds of the varieties it protects, thereby subjecting poor farmers who depend on farm-saved seed to dependence on commercial breeders.

There are also numerous South-South FTAs, which may be able to promote South-South trade and allow countries to export goods for which they face market access barriers in the North. South-South FTAs may be more equitable in that there is less of an imbalance between the negotiating partners and they are less likely to be as comprehensive in scope as the North-South FTAs, since they tend to focus mainly on trade in goods.

Nonetheless, the South-South FTAs have to be also assessed carefully to ensure that the overall benefits outweigh the costs for the countries concerned and that any sectoral implications as a result of the liberalization of tariffs on goods are properly addressed to help with adjustment costs. For example, under the Thai-China FTA, agricultural tariffs have been lowered on 116 types of fruits and vegetables, including garlic and onions, from 1 October 2003. Since then, Chinese garlic has entered the Thai market in large quantities and at lower prices, with the result that garlic growers and small traders in Thailand have lost their livelihoods (Narintarakul and Silarak, 2005). A major issue in 'asymmetric' North-South FTAs would be to ensure that policy autonomy is retained for national development and the particular needs of each society.

3.1.2 Major players: their roles and interactions

The roles of different countries and block of countries in influencing trade policy depend on their positions as importers or exporters or both, driven by the size of population and their food production. More recently, large corporations have become major players and have influenced trade policies.

China and India, with their large and growing markets will have a substantial influence on the pattern of trade within Asia. Because of the size of their populations, even at a lower per capita income level these economies are larger and their influence is likely to be greater than that of Japan or Republic of Korea during a corresponding period of their ascent as manufacturing powers (UNCTAD, 2005).

With China already achieving basic calorie requirement levels (accepting the regional and socioeconomic-based inequalities in such an aggregate measure), there is likely to be a further rise in demand for livestock products, oil crops, vegetable oils, fruit and vegetables (FAO, 2002b) and with the boom in home construction for wood. In India there is a lag of a decade or so, as compared to China, in the changes in the pattern of consumption. There is still scope for increase in consumption of basic calories and an increase in per capita food consumption at the bottom of the economic scale, though above that consumption patterns have changed. Some of the boom in demand is negative, as in the case of demand for wildlife products in East and South-east Asia for food and medicine, which has driven the illegal wildlife trade in the region (World Bank, 2005a).

Both Japan and Republic of Korea have substantially protected rice markets. But for other agricultural commodities, including fishery and meat products and vegetables, they present large and growing markets. Recently, however, Japan has reduced levels of protection. There,

however, are still issues of further reducing tariffs, enabling existing agricultural producers to shift to other livelihoods and also enhancing supply of environmental services.

Overall in Asia, the dietary pattern is changing not only towards higher value foods but also to the use of semi-processed and processed food stuffs, which are more convenient even for home cooking and even towards more consumption of food outside the home (Popkin, 1993). The last trend is particularly influenced by the large-scale entry of women into the non-home-based labor force. Within the ESAP region, Australia and New Zealand are both large agricultural exporters. They are among the Cairns group of countries that press for free trade in agricultural commodities. They are joined by Thailand and Vietnam, both of which are efficient agricultural producers.

The other major players are the developed economies of North America, Europe and Japan. Their policies have affected the trade prospects of Asian countries in many agricultural commodities. They were all substantial importers of sugar, but subsidized production of corn-based and beet-based sugar have changed the picture. Since the early 70s, US sugar imports have declined from more than 5 million tonnes per year to just more than 1 million tonnes per year. While Japan's sugar imports have fallen from 2.5 million to 1.5 million tonnes per year, the EU has changed from a net importer of 2.5 million tonnes in early 70s to a net exporter of 5 million tonnes (Mitchell, 2005) at the lower price created by its subsidies, thus further undermining the price received by farmers and producers in developing countries (Robbins, 2003).

Countries, however, are not the only actors in the region. Trade policies themselves are influenced by the various lobbies in the countries. Even WTO policies are influenced by corporate interests, which maintain substantial lobbying presences at WTO headquarters in Geneva (ActionAid, 2006).

Corporations, particularly the big multi-national corporations, influence economic decisions in the region not only through their lobbying with governments and international bodies, but also through their economic practices. Production is more and more being organized in global value chains, as mentioned in the Introduction to this chapter. Agricultural commodities, in particular, are organized in what are called buyer-driven or retailer-driven value chains. The big food retailers and producers have substantial influence over prices that are paid to producers of primary agricultural commodities at the end of the value chain. In their product markets there is oligopolistic competition. The price pressures of this competition are passed on to the producers through lower prices. It is competition among producers with no better alternative, which enables buyers to gain lower prices from small producers (Singer, 1950).

Concentration is not only a factor among buyers in agricultural product markets. It is also increasing in agricultural input markets (UNCTAD, 2006b). But the entry of China's national agricultural research organizations and small seed producers in India, both in Bt cotton, has increased competition in some input markets (Fukuda-Parr, 2007).

Consumers have recently entered as policy makers in international markets. Particularly in developed countries, consumers and consumer lobbies have become more active in demanding certain standards. This is sometimes reflected in improved SPS standards, some of which have becomes contentious issues between developing and developed countries. There are also other standards, environmental standards, for which consumers have shown a willingness to pay a premium on standard prices and include organic food, shade coffee and certification of sustainably harvested wood products.

A study by the International Trade Centre (ITC) of UNCTAD and the WTO surveyed the European market for organic foods and beverages. A major conclusion of the study was that demand for these products is growing rapidly (see 3.4.5) and that insufficient supply rather than demand is the problem for these markets (Kortbech-Olsen, 2001). There is also a growing demand for organic foods in the urban centers of many Asian countries, though it is still quite limited. China's production of organics under the Green Label was close to $12 billion, which almost matches the size of the US market, the largest organic market in the world (IFAD, 2005) India's exports of organics was just about $15 million, though a lot of organic production is consumed locally and not marketed outside the locality.

There are also other forms of consumer standards, as the Forest Stewardship Council (FSC) certification. The certification is expected to be based on environmental and community-role criteria. The 'Bird Free' symbol of 'Shade grown coffee', again, certifies the non-destruction of forests to cultivate coffee. These certification systems provide for some premiums on price.

Unlike consumers and consumer lobbies, producers' associations have not had the same impact. In the first few post-WWII decades, marketing boards for many agricultural commodities, such as coffee and cocoa, tried to control prices and reduce outputs. But the weaknesses of these opposition from buyers' lobbies and the spread of production outside export quotas (e.g. Vietnam's entry into world coffee markets) undermined the boards. The post-WWII experience would lend itself to the hypothesis that changes in the location of production cannot be managed through export quotas, as countries keen to expand their own export opportunities are likely to undercut established producers.

3.1.3 National policy trends

Within the ESAP region there are a number of differences in national policy. In OECD members, Japan and the Republic of Korea, there is a strong protection to their rice producers, often justified on the basis of national culture, or tastes. For Australia and New Zealand exports of agricultural commodities (including livestock) are an important source of national income. They, along with other members of the Cairns group press for removal of restrictions on trade.

In developing Asia, there is a difference between East and South-east Asia and South Asia. In most of East and South-east Asia the proportion of the population dependent on agriculture has come down substantially over the last few decades. Among them, for Thailand and Vietnam, agricultural exports are important but account for a declining share of total exports, as manufactured exports have increased. But in Indonesia and the Philippines there is a large proportion of population still dependent on agriculture, more like the picture in South Asia, where there is still something like 50% of the population dependent on agriculture as the mainstay of their livelihoods. The high numbers of people dependent on agriculture and the relative stagnation in agricultural technology and yields, along with insufficient growth of labor-intensive manufactures have made it difficult to move more people out of agriculture.

The above differences within South-east and South Asia are reflected in different national policies. In countries like Thailand and Vietnam there is a stress on increasing productivity, so as to retain or improve their competitive positions in world agricultural trade. In China too there is a similar stress on improving productivity and moving into high value agriculture. In both cases the attempt is to improve infrastructure and provide research and technology development and marketing support.

But in South Asia (as also in Indonesia and the Philippines) there is a much greater stress on protecting domestic producers, with subsidies, from international competition. While there are moves to diversify into high value agriculture, these are not as consistent. In the ‘Green Revolution belt’ of Punjab-Haryana continued minimum price support to wheat and rice continues to stall attempts at diversification, as the rates of return from assured grain prices inhibit a shift towards more risky, if higher return, crops (Joshi et al., 2004; Rao et al., 2006).

Along with the above, there are also trends to opening up sections of the agricultural markets, for instance in cotton. In India this has led to a fall in cotton prices, affected as they are by competing imports from subsidized producers, like those in the US (Philip and Jenniah, 2006). “Between the period 1990 and 205 the import of cotton lint increased at a compound growth rate of over 75%,

growing in geometric multiples to domestic production. The price witnessed a decline of more than 55% between the years 1996 and 2003. In terms of individual years, the prices dipped as low as US $1000 per tonnes in the year 2002," (Philip and Jenniah, 2006). The plight of cotton farmers was compounded by the many instances of sale of spurious Bt cotton seeds. The destitution of many farmers has resulted in numerous suicides. This has become a frequently recurring political issue.

Overall, South Asia, in particular, has yet to work out ways to effectively deal with the opening up of agricultural markets. It is less of a problem in East and south-east Asia, affecting a much smaller proportion of the population and where there has been more of a stress on achieving transitions to more productive methods of cultivation and higher value crops.

One problem that has recently come to prominence is that of displacement of agriculturists from their lands, taken over for industrial use. In this displacement without compensatory jobs, small farmers and the landless, along with indigenous and tribal peoples are disproportionately represented. This has exacerbated the problem of the rural-urban divide, which is part of the growing inequality in developing Asia. The numerous rural protests in both China and India are witness to the social tensions caused by the growing rural-urban divide in these major countries of ESAP. On the one hand, greater openness to international trade in the region and the resulting growth of Asia as a manufacturing centre of the world, have created many jobs, lifted tens of millions out of poverty and reduced the global inequality between developing Asia and the developed countries. On the other hand, there has been a neglect of the agricultural sector (after the initial first period of Green Revolution and agricultural export growth), increasing the rural-urban divide in the contemporary situation. The emphasis on trade has led to neglect of rural development and of non-tradable sectors of the economy.

Policies to reduce gender equality (e.g. land rights for women, recognizing women as holders and developers of AKST); to reduce social exclusion (of indigenous and tribal peoples, low castes, minorities); to increase public investment in the supply of rural and agricultural public goods, such as infrastructure (roads, communication, health and education) and policies that encourage investment in research for neglected and non-internationally traded crops are options to reduce the rural-urban disparity (see Chapter 5). Education and skill building can help rural poor people to benefit from the new jobs in manufacturing and services that are being created in ESAP.

3.1.4 Trends in private and public institutional roles

Some of the studies referred to in this chapter point to the weakness of "world governance on questions of corporate conduct and competition" (UNCTAD, 2006b). Whether it is competition

policy or corporate governance, there has been a globalization of economic processes, but not a globalization of the regulatory framework. This is an important public issue that affects agriculture and trade.

As an example, when China, as a concession to the growing trade surplus with the USA, agreed to buy soya, prices of soya immediately went up from $7.70/bushel in December 2003 to $9.82/bushel in March–April 2004 and when China completed its purchases, the price promptly fell to $5.93/bushel in August 2004. It was estimated by the Chinese Academy of Science (http:www.chinafeed.org.cn/cms/_code/business/include/php/218139.htm) that China overpaid $1.5 billion on this purchase; what is of greater interest is the next part of the story. Because of the high import prices of soya, many processing plants in China went into the red and as many 64 out of 90 soya mills are now partly or wholly owned by the same soya trading companies, ADM, Cargill, Bunge and Luis Dreyfus. International trade still does not have the regulations and organizations to deal with such cartel behavior.

3.1.5 Trade and food security

Regional experience of trade and food security

ESAP and developing Asia in particular, has seen rapid reduction of poverty and improvement in household and individual access to food. But, at the international trade level, this is largely due to its rise in exports of manufactures. At the same time, there are substantial gains from international, particularly, regional trade in food grains. Carrying and transport costs can be lowered as regional trade in food grains becomes part of the national food management system of countries, particularly smaller countries. The ability to utilize regional trade to supplement domestic production depends on the country concerned having adequate foreign exchange reserves, otherwise it can be subject to unwanted external pressures. Along with this there is the negative effect of cartel arrangements between exporters and importers being more likely in a regional than in a global context (World Bank, 2006a).

Farmer households do react to market prices in deciding between production alternatives. But market prices are lowered by subsidized exports, something done not only by developed countries but also by developing countries, as are rice exports by Thailand, India and Vietnam.

Thus, given the twin realities of power relations and subsidized exports, countries cannot depend entirely on market-based individual household production decisions to set domestic food production levels. Subsidized exports can justify import duty to the extent of the subsidy.

In the absence of improvements in public service delivery like irrigation and other agricultural infrastructure, adequate research and extension and adequate institutional credit and marketing channels, poor producers remain trapped in low productivity states. Poor and food insecure households can benefit from expanded opportunities of trade provided that those constraints are addressed. Giving voice to poor producers' interests by placing these issues on the policy agenda is crucial for fostering reforms that unleash the productivity potential of poor people and increase their bargaining power.

Importantly, however, food security issues are related not only to poor producers but also to poor consumers. Low prices of food, brought about through imports of cheap food, when combined with increased productivity, can lead to both higher real wages and increased farm incomes. Internal political economy considerations, i.e. the strength of different lobbies, determine the level at which food prices are set. Setting import duties higher than the extent of subsidies provided by exporting countries would further erode the food security gains of higher real wages. The possibility of substantial unofficial trade to take advantage of price differences in neighboring countries, in fact, sets a limit to the extent to which import duties can be greater than transport costs.

As detailed below, small producers' livelihood are often threatened by imports. In the manner of providing domestic support, however, measures to increase productivity are superior to providing subsidies to continue high-cost production. They would not only increase national productivity but also can strengthen the fiscal position as compared to subsidies.

Household food security would be improved by allowing farm households to choose their own mix of crops and livelihoods, reacting to market prices and their own aspirations, rather than have the mix of crops dictated by administrative decision. Farmers in many areas of Nepal, Bangladesh, Indonesia, etc. are themselves moving into areas of comparative advantage, like vegetables and other such crops, which require more labor than cereals. But developing competitiveness in new areas of production requires substantial support, especially in improving quality and building capabilities, for instance, in meeting Sanitary and Phyto-Sanitary Standards.

Thus, uniform rules on the nature and measures of support cannot be applied to developed and developing countries alike, in particular, to LDCs. Least developed countries, including the small Pacific islands, are unable to match the competitiveness of larger and more complex economies. Special, differential market access, for given time periods, both within ESAP and with industrialized countries, can help these and other LDCs benefit from international trade.

Developing countries in general and LDCs in particular (including the small island nations of the Pacific), with narrow markets and not-so-developed capabilities, need to be provided specific support to build on areas of comparative advantage. If they are bound by the restrictions of the WTO, disallowing the benefit or support that is crop specific, they may well be unable to undertake the necessary diversification of production that can increase household incomes and thus food security.

Prices of primary commodities, like coffee, however, are subject to substantial fluctuations, threatening the food security position of producing households. But measures of price stabilization can be combined with steps to encourage diversification of product use, as is the case with palm oil. Further, as lower cost producers, or producers willing to accept lower returns enter the market, higher cost producers need support to move into other areas production, with disincentives for not doing so.

In all of the above measures of changes in production structures responding to comparative advantage, gradual change would reduce the social costs of the transformation compared to 'big bang' type of change and would thus be more desirable

Where women have participated in the commercial process fostered by trade, they have gained in household and social position, though often at the cost of an increased work-load. But the frequent exclusion of women from long-distance trade may be tackled by access to capital, training and facilitation measures.

The non-market access rights of tribal or indigenous peoples to land and forests, which are important for their food security, may be eroded through trade agreements which open up land to the market. At the same time, the increased scale of production fostered by commercialization cannot be sustained without a transformation of indigenous property systems in the direction of individualization or regulated commons, so as to link investment and returns.

Trade and the rural poor

With underdeveloped infrastructure, the upland and mountainous areas of Asia suffer from social deprivation due to political neglect and remoteness. The current process of international trade increases the risk of further marginalization, disempowerment and desperation, unless it is specially adapted for these areas (IFAD, 2001).

The limited accessibility, fragility, marginality and diversity of the mountain areas generally require diversification of resource use and production. But international trade, guided by short-term

profitability and external demand, promotes narrow specialization in few specific products. It encourages indiscriminate resource-use intensification and over-extraction of niche opportunities, with little concern for their environmental and socioeconomic consequences. The process of globalization is so rapid that mountain communities do not have sufficient lead-time and capacity to adapt (IFAD, 2001). There are other agriculture-based poor, concentrated in the large arid and semi-arid regions, dependent on rainfed agriculture. They share some characteristics of poverty with the upland poor.

In many Asian countries, small farmers have been affected by competition from imports that are cheaper than their products. Their organizations have been raising the alarm and requesting assistance from their governments, e.g., Asian Farmers Group for Cooperation request that WTO continue to allow Asian countries to protect their agricultural products (Antara News Agency, 2000).

The Sri Lankan agricultural sector has come under heavy pressure from increasing competition arising from cheap imports resulting from import liberalization. The comparative and competitive advantage of Sri Lanka to produce particular commodities will need to be considered in selecting IFAD's interventions in future projects (IFAD, 2002). There have been protests of Sri Lankan farmers who were adversely affected by cheap imports. Protests were held by potato farmers, chili and onion producers and chicken farmers against cheap and ruinous imports (Samath, 1999).

In 2000 the U.S Agriculture Department accused the Philippine government of violating WTO rules when the import of US chicken was limited to curtail dumping. According to the Minimum Access Volume (MAV), only 19,000 tonnes could be imported to safeguard the local chicken industry. (The Philippine Daily Inquirer, 21 July 2000). About 330,000 workers or a third of a million in the chicken industry were affected.

The economic reforms in China, especially on the occasion of China's entry into the WTO, have led to concerns by some senior officials as well as experts that there may be adverse effects on the competitiveness and livelihoods of local farmers. "China's leaders worry that economic reforms could be placing more burdens on farmers than they can bear. Farmers are on the receiving end of the earliest and sharpest changes from the new policies that China agreed to implement to gain entry to the WTO ….According to a report by China's State Council, the country's WTO commitments are likely to wipe out the livelihoods of 13 million farmers who grow wheat, rice and cotton, while creating new ones in non-grain crops for only about 1.5 million. Some economists reckon that China will eventually need to find jobs for about 200 million farmers

as its market reforms continue. “The Chinese farmer is in a very unenviable position,' said, which is part of China's Ministry of Agriculture. The impact of reforms on agriculture is profound.” (Ke Bing-sheng, director general of the Research Centre for Rural Economy in China’s Ministry of Agriculture as quoted in Goodman, 2002). These concerns have materialized, as manifested in soybean (Box 3.1).

[Insert Box 3.1]

Indian farmers have in recent years faced competition from imported skimmed milk. “The import of 17,000 tonnes of skimmed milk powder from Denmark at zero duty a couple of years ago resulted in a political uproar in Punjab. New Zealand has dumped a large quantity of butter oil into India. Even after paying an import duty of 35.2%, the butter oil imports have been at less than US $1,000 per tonnes against the prevailing global price of US $1,300 per tonnes. Domestic prices crashed, coming down by 10-15 percent. Highly subsidized imports of milk flowing into India will only further marginalize millions of milk producers. Thousands of dairy cooperatives which pulled the poverty-stricken masses into a path of economic emancipation will collapse faced with cheap and highly subsidized imports” (Sharma, 2002).

Indonesian farmers in several sectors, including poultry, rice and corn have been affected by cheap imports on different occasions in recent years. As Indonesia has attempted to adjust its import policies with WTO agreements through lowering import duties and lifting bans on various commodities local producers say the flood of imports is forcing them out of business.

Rice is the staple food for most Indonesians and is a strategic commodity for the country, grown by 40 million farmers. Before to 1998, i.e. before the reforms in the country following the Asian financial crisis, the price of rice was kept at low levels by the government’s food agency, BULOG, by implementing a buffer stock policy. Farmers were given production input subsidies (Suparmoko, 2000). Although the 1997 crisis was rooted in the banking sector and exchange rate policy, the IMF demanded trade liberalization measures in both the agricultural and manufacturing sectors. This included ending the monopoly of the BULOG on food imports and marketing and cutting the import tariff on rice to zero (Oxfam, 2005). From 1996 to 1999, rice imports more than doubled, reaching 4.7 million tonnes. Since BULOG was unable to defend the floor price promised to producers, farmers were left to sell their crops at low prices. In late 1999, the government stepped in to restrict the flood in imports and in 2000 re-introduced a levy equivalent to an import tariff of 30%.

3.2 Developing Countries' Issues in Trade Agreements

3.2.1 Subsidies and market access

Developed countries (or industrial countries) share of world agricultural exports remains about 63% (Aksoy, 2005); Asia and the Pacific together have a share of 13.9% of world agricultural exports in 2000-01, which is almost the same as in 1980-81. This is in contrast to the change in the shares in manufacturing exports, where developing countries, particularly those of Asia, have substantially increased their share of world manufacturing exports.

What accounts for the high share of developed/industrial countries in agricultural exports and the relatively low share of developing Asia? A much commented upon factor is that of high subsidies and tariffs for agricultural products. The combination of tariffs (border protection) and direct subsidies were 44.9% of farm gate prices in 2000-02 (Aksoy, 2005). This support was down from 62.5% in 1986-88, but still very high. Among OECD countries, only Australia and New Zealand, had low levels of total support, which went down from 10.6% in 1986-88 to just 3.6% in 2000-02. In contrast to the OECD countries, developing countries as a whole reduced average agricultural tariff rate from 30% in 1990 to 18% in 2000 (Aksoy, 2005).

Developing countries, in particular LDCs, are exempt from reducing the so-called *de minimis* support. The important problem here is that developing countries' budgetary positions do not allow them to reach even the allowed *de minimis* support.

It is necessary to first consider the nature of the world food market. Here we take the example of rice, since rice is of critical importance to food security in most of the countries studied. The world rice market is neither deep nor very competitive (Tabor et al., 2002). The rice market is less dominated by import demand from Asia than it was two decades ago – Asia accounted for two-thirds of global rice demand in the 1970s, but this figure has come down to a third in the late-1990s. The number of traders in the rice market has increased and there are now numerous small traders, involved in what is called smuggling, but is better regarded as unofficial trade. But world rice prices at below $150 per tonnes are dominated by the major exporters. All of which use various forms of support to subsidize rice exports. The USA provides the largest subsidy to rice export, $143 per tonnes of paddy (Wailes and Durand-Morat, 2005) or about $530 per tonnes of exports, if all of the subsidy were attributed to exports (Tabor et al., 2002).

The major Asian exporting countries also subsidize rice exports. Thailand provides loans at subsidized rates; Vietnam provides credit subsides, while India allowed exporters to buy rice at subsidized prices supposed to be for 'Below the Poverty Line' (BPL) households. Consequently, although the exporters are also lower cost producers than the importers, competition between

exporters is “less on productivity gains and more on the degree to which domestic markets are protected and exports subsidized” (Tabor et al., 2002).

Vietnam is said to have the lowest rice production costs in the world (UNEP, 2005). This has allowed it to enter the market for rice exports in medium to low qualities of rice. Over the 1990s Vietnam’s rice exports have grown at 13% in quantity and at least 12% in value terms (UNEP, 2005). In response to the low export prices of rice, some of the major rice exporters, like Thailand and Vietnam, have proposed the formation of a cartel. This has been rejected by India, which has continued to undercut its rivals in the low end of the market (mainly Pakistan and Vietnam) by selling highly subsidized rice.

Subsidies to exports mean that global rice prices are not a good guide to marginal costs in supplying world rice requirements. This is the first reason why domestic food production cannot be determined by pure global price-based decisions. International rice prices would have to be revised upwards and domestic rice production would then also be higher than that which would be dictated at existing international rice prices.

In China, for instance, sugar prices were higher than world market prices. With the news that China would join the WTO, sugar and sugarcane prices began to fall. Sugarcane prices fell from Y 230 per tonne in 2003 to just Y 170 per tonne in 2004, bankrupting small producers (Oxfam, 2003). An option is to allow import duties, equal to the extent of subsidy paid by OECD countries and for as long as these subsidies, in whatever form they are given, continue to be in place.

3.2.2 Agreement on agriculture and fiscal support

The Agreement on Agriculture (AoA) limits the extent support that governments can provide to their agricultural producers. The aggregate measure of support (AMS) that developing country governments can provide is quite high, at 20% of the value of agricultural production. This does not compel developing countries to reduce their support, which is much less than that allowed. But countries dependent on exports of agricultural commodities, like the West African countries that export raw cotton, are pressing for the elimination of developed country (OECD) support to agriculture, as this support depresses world prices and enables, say, USA to export its cotton at prices that eliminate or reduce the presence of West African producers from the market. Middle-level developing countries like India are trying to get agreements that will maintain their own existing levels of support while reducing the levels allowed to developed countries. There are complex bargaining positions in the negotiations that are currently underway.

The issue we need to consider is: Is the sovereign right of governments to decide on the AMS curtailed by the AoA? Or, are developing country governments and least developed countries (LDCs) in particular, being forced to reduce their levels of support because of WTO agreements?

The AMS ranges from less than 2% in the case of Bangladesh to about 8 to 10% in the case of India and Vietnam. In both cases the AMS is below the permissible WTO limit. What keeps the AMS at the present levels is not the limit set by the WTO, but the fiscal weaknesses of the governments concerned

Given that all developing country governments face considerable resource constraints, which in fact restrict the AMS, one needs to ask what is the right balance between price-support or input-subsidy measures and productivity-enhancing investments? Price support measures in food grains have negative effects on food buyers, who include not only laborers but also small-scale farmers. This is a negative effect of whatever positive merit there might be in price support for farmers.

On the other hand, investments in infrastructure, including irrigation and public research and extension will have productivity enhancing effects. Given the admittedly low productivity of many sectors of food production in developing Asia) it is necessary to concentrate on productivity increasing measures. Such productivity increases will pay for the costs of the support.

Conversely, price support measures can lead to various distortions, both in product and input markets. For instance, subsidies for use of electricity in India have led to overuse of electricity. There is the well-known case of overuse of urea. Further, many of these input supports programs though targeted at protecting farmers, mainly benefit the input-producing enterprises.

Besides various types of domestic support, there are also explicit export subsidies. They can take various forms, such as low interest loans or longer-term loans, both financed out of public subsidies and other related promotional measures. Export subsidies can also take the form of food aid. Food aid, unlike other export subsidies, is not subject to the Uruguay Round AoA schedule of reductions. Food aid is often used by developed countries (now even some developing countries like India) to dispose off surpluses. The effects of food aid on the market are similar to that of export subsidies – they depress prices locally and reduce incentives to local producers, where the aid is being distributed. Contemporary experience (Sharma, 2005) shows that distribution of food aid can reduce local prices and thus serve as a disincentive to local producers to increase production.

3.2.3 Tariff escalation

Tariff escalation refers to the practice of increasing tariffs as commodities progress along the value, moving from raw materials to processed products. Moving up the value chain also means that the country and its producers are less affected by price fluctuations, as both intermediate and final product prices tend to fluctuate less than raw material prices. But such movement up the value chain is inhibited by the practice of increasing tariffs with stages of processing. For instance, the tariff on oranges is less than the tariff on orange juice. This makes it difficult, if not impossible, to use the developed country markets to make the shift from selling raw materials to selling processed products.

Tariffs on fresh, i.e. unprocessed fruit and vegetables in developed countries range from 0.9% for fresh fruits in Canada to 9.2% in the EU. For processed fruits the EU tariff rates are above 20%, with many facing tariffs of 50% (Diop and Jaffee, 2006).

Trade restricting measures can be classified as:

- Economic: Measures which affect pricing, competition and market entry or exit. For example, Quotas and domestic content requirements;
- Social: Measures that protect public interest like health, safety and environment. For example, quality standards, food safety measures and environmental regulations; and
- Administrative: Measures that are administrative formalities. For example, customs valuation, classifications and clearance procedures.

The technical barriers to trade (TBT) (Table 3.2) are regulations and standards governing the sale of products into national markets which have, as their primary objective, the correction of market inefficiencies stemming from externalities associated with production, distribution and consumption of these products. These externalities may be regional, national, transnational or global. These barriers include measures that protect public interest such as health, safety, environment and social cohesion. These could be food safety measures, environmental measures or quality standards. Depending on the policy instrument, TBT could be in terms of import bans – total or partial, technical specifications like process, product or packaging standards, or information remedies like labeling requirements. They could apply either to domestic as well as import products, or only imports or some imports. The compliance with these measures could mean either loss of markets or higher costs to the importers (Roberts, 1999). A study of technical barriers to US agricultural exports for 1996 showed that they were more of risk reducing measures, that too in the area of food safety and commercial animal and plant health protection. They were implemented through process and product standards mainly in the case of food safety and total and partial bans, besides process and product standards, in the case of

animal and plant health protection. On the other hand, non-risk reducing measures were few and mainly with respect to quality attributes. Many countries use very blunt instruments such as import bans that excessively restrict imports well beyond what is necessary for protecting the health of their people, plants or animals. The level of protection involved in some cases is equivalent to tariffs of more than 10% (Hoekman and Anderson, 1999).

[Insert Table 3.2]

An analysis of Technical Barriers to U.S. Agricultural Exports in 1996 showed that:

- 80% were risk reducing measures
- 60% were about commercial animal and plant health protection (CAPHP)
- 25% were about food safety
- More than 50% in were in CAPHP and 75% in food safety category in terms of process and product standards
- Non-risk reducing (quality attribute) were also mainly in terms of process and product standards
- 85% of barriers were under SPS agreement with an average trade impact per barrier being US $17 million.
- Major restriction by barriers was in market access or market expansion
- Most of the barriers were in East Asia, Americas and Europe
- Major products facing barriers were fruits, vegetables, grains and feed grains, animal products (beef and pork) and seed (Hoekman and Anderson, 1999).

On the other hand, from the US alone there were numerous technical barriers to developing country exports, amounting to up to 56 detentions per million dollars of imports (Table 3.3).

[Insert Table 3.3]

The WTO agreement on TBT sets standards for labeling and packaging of agricultural products as recommended by the Codex Alimentarius Commission (CAC). The CAC, on which both the TBT and the SPS Measures agreements of WTO are based, was established by FAO and WHO in 1962 which recommends food safety and labeling standards. In the 1980s, the CAC, came out with general labeling standards and nutritional labeling standards. After this, in the Tokyo round of GATT, an agreement on technical barriers to trade was negotiated. The TBT agreement which has been now signed by all the WTO members is applicable to all products including agricultural goods and food but its provisions do not apply to SPS measures (Swinbank, 1999).

The TBT agreement covers labeling of food, quality requirement for fresh food products, packaging requirements and labeling of textiles in the agro-food sector (Chawla and Kumar,

1997). Although the public debate on the use of technical barriers to trade has focused on use of these measures to protect consumer and the environment interest, a large number of these measures actually protect the commercial interest of producers by reducing the probability of biological risks to crops and livestock (Roberts, 1999). There is no doubt that TBT will remain an important issue in international regulatory and trade policy forums for the foreseeable future.

3.2.4 Sanitary and Phytosanitary (SPS) measures and AKST

a) The SPS measures agreement of WTO, reaffirms the right of countries to set their own health and safety standards, provided that they are justifiable on scientific grounds and do not result in unjustified barriers to trade. SPS measures include all relevant laws, decrees, regulations, requirements and procedures including, inter alia, end product criteria; processes and production methods; testing, inspection, certification and approval procedures; quarantine treatments including relevant requirements associated with the transport of animals or plants, or with the materials necessary for their survival during transport; provisions on relevant statistical methods, sampling procedures and methods of risk assessment; and packaging and labeling requirements directly related to food safety (Swinbank, 1999). The SPS measures, thus, encompass food additives, contaminants, toxins, drug or pesticide residues in food, certificate of food, animal or plant health safety, processing methods, food labeling, plant or animal quarantine, requirements for prevention, control or establishment of pest or disease and sanitary requirements for imports. Whereas the sanitary provisions relate to food and animal health, the phyto-sanitary provisions cover plant health aspects of products (Chawla and Kumar, 1997).

b) For the purpose of the definitions, “animals” includes fish and wild fauna; “plant” includes forests and wild flora; “pests” includes weeds; and “contaminants” include pesticide and veterinary drug residues and extraneous matter (Adopted from Swinbank, 1999: Original source GATT, 1994). The SPS standards comprise articles on basic rights and obligations, non-discrimination, harmonization, transparency, equivalence, regionalization, risk assessment and control, inspection and approval procedures; and are based on Codex Alimentarius Commission (CAC) guidelines of FAO/WHO which is nothing but application of Hazard Analysis and Critical Control Points (HACCP). This method is about improving and controlling processes as variability in processes can cause quality problems; and is product-specific in nature.

The basic rights and obligations clause means that members have the right to take SPS measures necessary for the protection of human, animal or plant life or health provided such measures are consistent with the provisions of the agreement, are based on scientific principles and do not arbitrarily or unjustifiably discriminate between members where identical or similar conditions prevail. The harmonization provision calls for members to base their SPS measures on

international standards where they exist though members can adopt more stringent SPS measures if there is a scientific justification as per the agreement. Under the agreement, members are also to recognize the SPS measures of other members as equivalent to their own if the exporting member objectively demonstrates to the importing member that its measures achieve the importing member's appropriate level of SPS protection (principles of equivalence). Further, if members wish to apply more stringent measures than the international standards, then they are obliged to base their risk assessment and level of SPS protection on scientific evidence and their levels should not be more trade restrictive. Members are also required to consider objective geographical and ecological conditions rather than national boundaries to apply SPS measures (regionalization clause). Under the transparency clause of the agreement, members are to ensure that all SPS measures and changes in them are notified in a transparent manner through a single national enquiry point. Finally, the control, inspection and approval procedures are to be applied in no less favorable manner for imported products than for like domestic products (Swinbank, 1999).

Critique of SPS measures. Since both the agreements (TBT and SPS Measures) are relatively new and technical, there is a certain amount of confusion and a lack of differentiation between the two measures. For example, shelf life regulations can be adopted as a SPS measure or a TBT measure depending on the exact purpose. Therefore, knowing the objective of a measure is critical to determine whether a measure is subject to the discipline of TBT or SPS agreement. Similarly, the range of measures given in the SPS agreement is not totally inclusive. For example, measures introduced to control the spread of weeds would generally be covered by the SPS agreement. But, the agreement is not clear enough about the concerns of those who believe that use of genetically modified organisms (GMOs) could lead to cross-pollination and GMO genes into the natural flora. In this context, the USA challenged the EU's labeling requirement for certain products produced from GMOs under the TBT rather than under the SPS agreement arguing that it is not aware of any information that GM foods differ as a class in any way from products produced by other methods (Swinbank, 1999).

Secondly, the differences in standards across countries are very difficult to resolve even with the best scientific advice. The examples of disputes under WTO umbrella in this field include that of beef hormones, irradiated food, cheese made from unpasteurised milk and genetically modified foods (Hoekman and Anderson, 1999). Though the SPS agreement does not impose international standards on members, it does enhance the importance of international standard setting agencies as it encourages members to base their SPS measures on international standards and that national provisions have to be justified on scientific grounds if they are more

stringent than international standards. Over time, it tends to impose, a de facto, set of international standards worldwide.

From the developing countries' and the Indian prospective, the SPS measures set very high standards which are not suitable for these countries either because they have higher cost of compliance or are not required in their contexts. Further, no lead-time has been given to these countries for implementing these provisions. It is also argued that what was designed in the Western contexts (CAC guidelines) has been imposed on the developing world. There is also hypocrisy in the practice of these provisions as there is lack of transparency and prevalence of discrimination against the developing world. For example, under Codex standards, the raw material for some types of cheese like mozzarella, cheddar has been restricted only to cow milk in the Codex standards on the basis of the argument that these cheeses were traditionally made from cow milk. This means that there may be difficulties in exporting cheese made from buffalo milk (Chawla and Kumar, 1997).

An SPS measure becomes a barrier:

1) When domestic standards are lower than those for imports
2) When standard conformity assessment is different/not recognized by two countries as it duplicates costs of product testing (Table 3.4).

[Insert Table 3.4]

There is also no doubt that the SPS barriers can lead to import bans which means higher cost of compliance (15-40% of FOB value) for the developing country exporters which, in turn, could lead to reduced trade or diversion of trade between exporters due to high cost. The developing countries are also likely to find it difficult to implement these standards as there is lack of SPS control systems, lack of awareness and understanding of standards, lack of technical abilities to implement standards and organizational structures are not geared for such standard setting (Henson and Loader, 1999). There are also problems of multiplicity of standards organizations which leads to duplication and lack of coordination and small size of firms/farms.

Due to the TBT and SPS provisions of WTO, India has faced non-tariff barriers for its products. In 1997 Indian fishery products were banned by EU and were put on automatic detention by the US (Scheuplein, 1999). There were numerous detentions in 2000-2001under the SPS provisions.

Cases of SPS Restrictions on Indian Food Exports subsequently have included:

1) UAE ban on Indian meat imports (for 10 companies) due to health and hygiene reasons;

2) EU ban on Indian fish imports due to lack of SPS standards especially in canning (only 90 out of 404 plants approved for fishery exports to the EU);
3) Fruit fly problem in fresh fruits and vegetables which needs to be treated (VHT) as the pests may be carried to the importing country (mango (stone weevil) in case of Australia, mango, citrus fruits and flowers in case of Japan and grapes in case of China);
4) HPS groundnut and spices (EU, Italy and Germany) and Chilies (Spain) due to aflatoxin and chemical residues;
5) India delisted from the list of approved countries in EU for import of egg powders, two years ago, for non-submission of Residue Monitoring Plan (RMP);
6) Dairy products export problems:
    a. of mastitis in bovines and F& M disease in cattle and buffalo which leads to deterioration in composition of milk
    b. Somatic Cell Count (SCC) based pricing in first world
    c. Input sector related problems like quality of fodder which affect milk quality
7) 'Karnal bunt' in wheat and also Iran's rejection of Indian wheat sent by two private exporters due to quality problem; and
8) Indian basmati rice consignments (40) (of 16 companies) detained in 1999-2000, by the USFDA on grounds of being filthy and containing pesticides.

Under the WTO agreement, India had obligated itself to comply with the SPS provisions by the end of 1997. In the food sector, this includes strengthening of the national food export control system.

A study of quality control and monitoring practices in two of the commodity sectors in India (fisheries and spices) found that there were serious problems of maintenance of hygiene and quality standards and processes at the primary production or procurement level. For example, the fishing boats did not have ice on their streams when they arrived at the pier. The appearance of the boats was dirty and it did not seem possible under those conditions that they complied with hygiene standards. When fish and shrimp were unloaded from the boats, they were dumped into piles sometimes very carelessly and in an unorganized manner. There was no separation of fish from the general walking areas and every one appeared to have free access to any place on the pier or any pile of fish. On the other hand, the processing centers were excellent at maintaining quality and hygiene standards and they had HACCP in place and in operation. But this may not be the case with all the 400 processing facilities in India. Most of the quality and hygiene problems at the primary produce level were due to lack of awareness and lack of infrastructure like portable water and landing facilities. Similarly, in spice production and processing, the major problems were in production which is carried out by small-scale farmers who lack knowledge of quality and hygiene and do not have an incentive to maintain them. Here too, the processing

plants had all the quality systems in place, but the contamination takes place at the farmer and the trader level (Scheuplein, 1999).

Options. At the international level, there is a need to make the WTO system more transparent. The farmers' organizations should be allowed to participate, either through their governments or directly, into the standard setting bodies like the CAC so that farmer concerns could be brought into the body and its rules and recommendations.

Further, since domestic markets do not value quality, the farmer is not encouraged to maintain high quality standards of the produce. Therefore, what is required is not end-product testing for exports but monitoring of the entire commodity chain to maintain quality and hygiene standards. It is here that the application of HACCP comes in as a process control concept which places the burden of ensuring safety on the members of the food chain which include farmers, traders, processors and distributors. There is a serious need to link farmers with processing and exporting agencies and firms so that quality can be ensured right from the raw material production stage. This can be achieved through appropriately designed arrangements like contract farming or the procurement cooperative alignment with processing and marketing companies.

3.2.5 Anti-dumping measures and AKST

After the removal of all other non-tariff barriers under the WTO regime, the anti-dumping measures are the most important non-tariff barriers as they are being used as a protectionist measure with little connection with dumping or fair trade. The anti-dumping disputes (15.4 % of total) were next only to import restrictions (on goods) related disputes (38.4% of total) brought to the WTO during 1995-2003 (Rameshan, 2004). It is not the use of the anti-dumping measures but their very existence that can have significant trade effects like collusive behavior among domestic and foreign firms (Zanardi, 2004). This is already evident in the fact that in the recent past, there has been a steady increase in the number of anti-dumping actions by both the developed and the developing countries. The exporters in many developing countries find that, as their exports rise, there are increasing pressures from developed country industries for the levy of anti-dumping duties on the ground that goods are being dumped. Thus, anti-dumping measures might counter balance the tariff reductions accomplished by various GATT rounds.

Anti-dumping measures are intended to prevent the import of products at prices lower than those at which they are sold within the exporting (home) country markets. It is a type of penalty against imports to protect the domestic industry. All members of the WTO are obliged to set up their own anti-dumping authorities to prevent injury to domestic industry.

The WTO agreement on anti-dumping measures stipulates a rigorous framework for dealing with the problem of dumping. The anti-dumping measures, as per the agreement, can be initiated only when; a) an existence of dumping is identified; b) injury to industry is measured; and c) causal link between dumping and injury to industry is established. All these steps require strong technical and analytical support (Panchmukhi, 2001). Dumping is defined as the introduction of a product of one country into the commerce of another country at less than the normal value of the commodity (Gupta, 1996). The principal criterion for determining dumping is whether the price of the product exported from one country to another is less than the comparable price in the ordinary course of trade for the product, when destined for consumption in the exporting country. In the absence of the domestic price, the highest comparable price for the like product for export to any third country in the ordinary course of trade or the cost of production of the product in the country of origin plus a reasonable addition of selling cost and profit are relied on. No matter which standard is used, in each case, it is enjoined that due allowance shall be made for differences in conditions and terms of sale, difference in taxation and other differences affecting price comparability (Kaul, 1997).

The conditions for imposition of anti-dumping duties to offset or prevent dumping are:

1) The anti-dumping duty shall not be greater than the margin of dumping.
2) No anti-dumping duty shall be levied by reason of exemption from or refund of duties for taxes borne by a product when destined for domestic consumption in the exporting country.
3) No anti-dumping duty shall be levied unless it is determined that the effect of dumping is such as to cause material injury to an established industry (Kaul, 1997).

Anti-dumping duties can be of several types i.e., ad valorem duty, specific duty and dumping margin duty. Besides anti-dumping duty, the other measures against dumping can be provisional measures or duties, price undertakings and voluntary export restraints. Provisional measures are used to prevent injury being caused during the anti-dumping investigation and can be in the form of provisional duty, security deposit or withholding of appraisement. These measures are normally limited to four months and expire with the conclusion of the proceedings. Provisional duties are refunded if no evidence of dumping and injury is found and the difference is reimbursed if the final duty is less than the provisional duty. Price and voluntary export restraint undertakings are voluntary undertakings given by any exporter to the effect that the exporter agrees to increase the prices or to cease/reduce exports to the area in question at dumped prices in order to satisfy the authorities that the injurious effect of dumping has been eliminated (Gupta, 1996). When petitions result in voluntary export restraints, exporters are allocated with export licenses based on firms' foreign market shares in the past. Thus, forward looking exporters have

an incentive to enlarge their market shares by dumping more at present and thus securing larger profits under the export restraint (Zanardi, 2004).

Until recently, most intensive use of anti-dumping actions has been made by the US, Canada, the EU and Australia in that order. Canada was the first country to adopt an anti-dumping legislation in 1904 followed by Australia in 1906 and several others by 1920. After the passing of the anti-dumping code during the Tokyo round of GATT in the 1970s, many developing countries also started passing anti-dumping legislation with India doing it in 1985 (Zanardi, 2004). By the end of June 1997, 76 members (with EU countries counted as one) had submitted notification of their anti-dumping legislation or regulations to the WTO's committee on anti-dumping practices and by the end of 2001, 94 countries (with EU countries counted individually) had their anti-dumping laws in place. By the end of 1996, the WTO member countries reported 900 anti-dumping measures, including price undertakings, being in force which rose to 1119 by the end of 2000. The major sectors affected by these measures were base metals, mostly steel, chemicals, plastics, textiles, machinery and equipment and agriculture and food in that order (Ghate, 1998; Zanardi, 2004)). The 'Big Four' i.e. the US, the EU, Canada and Australia still account for more than 40% of all anti-dumping investigations (Bhattacharyya and Gupta, 2001).

By 2001, more than 90% of world wide imports were potentially subject to anti-dumping actions compared with only 71% in 1990 (Zanardi, 2004). And, the developing countries are the major targets of anti-dumping actions. They faced 38% all cases during 1990-94 which rose to 42% during 1995-99 (Bhattacharyya and Gupta, 2001). On the other hand, Argentina, Brazil, Mexico, India and South Africa emerged as major users of anti-dumping actions accounting for 1/4th of all anti-dumping investigations since 1995 (Bhattacharyya and Gupta, 2001). The WTO Anti-Dumping Measures agreement excludes the use of AD in a retaliatory fashion in line with the non-discriminatory principle of the WTO (Zanardi, 2004).

During 1980-2001, 4597 anti-dumping investigations were initiated and the largest four users (Australia, Canada, EU and the USA) each had a double digit share and altogether filed 64% of all anti-dumping petitions. But, in more recent times (1995-2001), only the seven largest uses together reach a share of more than 64% with new ones being Argentina, India and South Africa who have even larger shares than Australia and Canada. India initiated a total of 192 anti-dumping investigations during 1980-2001 with most being after 1996 (Zanardi, 2004). India has been one of the major users as well as victims of the anti-dumping measures. India initiated 140 anti-dumping cases during 1995-1999 compared with only 15 during 1991-94 and 45 during 1993-1997 with definitive duties in 11 cases (Panagariya, 1999) and it was the highest among the developing countries, accounting for 15% of all cases in the developing world. India imposed its

first ever provisional anti-dumping duty in January, 1993. The index of such anti-dumping initiations was 1875 per dollar of imports for India compared with only 100 for the USA.

India also faced very costly anti-dumping actions for its exports: 779 per dollar of exports in terms of index, compared with only 100 for the USA (Mattoo and Subramanian, 2000). In 1998 alone, India faced one case of anti-dumping for every $2.74 billion of exports as against only 15 such cases faced by the US for every $45.46 billion of exports. India was next only to Ukraine in this regard. In fact, more than 15% of all final measures imposed under anti-dumping investigations were aimed at India (Bhattacharyya and Gupta, 2001).

Over the period 1980-2001, 113 countries were targets of anti-dumping investigations and during the recent period of 1995-2001 alone, 93 countries faced anti-dumping investigations with prominent ones being from Asia i.e. China, South Korea, Japan and Thailand which together accounted for 30% of all cases. In fact, China has faced about 15% of all (2416) anti-dumping cases filed by the WTO members up to the end of 2003. Due to this, China has recently set up an early warning system on 189 goods of export importance mainly including textiles, home appliances, steel and furniture which account for 60% of China's exports to the USA (Joseph, 2004). India's share in all anti-dumping actions suffered went up from 0.9% in the 1980s (1981-87) to 3.72% by the late 1990s (1995-2001) (Zanardi, 2004). Also, it is increasingly the developing world countries which are targeting more of other developing world countries (50% cases) besides the developed countries targeting developing countries. But, most of the cases in Japan, South Korea and the EU have been settled with price undertakings as the Japanese avoid courts and litigation by tradition. On the other hand, India had all its anti-dumping investigations settled through anti-dumping duties only (Zanardi, 2004).

The USA imposed anti-dumping duty on Indian preserved mushrooms along with those from China and Indonesia in 1999. The dumping margin calculated for India was the highest (243%), followed by China (198%) and Indonesia (22%). The USA imposed company specific anti-dumping duties on Indian firms which ranged from 7-243% though the effective rates were ranging from 7% to 15% as other firms were not exporting any more (The Economic Times, March 1, 1999). The EU investigated 28 exporters from India, the highest number followed by China (24) and South Korea (20) during 1998-2002 mainly in iron and steel, chemicals and textiles. On the other hand, the EU suffered most from USA and India in 2002 with 25% of the cases each by the two countries (Silberston, 2003).

There is also significant evidence of retaliation in anti-dumping actions. Twelve countries simultaneously targeted to protect the same industry group wherein same product was subject to

anti-dumping duty both at home and abroad. It is difficult to accept the fact that an industry that is injured by imports from a country can be causing injury to the very same industry in another country (Bhatt, 2003).

Decisions of the WTO panels on anti-dumping measures.

The working of the WTO panels on anti- dumping so far has shown that it is able to build confidence in the dispute settlement mechanism of the body. This is evident in the case of US Anti-Dumping Act of 1916 where the WTO panel and the Appellate Body have unequivocally held that the US Act, which provides for specific action against dumping in the form of civil and criminal proceedings and penalties, is inconsistent with the WTO agreement on anti-dumping (Satapathy, 2000a). Similarly, the WTO panel ruling on India's complaint against anti-dumping measures by the EC on imports of bed linen from India, in favor of India, suggests that WTO panels can not be manipulated. In particular, the measures of anti-dumping by the EU, were rejected. The EU is one of the four major traditional users of these measures along with the US, Canada and Australia and has a long experience and administrative and legal set up. Secondly, the panel has ruled against the EU practice of zeroing negative price differences in the calculation of dumping margins. This finding of the panel against the zeroing practice would now force the prevailing practice in some of the developed countries to change. This will mean that in many cases, the dumping margins may disappear or come down below the '*de minimis'* level for the developing country exporters, requiring no anti-dumping duties (Satapathy, 2000b).

Further, the EU did not even collect data for examining the effect of all economic factors on an industry which led the WTO panel to reject the EU's claim on injury to the industry because of dumping of imports. This means that in all the countries, much more economic analysis to determine injury to industry and to attribute it to dumping will be required. The panel even questioned the sample used for determining injury for the domestic producers as the EU found domestic industry to consist of 35 producers but used data on other and lesser number (17) of producers. The panel also argued that before imposing anti-dumping duties, possibilities of constructive remedies should be explored by the developed countries. The EU had rejected India's request to offer price undertakings and by doing so, EU had failed in its obligation to explore constructive remedies to the problem of dumping as provided in the Agreement on Anti-Dumping Measures (Satapathy, 2000b).

Anti-dumping system has been able to sustain and grow in practice due to public perception of 'dumping' which is different from the rules and regulations and its relevance as a safety valve, political expediency due to impact of liberalization and globalization, lobbying by pressure groups and differences in competition standards cross nations (Tharakan, 1999). Anti-dumping actions

have implications for foreign investment flows. There seems to be a coincidence between anti-dumping cases and inward investment. The evidence from the EU and the US shows that anti-dumping actions have substantially increased the incidence of manufacturing investment by Japanese firms in these regions. What it means is that imports are being replaced by local production by foreign firms which can still practice price discrimination or sales below full production cost. But, at the same time, anti-dumping actions lead to large welfare losses. Anti-dumping duties can also have negative impact on export competitiveness of an industry if duties are imposed on products that go as inputs into that industry (Bhat, 2003).

There are many problematic aspects of the Agreement. The definition of dumping favors the party imposing anti-dumping duties. Dumping is considered to exist if the export price of a product is less than the comparable price of the product or like product in the domestic market in the ordinary course of trade. However, when the average export and domestic prices of a product are calculated, domestic sales prices below total cost are considered beyond the ordinary course of trade and therefore, excluded. But, all export prices are included. This, artificially, raises the domestic price. Also, if no home market prices can be found, the sales price in a third country – the so-called surrogate country – can be used for comparison. Since, different countries have different levels of economic development and comparative advantage in different sectors, the arbitrary choice of a surrogate country may easily lead to finding of dumping. For example, while investigating dumping by the Chinese firms, the US authorities often use, as ‘surrogate’ country, market economies with higher cost of labor and raw material or countries where economic reform is proceeding more slowly and production in many sectors is less efficient than in China. This will naturally lead to the non-market economy being considered to be dumping. This practice has been now done away with by the EU in case of Russia but still prevails for other so called non-market economies and even Russia in non-EU markets (Silberston, 2003). Even use of constructed value price in the absence of availability of home market or third country prices is prone to inherent subjectivity as the costs which go into constructed value price vary greatly among countries and companies. The concept of injury is also problematic as if a market in an importing country is expanding in which domestic industry is also expanding but slower than the imported products which are taking a larger share of the market, can it be said that the domestic industry has been injured because it is expanding slower than imports? Further, the presence of dumping may have nothing to do with injury to the injury which may be the result of other local and international factors happening at the same time. Therefore, it is very difficult to establish a strong link between dumping and injury (Silberston, 2003).

Even selling below total cost is a normal business practice in some situations. For example, a firm may have to sell below total cost in order to attract skeptical customers or to meet existing

competition in a foreign market, without any intention to dominate the market, especially if the product is new and un-established. It is unreasonable to subject such practices to anti-dumping investigations. Further, the anti-dumping laws are also country specific instead of being firm specific as the country does not really represent costs of particular firm and all firms from a country should not be targeted. Another problem with the practice of these laws is that though the agreement recommends 'lesser duty' than the margin of dumping if that suffices to prevent injury, but many developed countries do not follow it and impose duty equal to margin of dumping as there is no obligation under the agreement which only refers to the desirability of the practice (Reich, 2003). Further, many firms and countries resort to back-to–back anti-dumping petitions in order to benefit from trade effects of anti-dumping litigation which discourages imports in their markets (Zanardi, 2004).

Besides, the use of anti-dumping duties to protect domestic industry from imports may be misplaced if the difficulties of domestic producers result from their own inefficiency. In this situation, the anti-dumping duties tend to penalize the more efficient foreign producers. Also, because of the difficulties in finding out the origin of a product due to global sourcing, it is problematic to identify the agency responsible for dumping. The anti-dumping agreement also does not define the concept of export price and the globalization of production further leads to difficulties in determining export price as products are the result of global souring. There are even problems with defining domestic industry (Didier, 2001).

Then, there is also an overlap and a contradiction between anti-dumping laws and the competition policy. Since anti-dumping actions aim at reducing anti-competition practices, they are a part of the competition policy. But, sometimes actions like price undertakings are anti-competition and in conflict with the competition policy of WTO (Bhattacharyya and Gupta, 2001). Some firms may also resort to anti-dumping in order to foster collusive agreements between/among domestic or foreign firms as this action will give relief from foreign competition or a domestic firm will use this threat to negotiate a collusive agreement with a foreign firm. This kind of practice was found in the USA (Bhattacharyya and Gupta, 2001).

3.2.6 Options

The above discussion shows that despite the WTO agreement on anti-dumping measures, there will be widespread use of these measures against developing country exports as well as dumping into these countries. Anti-dumping is also seen as a necessary valve in the presence of trade liberalization and globalization to protect domestic firms from foreign competition. There is a need to introduce competition considerations, end practices of cumulation of market shares in injury determination (except in cases where there is evidence of collusion) and introduce some form of

counterfactual analysis in measuring injury margins (Tharakan, 1999). Anti-dumping duty should be imposed only if it is established that there was a predatory intent on the part of the exporting country. If the market is already rapidly declining, dumping by any exporter can be ignored (Silberston, 2003).

3.2.7 Commodity Prices

Prices of primary commodities or commodities like coffee, tea, sugar, cotton, etc., in international trade are subject to two kinds of problems. The first is that there are often substantial, even violent short-term price fluctuations. Just a 10 to 15% swing in production can lead to major price changes. The second problem is that there is a tendency for a long-term or secular decline in the terms of trade for commodities.

These price fluctuations and secular decline in terms of trade have substantial effects on the producers of these commodities. The producers in developing countries are often small-scale producers, dependent on income from the commodity for their livelihoods. A sharp fall in price means a substantial fall in income. Income may fall below not only what the producers are normally accustomed to but also below the minimum required to pay debts acquired in the course of production. This is the micro-economic effect of price falls in commodities.

The market for commodities is again most often dominated by a few large buyers. It is a classic monopsonistic position with millions of small sellers and a handful of big buyers. The market for coffee, for instance, is dominated by a few big buyers like Nescafe and Volcafe, while there are millions of producers and sellers of coffee.

The problem of many small producers is compounded by the entry of new producers into the market. For instance, in the market-based reform in Vietnam, large numbers of farmers took to coffee production as a cash crop. These new producers may be willing to accept a lower net income, one which is an improvement for them but lower than what traditional producers are used to. In the manner that sections of manufacturing have relocated to areas of lower wage costs, sections of commodity production can also relocate to areas where small producers are willing to settle for less than what traditional producers earned. This type of competition among small producers in developing countries is a feature of current commodity production.

While the above analysis puts competition among producers as a key factor in low and fluctuating prices for commodities, another analysis points to the non-cognizance of environmental costs as leading to low prices for commodities (Dasgupta and Maler, 1990). When the social costs of

production are higher than private costs, there is a subsidy on the basis of non-valuation of environmental resources, which are production resources for the small producers.

More recently, yet another factor, that of competition between developed and developing countries, has entered the picture in leading to low prices of some commodities. This is the case of those commodities, like cotton and sugar, which can be produced in both tropical and in temperate or semi-temperate conditions. Take the case of sugar, which can be produced both from tropical cane and temperate beet. In the EU sugar producers are paid twice what they would get in the international market. At the same time, EU also export about 5 mts of sugar at the lower world price, thus "undermining further the price received by farmers in developing countries" (Robbins, 2003). But there are still many commodities, like coffee, tea or bananas, which are not producible in OECD countries and are thus not affected by subsidies and protection by OECD countries.

While commodities are largely produced in a competitive environment, the markets for manufactures are much more monopolistic, leading to a secular decline in terms of trade for commodities (Singer, 1950). Productivity increases are passed on to consumes and buyers as prices fall. But in the case of manufactures, the monopolistic market position of producers enables them to keep the benefits of technological advances that lower costs of production. This analysis leads to the conclusion that the only development path for developing countries is to diversify away from commodity production into manufacture; something that many Asian countries have successfully accomplished.

Along with providing some adequate return to labor in commodity production, there is also the problem of enabling transitions in commodity production. If incomes are assured then will there be a shift from high-cost to low-cost producers? This is the positive function of the competitive market mechanism. The market by itself, however, brings about this transition in an entirely ruthless manner, leading to the destitution of the displaced producers. To bring about an effective transition commodity interventions have to meet two objectives: providing a reasonable income to the producers and enabling an orderly transition from high cost to lower cost producers.

There are two types of interventions in commodity markets: (1) price stabilization, with buffer stocks; and (2) output regulation, with quotas and restrictions. The second, however, requires a few producers or a few organized groups of producers, to organize a cartel. This is what OPEC has done successfully to control crude oil production. Prices are then allowed to take their own levels.

In the Bretton Woods Conference, where the IMF and World Bank were born, Keynes proposed a commodity board which would operate buffer stocks. At each point of time, a base price would be set and fluctuations allowed of 10% on either side of the base price. If, however, stocks increased at the end of the year, then the base price would be marked down by 5% and vice versa for decreases in stocks. The annual reduction of prices would have the effect of enabling lower cost producers to increase their share of production, while higher cost producers would leave the sector. But unlike the violent adjustments of the market system this adjustment would be brought about in a gradual and thus less painful manner. There could be stability, but not stagnation, as producers enter or leave the market.

The US was opposed to such a scheme that would stabilize commodity prices and it was not taken up after Bretton Woods. But some commodity boards did come up in the post-Second War period. Among these commodity boards only the coffee board had what is known as an economic clause, meaning it would undertake market stabilization activities. The others confined themselves to trying to set export quotas.

The major problem with export quotas is that they tend to freeze production among existing producing. What about new countries that wish to enter? A big factor in the collapse of the International Coffee Agreement (ICA) was the spread of production outside the countries with quotas. Indigenous peoples in upland areas (e.g. Vietnam or India) have often taken to coffee production as a substitute for forms of swidden, or introduced coffee into the swidden mix. All this developed production centers outside of the traditional coffee growing areas. It is not possible to manage these changes in the location of production through export quotas.

In the 1970s there was a series of UNCTAD-inspired commodity agreements. But the experience of these commodity boards has not been encouraging. In price determination they played a positive role, in that coffee buyers purchased coffee from a handful of boards rather than large numbers of small operators. But the quotas were used, particularly in the African countries, to favor those ethnic groups from which the ruling sections came (Gibbon and Ponte, 2005). In years of high prices paid to producers were kept low, so that income was transferred from farmers to the board. In years of low prices the price stabilization efforts were swamped by exchange rate fluctuations. Large resource transfers were needed in those years, well beyond the capacity of the governments concerned.

The commodity agreements were discontinued because the main consuming countries withdrew financial support. In 1989 the economic clause in the coffee agreement was suspended and it was not renewed in 1994. What this meant was the removal of the national coffee boards from

the bargaining and, therefore, from the price equation and its substitution by a buyer-driven commodity chain (Gibbon and Ponte, 2005).

With the rise of the Washington Consensus there has been a shift of emphasis. In the first place there is an emphasis on respecting “market fundamentals”, rather than dealing with market failure. Second and perhaps following from the first, the search is not for schemes to stabilize prices, not to reduce volatility, but to reduce uncertainty with regard to volatility. Third, the attempt is to develop market-based instruments, futures and insurance systems to help producers deal with price risk. It is expected that the development of such market-based systems will allow for announcement of harvest prices, which would enable producers to plan their investments.

The proposed system is an elaborate market-based system of futures swaps, options and derivatives. These have worked in the US and Europe, where, for instance, livestock raising is done in large units. But even then it has been found that less than 10 per cent of OECD producers use these instruments. Why is the proportion so low? It is possibly due (ITF, 1999) to the fact that the producers actually depend on the high level of government subsidies, amounting to $19,000 per producer per annum. On top of that, they rely on tariff and non-tariff barriers to shield them from foreign competition. Further, the incomes of farm families are now mainly from non-farm sources. Finally, up to 40% of commodity production is done on contract basis with the large buyers, rather than with any price hedging systems (Economic Times, Delhi, 6 Feb 2006).

It is these measures, rather than the elaborate systems of market-based instruments that provide income security for farm households. These futures instruments are actually used by processing and marketing companies, which buy from producers and in turn pass on some of the benefits to producers. Finally all these market-based schemes link up to commodity markets in Chicago, New York, London and other financial centers. New large-scale commodity markets are coming up in China and India, but they are still at an early stage. In any case, they cannot substitute for price stabilization measures.

Among developing countries, Mexico has tried to implement market-based insurance and futures schemes. India is in the process of developing the secondary markets for commodities, which already has a larger turn-over than the Mumbai stock market. The Mexican Agricultural Products Options Program (APOP) has large lots in which operations can be conducted. Corn farmers, who have been devastated by NAFTA-induced competition from subsidized US corn and are typically small farmers, operating less than one hectare of land, have a very low participation in the APOP price insurance schemes. There is more participation in wheat and cotton, where

production units are larger (ITF, 1999). The Mexican experience is certainly not very encouraging about the possibility of using such market-based insurance and futures schemes.

In trying to extend price insurance schemes to developing there is thus one critical problem of small size of lots in which production is undertaken. Unless farmers join together in groups it will be impossible to participate in such insurance schemes. Collective action problems come in the way of such participation. But, it is important to overcome such collective action problems – in the increasingly buyer-driven commodity chains, small producers need to combine in order to strengthen their bargaining position.

Countries like China or India, with large volumes of commodities traded on the market, could possibly set up futures markets and price insurance schemes. But in smaller countries there would not be scale for such institutions. In this there is a possible role for regional institutions. The commodity exchanges in India could serve all of South Asia. But then profits from the trade would also accrue to Indian institutions.

Finally there is the need to compare price insurance mechanisms with price stabilization measures. The costs and benefits of the two would need to be compared. A crucial factor in the comparison is that while price stabilization would benefit all small producers, price insurance schemes would tend to exclude small producers from their ambit. If it is important not to exclude the poorest and smallest producers from the likely benefits, then price stabilization would certainly be superior to price insurance.

In insurance schemes the cost would be directly borne by participating producers. This would be direct deduction from their incomes, to be passed on to those, generally far richer then themselves, who would profit from their ability to take risks. On the other hand in price stabilization measures the costs would be borne, if done nationally, by tax-payers. If done internationally, the costs could even be borne, as Keynes had proposed, by the countries in surplus or rich countries. Given that the countries most dependent on commodities' export are among the poorest, there is a strong case for internationally-funded action. Should this burden be borne by tax-payers in the contributing countries? Or, by consumers of the commodities? A tax on, for instance, consumption of coffee could be used to fund a buffer stock scheme for coffee. If taxes are to fund a buffer scheme for a commodity, it would certainly be appropriate that the costs be borne by those who consume that commodity. This would further directly relate consumers with producers, strengthening the moral connection between the two.

What a buffer stock system should not do is to allocate quotas, whether between countries or within countries. There would inevitably be disputes about market shares. And, how would new countries be able to enter the market? The former Director-General of UNCTAD proposed export quotas, in which case, "… within each country, means would have to be found for distributing that country's quota among its domestic producers…" (Corea, 1992). Experience has shown that this increases the power of those who take these decisions, power which can be used to garner a portion of the income from the producers and also to favor one group or community against another. It is better to leave such decisions to individual produces operating in the market. As Keynes's scheme proposed if, when demand is less than supply and stocks pile up, there is a step-by-step reduction in prices, then the higher cost producers are likely to exit from the field. Such a process would involve the market mechanism in fostering competition and thus efficient, low-cost production, something administrative allocations are unlikely to achieve. While reducing the excesses of competition, it is also necessary to avoid stagnation.

Allied to a buffer stock operation, there is need for what the Committee of Eminent Persons (UNCTAD, 2003) proposed – action to develop other uses of the commodities and to support producers to move up the value chain. Developing new uses of traditional commodities is one way to expand the market for that commodity. Cassava producers are working to spread the use of cassava not just for animal feed but as the raw material for a food additive, monosodium glutamate, which is very popular in East and South-east Asia, though there are doubts on whether this is a good substance or not. Lac which is traditionally used as a lubricant is being replaced by artificial substances for this use. But a new food use has developed for lac – coating fruits. This coating both protects the fruit from insect attacks, increasing its shelf life and also makes it attractive to look at.

For instance some vegetable oils can also be used as diesel substitutes. The use of palm oil has been developed for this purpose. The Malaysian government taxes palm oil exports in years of good prices. In years of low prices, then the money so collected is used to subsidize the use of palm oil as diesel substitute, thus increasing demand for palm oil when prices are low. Finding new uses for commodities would help to increase demand for them. Other vegetable oils could also have similar uses.

The other measure recommended by the committee is for producing countries to move up the value chain. But the movement up the value chain is hindered by the strong barriers the developed countries have adopted in the form of escalating tariffs. This tariff issue needs to be resolved first. But after that there will still remain the currently inadequate capacity of many LDCs to undertake these movements into processing on their own.

Another form of movement up the value chain is not into processing, but into specialized products; in other words to switch from generalized commodities to specialized products. “Shade grown coffee” which commands a price premium as being environmentally friendly is one such high value product. Better qualities of *robusta* coffee also command higher prices and have a more stable market. Some processors are working with Central American coffee growers to enable them to switch to higher-quality and higher-value products. To what extent the producers get the benefit of higher quality depends on the manner of their integration into the supply chain, something which we will discuss later on. But the very fact of producing a higher value product, something that cannot be easily done by other producers, is likely to increase the bargaining power of the producers.

Existing WTO rules do not rule out the possibility of international supply side management, with coordinated action by producers and producing countries. The EU’s Agreement on Dairy Products was part of the WTO system; it set minimum export prices for milk powder, milk fat and cheese. When it was terminated, the reason was not that it contravened WTO rules but that its members saw no further need for it.

In the recent steel crisis in the USA and EU, for instance, the WTO Director General, Supachi Panitchpakdi, proposed just such a scheme to reduce production, “The long-term solution to the problem that has arisen can be found only through the adoption by producing countries of an agreement providing staged reduction in production. Such an agreement could be negotiated under the umbrella of the WTO and supported by the establishment of a World Trust Fund to provide adjustment assistance to industries which would be required to reduce production and compensate workers who lose their jobs,” (Robbins, 2003).

Supply side management with the objective of obtaining remunerative prices is explicitly allowed by GATT (Chapter on Trade and Development, Part IV, Article XXXVI), “Given the continued dependence of many developed countries on the export of a limited rage of primary products, there is need wherever appropriate, to devise measures designed to stabilize and improve conditions of world markets in these products including, in particular, measures designed to attain stable, equitable and remunerative prices thus permitting an expansion of world trade and steady growth of real export earnings of these countries” (Robbins, 2003).

It is a seemingly inevitable feature of such commercial crop intensification that it leads to a specialization in production and thus reduces the range of local production. In the Himalaya-

Hindukush region it is reported that families that used to produce and consume over 20 varieties of food items; consequent upon commercialization they now consume only 5 (Nagpal, 1999).

Such commercialization of products has often, even usually, been accompanied by monoculture of the products. Tea, rubber, potatoes and a host of other upland crops are often grown in plantation monocultures. But the traditional upland cultivation system, both of swidden agriculture and the home garden, is based on multi-species, multi-storey cultivation. Dedicated monocultures would destroy an important part of the value of the uplands, both to the mountain communities themselves and to the world at large, as biodiversity is an important global public good produced in the uplands.

Work done at a number of upland research institutes, such as the Institute of Botany and the Institute of Ecology both at Yunnan (Xie Jiwu, 1993), has developed models of human-made communities of trees and vegetation that could mimic the diversity of the home gardens. Choosing the combination of trees and crops, with an eye both to their commercial possibilities and to their use value for the farmers, could yield an overall value that is higher than that of single stand plantations.

New developments in the market also promote such diverse stands even with commercialization. For instance, there is now a growing market for ‘shade grown coffee’ as against the traditional ‘sun coffee’, which involved the cutting of huge areas of forests to turn them into coffee plantations. Similarly, in the Himalayan uplands too different tree and annual crops and grass are being simultaneously cultivated in farmers’ plots. In Meghalaya, farmers plant bay leaf trees and broom grass in the same plots. In other areas large cardamom is grown in the forest. In Kunming there are experiments to grow vanilla, a high value aromatic crop, in the natural shade of forests, rather than in greenhouses, as is the currently done in the Caribbean islands. Coffee plantations now contain pepper vines, while cashews are combined with pineapple, other fruits and turmeric.

What this shows is that commercialization and intensification of production need not necessarily lead to monoculture plantations. Under what conditions will one or the other occur? This needs further investigation and analysis. But a few preliminary points can be made. Where there is a known synergy between different components of the agro ecosystem, for instance bay leaf trees and hill broom grass and both or all components have commercial value, then farmers are likely to take up the simultaneous cultivation of more than one plant/tree.

Further, where the farmers undertaking the commercial production are locally resident farmers and not distant corporations, then the farmers are also likely to respond to the use values of other

components of the agro ecosystem that do not have commercial value, but can be of various uses to the farmers. On the other hand, distant corporations, concerned with their commercial profits will see these other plants or trees as weeds and seek the single minded maximization of production of the commercial crop in which they are interested. While farmers would have a multi-valued function, including even use values in their assessment, corporations have a single-valued function, based on the maximization of the commercial income from what they sell.

The introduction of diversity into the shade serves a very important economic function – that of protecting against the risk inherent in commercial systems of production. In the mid-1990s prices of tobacco collapsed and in the early 2000s it is coffee prices that have collapsed. What this shows is that monoculture commercialization carries serious risks. Particularly where the crops require large external inputs, as is the case with tobacco compared to coffee, there is a danger of falling into serious debt when prices collapse. A mix of commercial crops needs to be promoted so that farmers are protected against excessive risks in any one market.

At the same time the limits of such self-insurance, as it were, should be noted: it is costly. It is estimated that the loss of income due to choosing a mixed cropping pattern may be as much as 10 to 15% in India (Kabeer, 2005). This probably holds for crops between which there is no synergy. But for insurance, a better method is to pool risks, something that requires well developed insurance and financial systems. This is something that countries like China or India, with large commodity markets might be and are able to carry out. But for smaller countries, a regional approach might be needed. Of course, there will be issues of power and domination within such regional arrangements, issues that are probably better negotiated in regional forums, rather than on a one-to-one basis. And, as the volume of production in a country grows, it might set up its own forward trading and insurance arrangements.

Even these market-based instruments for dealing with fluctuations in commodity prices have their limits. They need to be well-funded. More important there is an important contradiction – if they work, the resultant subsidies may not bring about the needed changes in the structure of production, in particular the reduction in output of those products that are over-supplied, or, if they do bring about such a change, there is an enormous social cost that accompanies the change. The market method of bringing about a change in production is through the destruction of livelihoods of those in such sectors. The numerous suicides of farmers in different parts of India are testimony to the social violence of pure market-based transformations. The challenge is to fashion ways of bringing about change in structures of production that do not carry such social violence. The Group of Eminent Persons (UNCTAD, 2003) proposed the formation of a fund to

promote diversification of production by commodity producers and also the search for and promotion of new uses of products.

3.3 Trade Agreements, Intellectual Property Rights and AKST

IP (intellectual property) is driven by technology and business tactics. Intellectual property rights (IPRs) are not natural rights but rather privileges granted to inventors to reward them for inventions. There are many types of IPRs like patents, trademarks, plant breeders' rights and copyrights. Patents in agriculture are important for promoting agricultural research and development (Alam, 2004). This conferment of the privilege of monopoly is supposed to be an incentive for innovation and to enable recovery of cost. Any IPRs system has to balance the privilege given to inventors and corporations owning the IPRs with the public interest. The public interest includes consumer welfare, the right of other producers to use technology, the right to develop, sustainability and environmental protection.

3.3.1 The TRIPS agreement and other IPR regimes

WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

The Trade-Related Aspects of Intellectual Property Rights (TRIPS) was established as part of the WTO in 1995. The TRIPS agreement has resulted in a very significant shift in the balance in the IPRs regime away from the public interest towards the monopolistic privileges of IPRs holders. Since TRIPS is a legally binding international framework enforceable in the WTO through the threat of trade sanctions, it has been able to effectively disseminate a model of IPRs regime throughout the world to its over 130 member states. TRIPS has therefore instituted a basically "one-size-fits-all" system of IPRs, where similar standards are set for countries of differing levels of development. It is in the developing countries where the unsuitability and effects of the inappropriate provisions are most adversely and acutely felt.

Before TRIPS, where patent law existed, most countries provided for "process" patents but not product patents. So different people could use different processes to produce the same product and that allows many products to enter the market and consumers can have competitively priced products. Research and innovation was also encouraged and a good example was pharmaceutical products.

Most developing countries, before TRIPS, did not allow patents on food and medicines even if they had patent laws in operation. Patents on biological resources were also not allowed in almost all countries. Countries were free to choose the scope of patents, the term of patent protection (usually from 5 to 15 years depending on the national laws) and other safeguards to meet their socioeconomic objectives.

Developed countries in their developing stages did not allow patenting and other IPRs, or had very narrow scope of IP protection. Many of them also discriminated between nationals and foreigners, favoring the former. This was to promote domestic research, innovation and creativity. For example, Switzerland only allowed patents on pharmaceuticals and agricultural chemicals in the 1970s. Having reached industrial status, these countries then sought to have high IPR standards around the world to protect the technological advantage and market dominance of their major industries especially those in the pharmaceutical, agriculture, biotechnology and information technology sectors.

TRIPS sets mandatory “minimum standards” but these are based on standards of developed countries in the late 1980s to early 1990s when TRIPS was negotiated. Therefore the standards are actually very high and have serious adverse impacts on the development prospects of developing countries. Article 27.2 provides that an “invention” can be excluded from patentability, if it is necessary to protect *ordre* public or morality and the grounds include to protect human, animal or plant life or health; and to avoid serious prejudice to the environment.

Thus inventions can be excluded from patentability on grounds contained in national patent laws. The grounds for excluding patents are not exhaustive in TRIPS, so countries can decide what those grounds are, that are in line with the protection of *ordre* public and morality. There are also other provisions that give a WTO member flexibilities and safeguards at the national implementation level. It is therefore important to understand and interpret TRIPS in a proper way.

Under TRIPS Article 27.3(b), a WTO Member has to allow for the patenting of the following: non-biological and microbiological processes for production of plants and animals; and “microorganisms”. With TRIPS, for the first time there is an international obligation to patent microorganisms. But many countries interpret this to exclude “naturally-occurring microorganisms” as these are discoveries. Gene sequences and other parts of microorganisms are not specifically mentioned and many countries exclude these in their national laws, too.

A WTO Member may exclude the following from patentability: essentially biological processes for production of plants or animals; and diagnostic, therapeutic and surgical methods for treatment of humans or animals. IP experts and scientists have observed that it is illogical to exclude patents on biological processes but mandate patents on microbiological processes. This was a concession to the biotechnology industry that was already bioprospecting and commercializing microorganisms and TRIPS is openly acknowledged today as the result of successful industry lobby.

The criteria for patentability should also be carefully understood and applied. Patent principles and law were designed for mechanical inventions. Applying patent law to biological resources raises ethical, religious and socioeconomic issues. The patenting of gene sequences and microbiological processes also raises scientific questions on the legitimacy of patents in this area.

TRIPS Article 27.3(b) also requires new plant varieties to be patented or protected by a sui generis system or a combination of both. Many countries reject patents and are trying to develop or have developed national laws on plant variety protection that can protect plant breeders' rights as well as farmers' rights (see also 3.3.5). But they are under pressure to adopt the 1991 International Convention on the Protection of New Plant Varieties (UPOV) as the "sui generis" system, but this is more like a patent and favors plant breeders at the costs of small farmers.

IPRs provisions in Convention on Biological Diversity (CBD).

The entry into force of the United Nations Convention on Biological Diversity (CBD) in 1994 (before WTO agreements came into force) raised important issues on access to biological resources and the fair and equitable sharing of benefits arising from the use of such resources, between countries of origin or source and user countries. There are provisions in the CBD that directly deal with IPRs. The provisions are in Article 16 and appear to be finely balanced. Article 16.5 states: " Contracting parties, recognizing that patents and other intellectual property rights may have an influence on the implementation of this Convention, shall cooperate in this regard subject to national legislation ad international law in order to ensure that such rights are supportive of and do not run counter to its objectives."

This clause seems to recognize the IPRs can have a negative effect on implementing the CBD and that contracting parties have to cooperate to ensure that IPRs are supportive of and do not run counter to the CBD's objectives. However, the clause itself has a conditioning term, namely, that the cooperation is subject to national and international law. It is also balanced by Article 16.2.

Article 16.2 states that access to and transfer of technology to developing countries shall be provided and/or facilitated under "fair and most favorable terms, including on concessional and preferential terms where mutually agreed." In the case of technology subject to patents and IPRs, "such access and transfer shall be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights. The application of this paragraph shall be consistent with paragraph 3, 4 and 5 below."

Article 16.3 states that each contracting party shall take measures with the aim that parties (especially developing countries) that provide genetic resources are provided access to and transfer of technology which makes use of those resources, on mutually agreed terms, including technology protects by patents and IPRs, in accordance with international law and consistent with paragraphs 4 and 5.

Tensions between TRIPS and CBD.

There are several areas of tension between critical aspects of TRIPS and the CBD and of relevance to many countries as they are signatory to CBD and TRIPS. Following are some examples:

a) Differences in rational, origins and overall framework.

TRIPS is an international agreement drawn up with the encouragement and active support of large corporations to promote their technological dominance and gain additional margins of profit through obtaining private monopolies. The IPRs model contained in TRIPS is tilted heavily in favor of the rights and benefits of IPRs holders. Because WTO members are obliged to fulfill TRIPS obligations, TRIPS has facilitated the extension of its particular model of IPRs to the wide membership of the WTO. TRIPS is basically a commercial treaty with commercial objectives that largely benefit strong private corporations. The principles of environmental protection or human development are not central to TRIPS and are in fact marginalized by it, although there are references to or exemptions made on behalf of the environment, human and animal health and public order.

The establishment of the CBD was prompted mainly by the growing concern about the rapid worldwide loss of biodiversity, recognition of the important role of traditional knowledge and the rights of local communities that developed and hold the knowledge and the need to regulate access to and the sharing of benefits deriving from the conservation and sustainable use of biodiversity, including genetic diversity. One of the CBD's central aspects is to the recognition of the need to regulate the behavior and effects of private corporations and researchers and constrain their rights of access and benefits within a larger framework that stresses the goals of environmental protection and the rights of sovereign states to their resources and the rights of local communities within them. Many of the tensions betweens TRIPS and CBD stem from these differences in the overall rational and framework of the two regimes.

b) National sovereignty versus rights of foreign IPRs holders.

Based on the principle of national sovereignty enshrined in the CBD, countries have the right to regulate access of foreigners to biological resources and knowledge and to determine benefit sharing arrangements. TRIPS enables persons or institutions to patent a country's biological

resources (or knowledge relating to such resources) in countries outside the country of origin of the resources or knowledge. In this manner, TRIPS facilitates the conditions for misappropriation of ownership or rights over living organisms, knowledge and processes on the use of biodiversity takes place. The sovereignty of developing countries over their resources and over their right to exploit or use their resources, as well as to determine access and benefit sharing arrangements, is compromised.

c) Conflict between private rights of IPRs holders and community rights of traditional knowledge holders. In the preamble of TRIPS, it is recognized that "intellectual property rights are private rights". In TRIPS, the award of IPRs over products or processes confers private ownership over the rights to make, sell or use the product or to use the process (or sell the products of that process). This system of exclusive and private rights is at odds with the traditional social and economic system in which local communities make use of and develop and nurture, biodiversity. For example, seeds and knowledge on crop varieties and medicinal plants are usually freely exchanged within the community. Knowledge is not confined or exclusive to individuals but shared and held collectively and passed on and added to from generation to generation and also from locality to locality. The CBD has several provisions that acknowledge this and also that aim at protecting community rights, the key provision being Article 8(j).

d) Differing treatment of innovators using modern knowledge and traditional knowledge. Related to the different ways in which the CBD and TRIPS treat private and community rights is the difference in their treatment of knowledge holders is the difference in their treatment of knowledge holders or innovators using modern and traditional technology. Whilst the CBD adequately recognizes the nature and crucial role of traditional knowledge and practices in biodiversity conservation and use (for example, see article 8(j) of the CBD), TRIPS is constructed in ways that effectively deny this and instead rewards additions to knowledge (even if very slight and minor) made through modern technology. This different treatment for modern technology and traditional knowledge is also associated with discrimination against local community rights.

e) System of prior informed consent of states and communities (under CBD) versus unilateral patent actions by private companies and researchers (under TRIPS)

Article 15.4 of the CBD states that "access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party." Thus, intending collectors of biological resources or of knowledge relating to these have to provide sufficient information of their work and how it is intended to be used and obtain

consent, before starting the work. The PIC requirement is thus a measure to prevent misappropriation of resources and knowledge and to facilitate fair benefit sharing.

In TRIPS, there is no provision that applicants for patents or other IPRs over biological resources have to obtain prior informed consent. There is thus no recognition in TRIPS of the rights of the country in which the biological resource or knowledge of its use is located. Thus, patent applicants can submit claims on biological resources or knowledge to patent offices in any country (that recognizes such patentability) and the patent offices can approve the claims without going through a process even of checking with the authorities of the country or countries of origin. Thus, whilst the CBD has set up a PIC system as a check against misappropriation or biopiracy, TRIPS on the other hand facilitates the possibility of such misappropriation by not recognizing the need for and thus omitting a mechanism of PIC.

f) Differences in benefit-sharing arrangement.

A key aspect of the CBD is that it recognizes the sovereign rights of states over their biodiversity and knowledge and thus gives the state rights to regulate access and this in turn enables the state to enforce its rights on arrangements for sharing benefits. Access, where granted, shall be on mutually agreed terms (Article 15.4), shall be subject to prior informed consent (Article 15.5), countries providing the resources should fully participate in the scientific research (Article 15.6) and, most importantly, each country shall take legislative, administrative or policy measures with the aim of “sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the contracting party providing such resources. Such sharing shall be upon mutually agreed terms”.

Under TRIPS, there is no provision for the patent holder on claims involving biological resources or related knowledge to share benefits with the state or communities in countries of origin. In fact, there is little that a country of origin can do to enforce its benefit-sharing rights (recognized in CBD) if a person or corporation were to obtain a patent in another country based on the biological resource or related knowledge of the country of origin. If the patent laws, the administration of approvals, or the courts of a particular country operate in a context that is favourable to granting such patents, there is little that can be done by a country of origin to ensure that biopiracy does not take place, or that if it takes place that it can get a remedy.

g) Treatment of the environment

Protection of the environment is at the heart of the rational and provisions of the CBD. The objectives of the Convention are “the conservation of biological diversity, the sustainability use of its components and the fair and equitable sharing of the benefits arising out of the utilization of

genetic resources" (Article 1). Countries are obliged to develop strategies and plans to conserve and sustainably use of biodiversity in sectoral and cross-sectoral plans and policies (Article 6); to carry out in situ and ex situ conservation (Article 8, 9); to minimize adverse impact on biodiversity whilst also carrying out remedial action in degraded areas (Article 10); and to conduct environmental impact assessment on and minimize adverse effect of projects (Article 14). In particular, Article 19 asks parties to consider the need for an international biosafety protocol, which has been established —The 2000 Cartagena Protocol on Biosafety (CBD, 2000). This Protocol is meant to deal with the safety aspects of biotechnology and international transfer of genetically-modified organisms.

TRIPS does not have environmental protection as part of its objectives. It does, however, have provisions that enable members to exclude patents on environmental grounds as stated in Article 27.2 (see above). This provision provides some scope for members to take the environment into account in their IPR policies. Article 27.3(b) of TRIPS also allows for exclusion from patentability of plants and animals other than microorganisms and essentially biological processes other than microbiological processes. Whilst the article at first reading enables the exclusion of patentability for plants and animals, in fact it has opened the door to worldwide patenting of genes and micro-organisms and patenting of genetically-modified organisms, including modified plants and animals. Many environmental groups and scientists are concerned that patents granted on life forms would hinder the process of scientific research by researchers that do not own the patents; and also that the incentive of providing monopoly rights to companies to produce GMOs would contribute to the proliferation of genetic-engineering application that have adverse effects on biodiversity.

3.3.2 Farmers' access to AKST vs. breeders' rights

The importance of the conservation and sustainable utilization of plant genetic resources (PGRs) for food and agriculture is broadly recognized today. One of the areas for global action relates to farm conservation. Farmers not only use seeds and related AKST; they are key players in the process of conservation and improvement of plant varieties. Their activities ensure crop evolution whereby new varieties arise through genetic recombination, mutation and hybridization within and between cultivated and wild plant populations (Brush, 1994).

With the importance of farmer protection and public interest protection from the patent regime in agriculture, many developing countries like Thailand, Zambia, Bangladesh and Costa Rica provide farmer rights in their legislations. The Indian Protection of Plant Varieties and Farmer Rights Act, 2003 also provides for farmer rights to use, reuse, exchange and even sell (unbranded) seed, has researcher exemption, creates a national gene fund and provides for

compulsory licensing in case of public interest. Farmers' rights are valuable as they promote equity, conservation and preservation which are so crucial for sustainable agriculture. But so far as protection of farmer varieties is concerned, there are problems of identifying one from another, duration of protection and passing on the benefits to community (Alam, 2004).

A recent comparative analysis of the protection to plant varieties and farmer rights in the patent laws of the various Asian countries shows that only India and Malaysia recognize the protection of farmers' interests as one of the objectives of the law and almost all the countries have based their definition of plant variety and essential derived variety on the UPOV with only Bangladesh, India, Malaysia and Thailand excluding microorganisms expressly and only China and South Korea not defining EDVs.

On definition of breeders again, except India and Thailand, other countries specifically recognize 'discovery' as a ground which could hurt farmer interest as any breeder could discover a variety which rightfully might have been invented by farmers. Only India and Malaysia recognize 'evolution' and 'genetic manipulation' as one of the criteria for breeders respectively. Surprisingly, most of the countries except India, do not define farmers as they are not given any rights. This is due to the fact that UPOV has been followed which only provides breeder rights. Indian definition of farmer is broad enough. Except India, Malaysia and Thailand which accommodate farm varieties to some extent, mostly UPOV laws have been followed for criteria for granting protection to plant variety which is NDUS – new, distinct, uniform and stable.

TRIPS requires protection of plant varieties as against new plant varieties under UPOV. Breeders have exclusive rights over agricultural and horticultural varieties and even export and import is in the hands of breeders. Most countries provide Plant Breeders Rights (PBRs) for 20-25 years for trees and 15-20 years for other plants except India which has initially shorted protection but extendable and Malaysia which is biased against farmers' varieties. In all cases, the PBR can be forfeited if variety does not fulfill the claims made or if it is detrimental to the environment or the public order with Bangladesh even going further by making provision for invoking food security, monopolies or rights of the communities.

Most of the countries also provide exemption to the rights granted to plant breeders but not as wide as in case of India. The exhaustion of breeder right is provided by Pakistan, Sri Lanka, South Korea and Philippines which is UPOV style while others are silent on this but this provision may have implications for sale for seed from harvested crops or subsequent sale of variety after it has been put into the market by the right holder. Most importantly, so far as farmer rights are concerned, India provides very comprehensive rights which encompass saving, sowing,

resowing, exchanging, sharing or selling his/her farm produce including seed of a protected variety provided that farmer is not entitled to sell branded seeds of a protected variety. A farmer in India is also entitled to registration of his newly developed variety like a breeder and for reward under the Gene Fund for conservation of genetic resources of land races and wild relatives of economic plants. But, most other countries have not granted rights to farmers. Further, India and Pakistan also safeguard farmers against sold variety failing to perform but no other country has such provision. Most countries have compulsory licensing of a protected variety provision in public interest. Indian law also prevents terminator technology. Further, only Bangladesh, India and Thailand provide for community rights and benefit sharing and common gene fund (Kumar and Sahai, 2003).

Also, implementation of TRIPS can have a negative impact of farmers' access to AKST. Article 27.3(b) of TRIPS is a major driving force of the biotechnology industry and provides the legal protection for the development of GMOs, which are patented. Furthermore, countries like the United States allow patents on plants and animals and there is enormous pressure on developing countries to adopt similar standards for IPRs. All these have implications for farmers around the world. Patented seeds cost more and threaten farmers' rights to save, reuse, exchange and sell seeds, or even access to the seeds. This is already evident in the case of BT cotton seed in India as discussed below.

Monsanto-Mahyco Biotech Limited is charging Rs. 1250 per 450 gm packet of BT cotton seed from its licensees as trait value of seed which is nothing but royalty for transfer of BT technology to about 20 Indian seed companies, for which it has a patent under the TRIPS regime. It also collected Rs. 50 lakh from each of its sub-licensees as non-refundable fee which is illegal as per MRTP commission that monitors trade practices in India. MRTP has already initiated investigations against the company for overcharging for BT cotton seed, which is considered an unfair trade practice by a monopoly as the company is the only BT cotton seed seller in India. In US, it charges a royaly of only Rs. 573 per acre (Janaiah, 2006). The real cost of seed is said to be Rs. 500. The company on its own reduced the trait value fee to Rs. 900 per packet after the initiation of the case, but in US, the company charges only Rs. 108 per packet which is much lower than its rate for India (Times of India, New Delhi, April 21, 2006). The BT cotton seed costs only Rs.550 per packet per acre in China, Rs. 250 in South Africa and Rs. 1000 in Mexico. Only in India and Argentina, it is priced very high, i.e. Rs. 1800 and Rs. 1900 per acre respectively (Janaiah, 2006). The company has its patented technology based BT seed being sold in India with the help of many licensees. Thus, TRIPS has already become a barrier due to high price of the BT cotton seed so far as poor farmers are concerned.

There are conflicting reports on the performance of the new seed in India and it has been banned in Andhra Pradesh for three years due to poor performance. It is due to this prohibitive high price of BT seeds that some farmers in India have resorted to illegal and spurious BT cotton seeds being sold by local traders and farmers, especially in Gujarat where the so called BT seed is available for Rs. 300-800 per packet. Thus, a large proportion (50%) of total BT cotton area in India is under illegal and spurious varieties. The Supreme Court of India has recently asked the company to bring its trait value to levels which it charges in China within a month. Thus, Monsanto may have to slash its trait value fee to Rs. 40 per packet from Rs. 900 per packet of 450 grams of BT cotton seed. But, the company is likely to appeal against the order.

In several developed countries, patenting of plants, plant varieties and traditional knowledge associated with their use is already taking place and has been accelerating since TRIPS. In that process, “biopiracy” or the misappropriation of biological resources and traditional knowledge is taking place, as plants and seeds originating in developing countries are being patented, usually without the knowledge or consent of these countries of origin.

Between 1985 to 1999, about 11,000 patents on plants had been registered in the US (ActionAid, 1999). In the European Union, patent law has been extended to microorganisms and genes of plants, animals and humans. The biotechnology industry is racing to map the genomes of the world's staple food crops with a view to patenting the vital and most interesting genes. The farmers of developing countries that developed the world's food crops would have no effective rights over the varieties, due to the patenting being carried out by the transnational companies. Only 10% of seed in the developing world is purchased commercially with some poor farmers buy seed only once in five years, hence patents pose a threat to farmer livelihoods and global food security (ActionAid, 1999).

There is no system of informed consent to notify communities involved of the intentions of genetic collectors even if the "invention" relies upon the knowledge and insight of local people. In some of those countries where there are patents on plant varieties, farmers are being prosecuted for alleged violation of IPRs. These developments could be reproduced in developing countries in the future.

3.3.3 Public and private sector research and development

How have IPRs, especially the availability if IPRs for living organisms affected public and private research and development in AKST? Plant breeding has shifted from the public to the private sector since the early 1980s for soybean, wheat, cotton and 75% of the plant biotechnology patents originate in the private sector (Atkinson et al., 2003; Gepts, 2004). There is evidence to

suggest the shift occurred with the introduction of TRIPS and in agriculture input segment has coincided with consolidation of agribusinesses resulting in integrated companies controlling agrochemicals, seeds and biotech traits (Lesser and Mutschler, 2002; UNCTAD, 2005). For agrochemicals, the three leading corporate groups alone are estimated to represent approximately half of the market. For seeds four corporations have about 30% of the market share, but the figures may mask much stronger market concentration for major crops in specific regional markets. The figures obscure the outstanding degree of consolidation in some of the major seed country markets (UNCTAD, 2005). There is a strong potential for demand complementarity between agrochemical and seed businesses.

Another structural change has been increased coordination with a trend towards heightened strategic cooperation amongst large competitors in the agricultural biotechnology sector and vertical coordination upward and downward along the food chain described in the introduction (UNCTAD, 2005)

The incentives for extensive mergers along with "… the breadth of protection accorded to the patent holder (in many cases the seed or biotech company), concentration in agricultural biotechnology is giving the largest corporations unprecedented power vis-à-vis growers and other stakeholders. In particular, the privatization and patenting of agricultural innovation (gene traits, transformation technologies and seed germplasm) have supplanted the traditional agricultural understandings on seed and farmers' rights, such as the right to save and replant seeds harvested from the former crop (UNCTAD, 2005). In some cases, this has resulted in a drastic erosion of traditional farmers' rights and changed farmers from "seed owners" to mere "licensees" of a patented product (UNCTAD, 2005). The synergy and vertical integration offered by the alliance of traditional seed industry and biotech have facilitated a race to buy seed companies by the biotech and agrochemical giants.

The combination of biotech and seed companies has been crucial to the market penetration of GM varieties. Some of the largest agricultural biotechnology companies in Europe and the United States have emerged as significant players in the rapidly growing Brazilian seed market (UNCTAD, 2005). By these acquisitions the largest biotech companies have established global corn and oil-seed business through which to commercialize crop enhancement products in Brazil, a country that had for long resisted GM crops. ESAP countries are a major market for the global biotech and agrochemical giants, thus it is conceivable they would employ similar strategy in ESAP regions. While the synergy and vertical integration can be good thing for business, it raises serious concerns for AKST development. The companies' overriding profit-seeking motives may

not always be compatible with the goals of poverty/hunger reduction and sustainable development.

The recent development in IPR regime is also a driving force of market consolidation and concentration in the sector. Led by changes in US patent system, growing proprietary rights have been granted to agricultural innovation. This leads to increasing number of patents, patents being increasingly issued on fundamental technologies, multiple claims over various aspects of a technology. Due to these reasons, even giant companies often find it difficult to avoid infringing patents when conducting product development research. “Monsanto and DuPont, DuPont and Syngenta, Monsanto and Syngenta, Syngenta and Dow have all filed suits against one another involving claims of patent infringement…Besides litigation, "defensive patenting" (companies tend to patent as much as they can to deter litigation though the threat of reciprocal suits) has become common practice within the industry” (UNCTAD, 2005). This thus creates a need to consolidate patent portfolios, thus acts as an incentive for the extensive mergers and acquisitions in the agricultural biotechnology and seed businesses.

The asymmetries between the developed and the developing world in aspects like agricultural systems, market institutions and research and regulatory capacity, which raise transaction costs for the latter, increase doubts whether poor people can benefit from the biotechnology development in terms of spill over or trickle down effects. China is the only country to have developed GM technology in the public sector with other developing countries depending on imports or local adaptations of imported varieties. Further, GM crops are not targeted at poor farmers and marginal environments as they are not attractive to the private sector agencies involved in this technology (Pingali, 2005). In India, the policy towards GM crops was more of preventive nature in terms of IPRs and trade, precautionary in terms of biosafety and permissive on food safety and consumer choice while being promotional on public research investment (Paarlberg, 2000).

The crowding of IPRs and the increasing concentration of them in corporations is also jeopardizing research. According to the UNCTAD study, “Academic scientists engaged in agricultural research report problems of access to important technologies due to an overlapping set of intellectual property (IP) rights on research tools and genetic contents. The reasons would lie in the increasing number of patents being issued, increasing patent breadth and uncertain ownership of rights, all resulting in IP congestion and uncertainty. The accumulated transaction costs involved (tracking down owners, conducting negotiations and multiple royalty payments to administer) have created a major access obstruction that is hampering agricultural research, according to some commentators.”

Gepts (Gepts, 2004) used the case of golden rice to explain the problem, “The development of the pro-vitamin A-rich, "golden" rice (Ye et al., 2000) provides a stark example of how quickly an invention can get lost in a "thicket" of IP rights. Seventy IP or tangible property rights belonging to 32 companies and universities had been used in the development of this rice line (Kryder et al., 2000). In addition, MTAs (material transfer agreements) further complicated the situation- “Freedom to operate” (FTO) was achieved by providing a license to a large biotechnology company, Zeneca, covering not only the pro-vitamin A pathway in rice but also in any other crops, in exchange for a humanitarian use (defined as a maximum of U.S. $10,000 revenue from golden rice) in developing countries (Potrykus, 2001). Clearly, such a solution was made possible in part because of public relations concerns on the part of the major holders of IPRs, mainly large, multinational biotechnology companies. However, this "segmentation" of the potential market did not solve fundamentally the issue for researchers, farmers and consumers in developed countries.”

Gepts also points out the negative impacts and challenges by the IPRs regime on public research: “Public institutions are faced with similar "thickets of IPRs," despite the fact that they have been responsible for much of the basic research leading to the initiation and continued development of biotechnology in the first place (Atkinson et al., 2003). The fragmentation of IPRs covering technologies (so-called "enabling technologies") and plant materials among many companies and institutions also created FTO problems. Biotechnology companies have dealt with these problems by developing their home-grown technology, licensing technology from other companies and by acquiring or merging with other companies and, thus, assembling a complete IP portfolio allowing them to commercialize new technologies, including transgenic cultivars of major field crops such as maize, soybean and cotton. Left out of this equation are many horticultural crops or specialty crops with smaller markets in developed countries and subsistence crops in developing countries.

A recent initiative from some leading public universities and private foundations promises to address the FTO issue. The Public-Sector Intellectual Property Resource for Agriculture (PIPRA; www.pipra.org) intends to establish "best practices" encouraging the greatest commercial application of publicly funded research, while also retaining rights to allow public institutions to fulfill their responsibilities toward the public at large. It will also establish a database providing an overview of IPR currently held by public institutions, with up-to-date information on the licensing status of these IPRs. In addition, it will also attempt to pool patents or other IPRs to develop "technology packages" of complementary patents, which would provide FTO to public sector researchers and reduce transaction costs associated with obtaining licenses to develop

transgenic cultivars (Atkinson et al., 2003). While actions such as those proposed by PIPRA attempt to address the FTO issues, they do not fundamentally alter the framework in which current public research has come to operate. The public-sector research "culture" has a long tradition of open sharing of genetic resources, germplasm and research findings. This has led, among other things, to extensive genetic resources collections with broad availability. This tradition of open sharing and exchange is now severely challenged and raises several concerns with regard to the availability of biodiversity for research and cultivar development."

In response to bioprospecting by corporations, the gene banks of the centers belonging to the Consultative Group for International Agricultural Research (CGIAR), such as the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT; Mexico), the International Rice Research Institute (IRRI; The Philippines) and the Centro Internacional de Agricultura Tropical (CIAT; Colombia), which hold more than 500,000 germ plasm accessions, have instituted an MTA (http://www.sgrp.cgiar.org/MTA_E.pdf). This MTA seeks to protect the germ plasm or breeding lines and associated information distributed by the CGIAR center from ownership or IP claims by the recipients of this material. Obviously, this MTA does not cover further breeding uses leading to improved materials. It is noteworthy that most of the germ plasma in these gene banks were donated by Southern countries and has been and continues to be accessible on an open access basis. Yet the genes and improved varieties derived from such material (usually developed by Northern corporations or agents) often enjoy proprietary protection under the current IPR regime. In the growing enclosure of genes and biodiversity, the developing countries are getting the raw deal.

3.3.4 Technology dissemination and transfer

A strong IPR system is normally advocated to stimulate innovation. However, for most developing countries, the extra innovations generated by stronger PIPRs (private IPRs) would be meager, as agents in these countries possess poor innovative capabilities according to IPR criteria. As even Primo Braga (1996), who is quite sympathetic to TRIPS, admits, there is little evidence that stronger PIPRs encourage greater R&D in developing countries. Thus, one of the main concerns of developing countries with the adoption of the TRIPS agreement has been the extent to which the new rules will affect the transfer of technology, a vital element to foster economic development. As 97% of world patents are held by developed countries (UNDP, 1999), the cost from paying royalties may significantly outweigh the benefits from (the insignificant) additional knowledge that the system extracts from nationals of developing countries.

It has been argued that higher standards of IP can lead to transfer of technology, as foreign corporations would be encouraged to invest in developing countries and make use of their

technologies. However, there is also a counter-argument that foreign firms that have obtained patents in developing countries are able to make inroads and profits in these countries without having to produce the patented products there, as they can import the products and sell them at monopoly prices.

There are several ways in which a strong IPR regime can hinder access of developing countries to technology (see Khor, 2002). Obstacles to technology transfer make it difficult for developing countries and their corporations to upgrade productivity which is necessary for them to compete successfully. They thus impede competition. Firstly, a strict IPR regime can discourage research and innovation by locals in a developing country. Where most patents in the country are held by foreign inventors or corporations, local R&D can be stifled since the monopoly rights conferred by patents could restrict the research by local researchers. Strict IPR protection, by its apparent bias, may actually slow the pace of innovation in developing countries and increase the knowledge gap between industrial and developing countries. In such situations, the IPR system favors those who are producers of proprietary knowledge, vesting them with greater bargaining powers over the users (Oh, 2000). The CIPR report (2002) also provides analysis and examples of how the patent system might inhibit research and innovation. Secondly, a strict IPR regime makes it difficult for local firms or individual researchers from developing or making use of patented technology. Thirdly should a local firm wish to "legally" make use of patented technology, it would usually have to pay significant amounts in royalty or license fees. As pointed out earlier, TRIPS increases the leverage of technology-suppliers to charge a higher price for their technology. Many firms in developing countries may not afford the cost. Even if they could, the additional high cost could make their products unviable. Moreover, there could be a large drain on a developing country's foreign exchange from having to pay foreign IPR holders for the use of their technology. Many developing countries with serious debt problems will be unable to afford to pay the cost of using the technologies.

Fourthly, even if a local firm is willing to pay the commercial rate for the use of patented technology, the patent holder can withhold permission to the firm, or impose onerous conditions, thus making it impossible or extremely difficult for the technology to be used by the firm. Patent holders can refuse to grant permission to companies in the South to use the technologies, even if they are willing to pay market prices; or else the technologies may be made available at high prices (due to the monopoly enjoyed by the patent holders). Companies in the South may not afford to pay at such prices and if they do their competitiveness could be affected.

3.3.5 Indigenous, traditional and institutional knowledge

Local or traditional knowledge (TK) refers to information held by local or indigenous people with regard to biodiversity in this case (Brush and Stabinsky, 1996). Indigenous people are defined as descendants of preconquest, traditional people of a certain geographic area, with a common history, culture, language and customary law. TK encompasses information about, for example, crop landraces and their agronomic or culinary characteristics or the medicinal qualities of native species. TK is an essential aspect of an indigenous group's cultural survival; it has been developed through generations of intimate contact with the biological materials (Mauro and Hardison, 2000). It is transmitted in many ways, including apprenticeship with elders and specialists and oral tradition (including poems, songs and music; Posey, 2002). Although indigenous people comprise only some 5% of total world population, they have a disproportionately large role in the maintenance of and knowledge about biodiversity because they are located primarily, although not exclusively, in biodiversity centers. Furthermore, with regard to crop biodiversity, indigenous or local farmers play an important role in in situ (on farm) conservation of landrace varieties (Brookfield et al., 2002). TK is not, however, limited to the knowledge of indigenous people but encompasses knowledge (and associated heirloom varieties) of local, nonindigenous communities in modern societies as well (e.g. Bérard and Marchenay, 1996).

Traditional knowledge is now widely recognized as having played and as still playing crucial roles in economic, social and cultural life and development, not only in traditional societies but also in modern societies. Even today, the majority of the world’s population depend on traditional knowledge and practices for food and medicines. Eighty percent of the world’s people rely on indigenous knowledge for their medical needs and half to two-thirds of the world’s people depend on foods provided through indigenous knowledge of plants, animals, insects, microbes and farming systems (RAFI, 1997). This recognition has heightened in recent years as a result of the increased awareness of the environmental crisis; the role of some modern technologies, production methods and products in contributing to this crisis; and a growing appreciation that local communities (especially in developing countries) have a wide range of traditional knowledge, practices and technologies that are environmentally sound or “friendly” and that have been making use of the manifold and diverse biological and genetic resources for food, medicines and other uses. The knowledge of local communities, farmers and indigenous peoples on how to use the many forms and types of biological resources and for many functions, as well as on how to conserve these resources, is now recognized as being a precious resource that is critical to the future development or even survival of humankind. At the same time, this precious knowledge is maintained and thrives in the context of the traditional ways of social and economic life and customary practices of the traditional communities. Their rights to their knowledge, to the use of

their knowledge and to the products arising from such use must be recognized. The misappropriation of their resources, their knowledge or the products of their knowledge would not only violate their rights, but also adversely affect the conservation and use of the knowledge and of biodiversity (as the IPRs obtained by corporations and other institutions may erode the communities' rights to continue using their resources or to continue with their traditional practices).

The position of traditional knowledge and the rights of local communities is now widely accepted with acknowledgment: (i) of the role and importance of traditional knowledge; (ii) that for traditional knowledge to be maintained, the social and economic context in which it developed and is applied has to be maintained; (iii) that for this context to be maintained, the rights of local communities to their resources and knowledge have to be recognized and respected; and (iv) that misappropriation of these rights can erode the basis of traditional knowledge and thus adversely affect the prospects of sustainable development.

There are proposals to encourage countries to use their options under TRIPS and the CBD in favor of sustainable development. Each country should interpret the agreements in ways that are most appropriate for itself, maximizing the creative use of provisions of each agreement to suite the country's chosen policies.

A major drawback of this approach is that developing countries in general have limited capacity (in terms of policy-making, legal and administrative expertise) to analyze the international agreements and to formulate national policies and draft legislation with the sophistication required. Thus, they may not be able to make full use of the flexibilities in TRIPS and the CBD. Also, for this approach to work, developed countries would have to allow the developing countries to make use of the flexibilities in the agreements and not unduly put pressure on them when they do so.

This approach is an attempt to harmonize the traditional knowledge system and western IPR system. There are already some existing cases that are noteworthy. For example, India has already seen its practice in Kerala state where Jeevani – a drug with anti-fatigue properties – has been patented by TBGRI under a benefit sharing formula with Kani Tribe. The drug was extracted from a plant called *arogyapacha* in local language and was developed based on lead knowledge given by the tribe. For this kind of development, it is important that the system of protection takes into account the ethical norms of the community involved, intention of protection (trade or health), GI protection and benefit sharing mechanisms for cumulative innovations (Harilal, 2006).

Meanwhile, many representatives of indigenous communities are advocating rejection of the application of an IPRs system based on their worldviews. In June 1999, a group of 114 indigenous peoples' organizations from many countries around the world, as well as another 68 indigenous peoples' support groups, issued a joint indigenous peoples' statement on the TRIPS agreement (Tebtebba Foundation, 1999). Some of the key points of the statement are as follows:

I) Nobody can own what exists in nature except nature herself… Humankind is part of Mother Nature, we have created nothing and so we can in no way claim to be owners of what does not belong to us… W]estern legal property regimes have been imposed on us, contradicting our own cosmologies and values.

II) We view with regret and anxiety how, Article 27.3b of the Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO) Agreements will further denigrate and undermine our rights to our cultural and intellectual heritage, our plant, animal and even human genetic resources and discriminate against our indigenous ways of thinking and behaving.

The indigenous peoples' representatives are of the view that the IPRs regime threatens the rights, way of life and knowledge of indigenous peoples. They also reject the application of an IPRs system of indigenous peoples which is based on collective innovation and collective rights. Thus they are advocating that the international agreements need to modify to include diverse worldviews. This was also presented in a statement on behalf of indigenous peoples at a roundtable on Intellectual Property and Traditional Knowledge at the World Intellectual Property Organization (WIPO) in November 1999. According to the statement: "We believe that the challenge for WIPO and governments, as well as other international multilateral organizations, is to maintain an open mind and be more daring in exploring ways and means to protect and promote indigenous and traditional knowledge outside of the dominant IPR regimes. WIPO should not insist in imposing that the IPR regime it is implementing, particularly patents, is what should be used to protect traditional knowledge. Other forms of protection should be explored and developed in partnership with indigenous peoples and other traditional knowledge holders. Any effort to negotiate a multilateral framework to protect indigenous and traditional knowledge should consider indigenous practices and customary laws used to protect and nurture indigenous knowledge in the local, national and regional levels." (Tauli-Corpuz, 1999)

3.3.6 National and regional responses, impact on developing countries

There is a trend for bilateral free trade agreements (FTAs) between developing and developed countries (especially the United States) to oblige the countries concerned to allow for the patenting of plants and animals and this is often under pressure from the developed countries.

In the case of new plant varieties, there are pressures for developing countries to adopt the 1991 International Convention on the Protection of New Plant Varieties (UPOV) as the "sui generis" system, but this is more like a patent and favors commercial plant breeders at the cost of small farmers and even public researchers. Malaysia and Thailand have adopted sui generis plant variety protection laws that strike a better balance for small farmers, but in on-going negotiations of bilateral FTAs with the United States, they are pressured to take on UPOV 1991. China became a Member of UPOV 1991 on 23 April, 1999. As a WTO Member, China also has TRIPS obligations and the challenge is to ensure that the flexibilities and safeguards are maximized so that the public interest and long-term sustainable development of the country are assured.

The shortcomings and inherent inequities in existing intellectual property systems, especially patents, are increasingly acknowledged. A comprehensive assessment and the net adverse impact of IPRs on developing countries can be found in the report of the International Commission on Intellectual Property Rights, entitled "Integrating Intellectual Property Rights and Development Policy" (2002). This Commission was initiated by the UK government and chaired by a leading US lawyer, Professor John Barton. Literature survey, commissioned papers, consultations and country visits were undertaken to "incorporate voices from both developed and developing countries: from science, law, ethics and economics and from industry, government and academia" [for a full report, see www.iprcommission.org].

The obligations on developing countries to implement TRIPS are estimated to result in increased payments by them of US $60 billion a year (Finger, 2002). The net annual increase in patent rents resulting from TRIPS for the top six developed countries in this field are estimated to be US $41 billion — with the top beneficiaries being the US with $19 billion, Germany $6.8 billion, Japan $5.7 billion, France $3.3 billion, UK $3 billion and Switzerland $2 billion (World Bank, 2002). Developing countries that will incur major annual net losses include South Korea ($15.3 billion), China ($5.1 billion), Mexico ($2.6 billion), India ($903 million) and Brazil ($530 million).

The World Bank's patents rents estimates, already high enough, significantly understate the actual costs to developing countries, as these only measure the direct outflow of patent rents from these countries (Weisbrot and Baker, 2002). In addition there are economic distortions as the IP protection causes goods to sell at prices far above their marginal costs, thus given rise to "dead-weight cost". Citing other studies, they estimate the deadweight costs to be twice the size of the estimated patent rents.

In addition, there are costs for administering and enforcing IP laws and policies, requiring law reform, enforcement agencies and legal expertise. World Bank project experience indicates that it

will cost a developing country $150 million to get up to speed on three new WTO areas (IPRs, SPS and customs valuation) (Finger, 2002); this amount is more than a full year's development budget in many LDCs.

Compared with the outcome of the market access negotiations, the TRIPS amounts (i.e. net rents) are big money (Finger, 2002). The US obtained 13 times more benefit from annual patent rents arising from TRIPS than from liberalization of industrial tariffs with Germany, France and UK gaining 3.6 times more. Conversely, the loss from TRIPS obligation is 18 times greater for Korea than gains from Uruguay Round tariff liberalization and the costs outweigh benefits 7 times for Mexico and 4.7 times for China.

Well-known trade economists who advocate free trade have also written harshly on the imbalances of TRIPS and the adverse effects on competition caused by the upward harmonization of IP standards induced by TRIPS. For example some have argued that the TRIPS Agreement be removed from the WTO because the WTO is meant to be about mutual gains in trade and IP protection is a tax on poor countries' use of knowledge, hence constitutes a wealth transfer to the rich countries (Bhagwati, 2001). Others argue that if it is not removed at least some of its provisions should be renegotiated (Srinivasan, 2000). The arguments put forward that high IP standards benefit developing countries center around the encouragement of local innovation and the likelihood that foreign enterprises would be more willing to transfer technology and to invest.

"These a priori arguments are based on the premises that first IPR protection of the type imposed by TRIPS is needed to encourage innovation and second that foreign enterprises place a significant weight on the strength of IPR protection regime. The theoretical justification for and even more importantly the empirical evidence in support of both these premises is not at all strong….It would appear that patent protection as a spur to innovation does not appear to be powerful in the real world. And the cost to the general public of restricting access to new technology through patenting may be high."

3.3.7 Ways forward

The shortcomings and inherent inequities in existing intellectual property systems, especially patents, are increasingly acknowledged, with concerns over the net adverse impact of intellectual property rights (IPRs) on developing countries, who remain net IPR importers. The WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) sets global minimum standards on IPRs. There is debate over the role of IPRs in development, with some claiming that high IPR protection is necessary to ensure returns to research investment and

innovation. Yet, evidence shows that the monopoly of knowledge afforded by IPRs can be detrimental to development goals. Historically, IPRs were applied mainly to mechanical inventions, or to artistic creations, however the assignment of IPRs to living things is of relatively recent origin in developed countries. While these issues are still being debated and not fully addressed yet, regrettably, higher protection of IPRs, even going beyond that required under the TRIPS Agreement, is increasingly advocated in free trade agreements, particularly with developed countries like the United States.

IPR standards under trade agreements have contributed to a shift in AKST, by facilitating private sector dominated research and consequently privately-generated and owned AKST. Patents and to some extent plant variety protection (PVP), have played a part in the major consolidation of the global seed and agricultural input corporations, many of which are also developing transgenic crops. The need to consolidate patent portfolios and hence ensure freedom to operate appears to have created incentives for this consolidation. In this private sector dominated context, market forces rather than food security needs have dictated the direction of research in general. At the same time, public sector research is either stagnating or declining and also faces barriers in terms of IPRs preventing access to research materials, tools and technologies. Public sector research needs to be strengthened and better funded. The objective should be to ensure that research is oriented to address the needs of poor and small farmers. There is a need for governments to consider the use of competition law (e.g. anti-trust) to respond to the high level of concentration in the private sector. While some national level action has been taken to break monopolies and encourage competition, there is no international mechanism to deal with such issues.

The international trade regime raises issues of relevance, adequacy, affordability and access to AKST; in particular, IPRs may restrict access to plant material for farmers and threaten farmers' rights. For farmers and rural producers, knowledge is increasingly becoming an economic good for which they are willing to pay and are paying significant costs. However, IPRs may restrict access to plant material for farmers. Patented seeds cost more as patent owners have a monopoly and can charge high prices. There are considerable dangers to food security if seeds are overpriced to the exclusion of poor and small farmers. The consolidation of the global seed and agricultural input corporations and their subsequent monopoly over the agricultural chain also results in high prices for agricultural inputs.

The spread of private IPRs is also considered to be a threat to the rights of farmers to save, use, exchange and sell seeds that have been subject to proprietary claims, even though it is farmers who have played a crucial role in conserving, developing and making available plant genetic

resources that are the basis of food and agriculture and these are the very practices that have formed the basis of their traditional role in conservation and development. IPRs can thus stifle local innovation and research. Furthermore, Genetic Use Restriction Technologies (GURTs) or "terminator" technologies can be used to biologically prevent seeds from germinating in order to protect proprietary claims of IPR-holders. This has tremendous impact on small farmers and indigenous communities and has been heatedly debated under the Convention on Biological Diversity, under which a de facto moratorium on field-testing and commercialization of GURTs exists.

Currently, farmers' rights are not yet adequately protected through effective means, both domestically and internationally. The International Treaty on Plant Genetic Resource for Food and Agriculture is a start, as it acknowledges the role and contribution that farmers have played in conserving and developing plant genetic resources. Parties have an obligation to protect and promote farmers' rights, including the right to save, use, exchange and sell farm-saved seed/propagating material. However, these rights are subject to national law. Implementation of farmers' rights at the national and international level is critical to ensure continued conservation and maintenance of agricultural biodiversity and associated AKST and provide an important counterbalance to the rights accorded to formal plant breeders under PVP and patents.

3.4 Trade and Technology Options

Pesticides and genetic engineering provide examples of technology options in agriculture that largely exemplify a flow of trade from developed to developing countries. On the other hand, fisheries, aquaculture and forest products are examples of technology options being implemented in developing countries and of the products being traded from developing to developed countries.

3.4.1 Composition of output and relationship to technology development

The rice market in Asia is less dominated by imports than it was two decades ago. Asia accounted for two-thirds of the global rice demand in 1970s, but this has come down to a third in the late-1990s (Tabor et al, 2002). This is due to the regional spread of HYV-rice, which has increased domestic production in most Asian countries, but has substantially reduced rice diversity.

The growth of the sugar industry in the developed countries, due to the development of technology to extract sugar from corn and beet, propped up by substantial subsidies, has almost eliminated Asia developing countries' possibilities of exporting sugar. With Asia as a whole being a labor-abundant region, it could be expected that comparative advantage in international trade would lie in the production of labor-using products, like vegetables, fruits and flowers, as against

the less labor-using products, like cereals. Calculations for Bangladesh showed that the Domestic Resource Cost (DRC, i.e. the cost of all inputs, including land, labor, capital, used in production) in vegetables is only about 10% of the export rice, as against 60% for aromatic rice and more than unity for other rice. At the same time, in import price terms the DRC of other rice is also around 60 to 70%. Thus, while development of rice is beneficial in import substitution terms, it is not beneficial in export terms. Thus, Bangladesh and most other Asian economies with similarly abundant labor have turned to export of vegetables, fruits and flowers. The production of these 'new export crops' has grown across most countries of Asia.

It, however, is not only the more abundant and cheaper labor in ESAP developing countries that is the factor enabling Asia to undertake export production of fruits, flowers and vegetables. It is also depends on the advances in transport (containerization), packaging and communication technology (ICTs). The extent to which it is profitable to shift perishable agricultural commodities long distances depends on transport costs. As fuel prices rise, which they will by all indications, small differences in production costs might be neutralized by higher transport costs. Thus, while making use of the international trade possibilities currently available, countries may also find it necessary to consider alternatives in the event that fuel prices and transport costs rise substantially. The growth of demand in some agricultural commodities, however, has triggered some changes in technology or the widespread adoption of some technologies. This has been the case, for instance, in both fish and forest products. In fish there has been a shift from capture fisheries to culture fisheries. In 2002, Asia accounted for above 90% of the quantity and 70% of the value of aquaculture, both freshwater and marine (FAO, 2004b). This is a technology whose widespread adoption was induced by the shortages resulting from over-harvesting of wild fish.

Similarly, in the case of wood products and Non-Timber Forest Products (NTFP) there has been an initial depletion of natural stocks and then a shift to plantation of valuable species. Asia in 2005 accounted for more than 50% of plantation forests in the world (FAO, 2006). In a number of NTFP too collection from the wild has been replaced by culture or plantation as wild stocks have been depleted. A well-known example is that of orchids. Initially collected from the wild and with the growth of demand, subject to depletion, tissue culture has now replaced such collection in most countries and regions. Regions like North-east India, however, still continue collection rather than tissue culture.

High prices of timber have stimulated the development of substitutes for wood in different uses, some using artificial substances, like plastic, other fast-growing species, like bamboo and still others, former waste material, like the trunks of aged rubber trees.

A broad conclusion can be drawn from these experiences. Initially increasing trade (both international and national) in agricultural commodities that are collected from the wild, led to over-exploitation of natural resources. But this has been followed by changes in both technology (aquaculture, plantation) and management systems (community-managed, or individual household-based in the place of open access systems) and the development of substitutes. There are positive examples of learning and technology development and systems of culture that have reduced pressure on natural stocks. They have also created new problems of waste management, environmental change, biodiversity conservation and increasing social inequality (Table 3.5).

[Insert Table 3.5]

3.4.2 Pesticides

At the most basic level, pesticides are intended to kill organisms; they include herbicides, insecticides and fungicides, as well as algicides, insect and animal repellents, antimicrobial and cleaning products, wood and material preservatives and insect and rodent traps. Besides harming target insects, weeds and fungi, pesticides also affect wildlife and human health. Some have immediate lethal effects including death, some cause acute illness at even minute levels of exposure and others have been found to cause chronic (long-term) health and environmental harm.

Today, organochlorine pesticides, organophosphorus pesticides, pyrethroids, herbicides such as 2,4-D, glyphosate and paraquat and fungicides are commonly used. With increasing evidence of negative effects, efforts have been undertaken to ban or restrict some pesticides, but in general, their use in developing countries is still widespread.

National and global concerns over food security drove the intensification of agricultural production in the South, epitomized by the Green Revolution and the adoption of synthetic chemical pesticides. Pesticide reliance became widespread across much of Asia and Latin America, where the Green Revolution had been widely embraced (Rosset et al., 2000).

Thus, the spread of Green Revolution-type agriculture throughout most developing countries was accompanied by a rapid rise in pesticide use (Rosset et al., 2000). Along with the CGIAR, the agricultural research and development agencies and universities of many countries focused on breeding seeds to increase plant uptake of nitrogen, so as to boost yields, which frequently required increasing pesticide use to control pest outbreaks.

However, promising increases of yield were offset by rising costs associated with increased use of chemical inputs. In the Central Plains of Thailand, yields went up only 6.5%, while fertilizer use rose 24% and pesticides jumped by 53%. In West Java, profits associated with a 23% yield increase were virtually cancelled by 65% and 69% increases in fertilizers and pesticides respectively (Rosset et al., 2000).

While multinational chemical companies based in the US or Europe account for the bulk of worldwide production and sales, local pesticide industries have also expanded, growing rapidly in countries favoring high input agriculture. For example, the pesticide industry in India is now the fourth largest in the world and second largest in the Asia-Pacific region after China. Estimates of its total market value vary between US $850 million and US $911 million. According to the Pesticides Manufacturers and Formulators Association of India, there are around 55 basic producers and 300 pesticide formulators, as well as numerous small-scale manufacturers. Around 200-odd generic pesticide products are made in India (CSE, 2001).

Pesticide manufacturers are the most direct drivers of pesticide use, acting on their own as well as through public agencies. They have increased pesticide sales through extensive marketing, advertising, supply to extension agencies or workers and local or district leaders and through partnerships.

Policy drivers include decisions by many developing countries to focus on export-led agricultural growth, which is typically accompanied by high pesticide use. Many governments also focused on increasing yield through adoption of Green Revolution technologies. Extension workers and government media channels like television and radio with high penetration into rural areas have been used to disseminate pesticide application related information. States shifted to a more ‘science-led’ rather than farmer-led agriculture and also linked farmers’ access to credit and capital to their acceptance of Green Revolution packages of seeds, fertilizers and pesticides. National quotas, priorities and directives for farmers were established in many regions (e.g. wheat and sugarcane in India, rice in Indonesia). National government research and extension systems removed farmers’ decision-making power through direct state intervention in pest management via calendar spraying regimes and enforced control methods (Meir and Williamson, 2005).

Technological drivers include both public and private research and development of new technologies in seeds, machinery, fertilizers and pesticides. Institutional arrangements that contributed to the development of Green Revolution technologies included the international research community (e.g. CGIAR), the national agricultural research systems (NARs), academic institutions, research stations and the private sector. International donor agencies and bilateral

agencies have also indirectly supported the spread of pesticides by supporting shifts towards Green Revolution technologies and/or have supplied pesticides directly in agricultural aid packages (Shiva, 1991; USAID, 2004).

International financial institutions such as the World Bank have contributed directly to increased pesticide dependence, traditionally providing them in fixed packages of inputs that farmers are required to use by the terms of their contract (Ishii-Eiteman and Ardhianie, 2002), or indirectly, by imposing structural adjustment conditions on borrower countries that require shifts towards high value export crops that result in increased pesticide dependence (Hammond and McGowan, 1992; Korten, 1995; Oxfam America, 1995; McGowan, 1997); by promoting intensified production without offering training in Integrated Pest Management (IPM) and leaving pest control advice up to pesticide companies (Hamburger and Ishii-Eiteman, 2003) or by providing emergency rehabilitation or reconstruction loans that encourage or promote increased pesticide use (Karel, 2004).

Recent external reviews of World Bank lending have found that a majority of projects likely to affect pesticide use failed to provide plans for introducing or implementing IPM in a meaningful way and were considered more likely to increase farmers' dependence on pesticides (Tozun, 2001; Karel, 2004). Past reviews also acknowledge the Bank's difficulty in implementing its IPM policy, but suggest that compliance is likely to improve in future (Liebenthal, 2002; Sorby, et al., 2003). The World Bank's "poor record of compliance" with its pest management policy has been linked to its practice of "actively open(ing) the door" to pesticide companies through programs geared towards modernizations of agriculture, liberalizations and privatizations (FAO, 2001). Nonetheless, other UN agencies like the FAO have helped the move towards IPM, providing examples of how developing countries have been able to adopt AKST beneficial to farmers in the face of powerful trade interests (see 3.4.3).

Partnerships and linkages between the pesticide industry and public agencies have also encouraged the opening of new markets for industry products. The French pesticide company, Rhône-Poulenc Agro, for example, joined a World Bank program in West and Central Africa in the late 1990s, in order to "break into the cocoa, coffee, rice and vegetable [pesticide] markets which account for around 40% of the crop protection market in [West Africa]" (Rhône-Poulenc, 1998).

Social drivers include perceived inefficiencies in low external input farming as compared to Green Revolution agriculture. Changing food consumption preferences and patterns, with a shift towards more meat and grain in many regions, have led to increased production of specific crops such as wheat and rice. As newer generations of farmers lost much of traditional AKST in countries that

embraced the Green Revolution, they naturally resorted to the Green Revolution technologies that surrounded them (Shiva, 1991; Rosset et al., 2000; Meir and Williamson, 2005).

In China, the situation is slightly different. Self-sufficiency in food formed a central component of national policy. The agricultural systems focused on the use of external inputs and mechanization of agriculture to increase yields (Xiaoyun et al., 1997). Agriculture was characterized by extensive monoculture and use of HYVs, chemical fertilizers, pesticides and biotechnological products. The collectivization model of agricultural production was followed until the mid 1980s, after which the Household Production Responsibility System emerged (Xiaoyun et al., 1997; Wen, 2005), within which technological change has become the primary engine of agricultural growth.

China relied heavily on chemical fertilizers and pesticides to achieve short term yield gains. Central planning offices compelled the planting of Green Revolution crops, thus increasing the demand for pesticides to control the associated pest outbreaks (Xiaoyun et. al., 1997). Widespread loss of traditional AKST, including non-chemical approaches to pest management, occurred among peasant communities, who were required to adopt the collectivization model and expert advice of agricultural scientists (Hamburger, 2002).

Since 1975, the value of pesticide imports into China has grown from US $76 million to $293 million in 1994 (Pretty, 1995). A more recent spur for the growth of the Chinese pesticide industry has been the growth of pesticide exports and collaboration with multinational pesticide companies since the opening up of the Chinese economy. During this period, the Chinese Ministry of Chemical Industry signed cooperation agreements with Dupont, Ciba-Geigy, Bayer, BASF and Rhône-Poulenc and established joint ventures with Dupont, Ciba-Geigy, Zeneca and Agrevo to produce herbicides and insecticides. The Chinese government has also supported the pesticide industry by subsidizing importation of raw materials (although this type of assistance is decreasing quickly), tax exemption, lower costs for raw materials allocated through the central planning mechanism and preferential electricity rates and bank loans (US Embassy Beijing, 1996).

According to data from Nanshen Pesticide Company, China produced 250,000 tonnes of pesticide active ingredients in 1995, equivalent to 1.5 million tonnes of formulated product (PAN-UK, 1996). Data from 2000 indicate that China is the second largest producer in the world of agrochemicals by volume, of which 35% is exported (Dinham, 2005). In 2004, China's pesticide industry experienced high production and growth in exports (China CCM, 2005). Domestic use of pesticides in Chinese agriculture has continued to grow and China has become one of the primary exporters of cheap pesticides to Asian markets.

3.4.3 Technology choice for sustainable agriculture: integrated pest management.

As the Green Revolution model of agriculture began to break down in ESAP, with increasingly evident health and environmental impacts, farmers, scientists and governments began to look for alternatives, including Integrated Pest Management (IPM). IPM is generally understood to focus on maintaining pest populations at economically acceptable levels through a systems approach that can include: cultural practices, soil, field and habitat management, use of resistant varieties, biological and sometimes chemical control strategies (Shennan et al., 2005). Organic farmers have taken IPM a step further and have eliminated synthetic pesticides from farming practices. This is also known as non-pesticide management (NPM). Pest management among organic farmers can range from simple input substitution (e.g. use of biopesticides) to more comprehensive ecological approaches.

Advances in ecological understanding of pest population and community dynamics in rice fuelled the development of a more nuanced and comprehensive approach to pest management (Kenmore et al., 1984; Settle et al., 1996). FAO's paradigm-shifting work in Asia in the late 1980s provided (a) the scientific demonstration that pesticide-induced pest outbreaks were, at times, responsible for crop failures in rice; (b) the ecological evidence that removing pesticides would restore yields and system stability; and (c) the policy insight that a number of directives (e.g. ban on pesticides, removal of pesticide subsidies and national support for IPM) could transform the situation.

Participatory field-based educational processes in pest management replaced conventional "transfer of technology" methods (Röling and Wagemakers, 1998). IPM programs that utilize non-formal education methodologies and build on - rather than replace - farmers' traditional knowledge, have longer lasting success in farmers' adoption of and innovation in AKST, than training methods that disseminate fixed instructions for input use and pest control (Mangan and Mangan, 1998).

The IPM Farmer Field School (FFS) methodology pioneered in Southeast Asia typified this knowledge process and was subsequently adapted by governments, NGOs and farmers' associations. As such, IPM has evolved from a classical and technological insect management approach towards one in which the focus is on education and social change, whereby farmers develop the scientific research skills to test hypotheses and manage pest populations (Matteson, et al., 1994; Ooi, 1998). This, of course, is expensive; but it builds the knowledge of the farmers, which is the base of improvements in production.

Meanwhile, demand for pesticide-free, organic and fair-trade produce in export markets is growing and has created new markets for Southern producers (IFOAM, 2003), although farmers must negotiate complex and costly certification processes. Burgeoning consumer interest in "green" and "pesticide-free" products, particularly in countries with growing middle class populations (e.g. Thailand, China, India), has supported the emergence of new domestic markets that encourage transition towards IPM.

IPM has met with significant success in rice producing Asian nations like Indonesia, Vietnam, China, India and Sri Lanka (Pretty, 1995, 2001). Millions of farmers have reduced pesticide use through IPM, without experiencing reduced yields (Heong and Escalada, 1998; Mangan and Mangan, 1998; Barzman and Desilles, 2002). Yield advantages of IPM have been particularly strong in the South and thus have significant policy implications for food security in developing countries.

Some actors have questioned the ability of pesticide-free IPM methods - and sustainable and organic agriculture more generally - to produce adequate quantities of food. However, a growing body of literature demonstrates the high productivity of both organic and low-external input systems, particularly when the production of multiple outputs is calculated (Pretty, 2000; Pretty and Hine, 2000; FAO, 2002a; Parrot and Marsden, 2002).

The community-wide economic, health and environmental benefits of IPM have been widely documented. IPM Farmer Field Schools, in particular, have led to improved farm profitability and yields; significant reductions in pesticide use; improved occupational health, reductions in medical costs and lost working time caused by pesticide poisonings; reduced environmental harm; positive social impacts at the individual farmer and community level; better returns on government investments in extension and longer-term advances in food security (ter Weel and van der Wulp, 1999; Mancini, 2006; van den Berg and Jiggins, 2007).

It is clear that IPM is an example of AKST that not only provides an alternative to harmful pesticides, but that also brings benefits in its own right. The challenge is to mainstream its adoption, while providing the necessary policy support. A growing number of bilateral donor agencies are investing in ecological IPM strategies. The Global IPM Facility, FAO and EU have provided considerable technical and policy assistance to countries seeking to develop national IPM programs and to establish favorable policy environments.

3.4.4 Genetic engineering

Genetic engineering, also called modern biotechnology or genetic modification, is a departure from conventional breeding, involving the transfer of genetic material from one organism to another, often unrelated, species. This results in a transgenic organism containing new genes or novel combinations of genes.

The introduction of genetically engineered (GE) crops (biotech crops, genetically modified crops or transgenic crops) has been accompanied by controversy over the role of genetic engineering in addressing agricultural problems in both developing and developed countries. Advocates cite potential yield increases and reductions in pesticide applications, among other factors. Critics point to environmental and health risks and widening socioeconomic disparities as significant drawbacks.

Although GE technologies have the potential to affect both traded and non-traded products, most applications to date have involved highly traded agricultural commodities (Diaz-Bonilla and Robinson, 2001). Agricultural commodities such as soybean, maize and canola, for the purposes of food, feed or processing use, are the major genetically modified organisms (GMOs) that are currently traded internationally.

In addition, two GE traits, herbicide tolerance and insect resistance, have thus far dominated the market. In 2006, herbicide tolerant crops accounted for 68% of the global GE crop area, insect resistant (Bt) crops, 19% and stacked genes for the two traits, 13% (James, 2007). Almost four out of every five hectares of GE crops are engineered to withstand the application of proprietary herbicides sold by the same company that markets the GE seed and thus have little, if any, relevance to farmers in developing countries who often cannot afford to buy these chemicals (FOEI, 2007).

The major exporters of GE crops and their products are the US, Argentina and Canada, with Brazil recently joining the ranks. Analyses show that in 1961/1963 developing countries as a whole had an overall agricultural trade surplus of US $6.7 billion, but that this has gradually disappeared so that by the end of the 1990s trade was broadly in balance. The outlook to 2030 suggests that the agricultural trade deficit of developing countries will widen markedly, reaching an overall net import level of US $31 billion (Bruinsma, 2003). Given the current limited distribution and traits of GE crops, it is likely that the major GE crops importers will continue to be developing countries, with the exception of a few large agricultural developing country exporters. Furthermore, the cautious stance of the European Union towards GMOs and the overwhelming public opposition there, has led to the domestic market in the EU being largely GE-free, or at the

very least, only allowing GMO products that are clearly labeled for consumer choice. This restricts the export market for GE crops.

The changing focus to trade in agricultural commodities and export-oriented agriculture may have serious ramifications for developing countries. As farmers and peasants directly link to the international market, economic forces increasingly influence the mode of production characterized by genetically uniform crops and mechanized and/or agrochemical packages (Altieri, 2003). This situation is expected to be aggravated by genetic engineering, whose development and commercialization is increasingly concentrated in a few corporations, accompanied by the increased withdrawal of the public sector as the major provider of research and extension services to rural communities.

Even if the rural poor benefit from GE crops, because GE crops are mainly traded cash crops, this benefit would be likely reduced. Technological crop improvements tend to lower the market price and therefore the value of the farmer's marketable surplus (Santaniello, 2003). Moreover, the great majority of GE crops cultivated today are used as high-priced animal feed to supply rich nations with meat. GE crops have therefore not addressed the main agricultural problems and challenges facing farmers in most countries, neither have they proven to be superior to conventional crops (FOEI, 2007). It remains to be seen if large-scale production and trade of commodity GE crops has positively affected overall food security, although the opposite has been argued for some countries.

For example, in Argentina, one of the main exporters of GE soybean, adverse impacts have been observed, including the loss of food diversity and food sovereignty (Pengue, 2005) The export-oriented, commodity-production system is most likely to drive smaller farmers that are not able to face uneven competition out of business. Thousands of small- and medium-scale farmers in Argentina have been forced out of the production system, due to the expansion of GE soybean (Pengue, 2005). This phenomenon is not new or unique to Argentina. In many developing countries, due to historical and colonial inequalities, rural food-producing societies have been pushed off the best land most suitable for farming, into marginal areas (Rosset, 2005). The best lands were converted to production for export and this trend has continued post-independence. Land is increasingly concentrated in the hands of the wealthy, leaving the rural areas in many developing countries today characterized by extreme inequities in access to land, security of tenure and quality of land farmed.

The marginalization of the majority then leads to narrow and shallow domestic markets, leading land-owning elites to orient their production to export markets where consumers have purchasing

power. In an ever-vicious cycle, elites become less interested in the well-being or purchasing power of the poor at home. By keeping wages and living standards low, this pre-empts the emergence of healthy domestic markets and thereby reinforces export orientation (Rosset, 2005).

The increased focus on agricultural export commodities, particularly GE crops, influences the type of AKST that is generated. The potential implications of technologies for agro-ecological stability and for sustainability and equitability have fundamental consequences for the planning of future agricultural research strategies (Bruinsma, 2003). Reluctance to challenge the belief that GE crops can benefit the small farmer and relieve world hunger has led to massive investments in GE technology to the neglect of other more promising but less glamorous approaches (Jordan, 2002). This has led to a disproportionate focus on GE research and investment into those technologies.

Already, in the last decade, national government and international donor support for agricultural research has declined significantly. While more and more funds go into biotechnology research, including GE, other key areas into agricultural alternatives, such as organic research, attracts only a fraction of investment compared to conventional and biotechnological approaches (Parrott and Marsden, 2002). Research in ecology and natural resource management, as well as socioeconomics, are trailing behind (Bruinsma, 2003).

Furthermore, a number of recent World Bank loans are facilitating the introduction of GE crops in Southern borrower countries (Ishii-Eiteman, 2002; Karel, 2004). Through these loans, the Bank is financing the research, development, field-testing and mass release of newly created transgenic crops (World Bank, 2002). Other Bank loans with implications for developing country uptake of GE technology have focused on introducing or revising IPR laws around genetic resources and/or have included research contracts or grants in support of biotechnology (World Bank, 1999ab; Karel, 2004).

While some analysts argue that all this means that more efforts should be made to redirect research focus towards public sector agricultural biotechnology research, including on genetic engineering (e.g. FAO, 2004a), others call for a reassessment of research priorities, so that more resources and research are directed towards alternative and proven approaches, that could better meet the needs of the poor, such as sustainable or organic agriculture, or agroecology (e.g. Jordan, 2002; Parrott and Marsden, 2002; Rosset, 2005).

In addition, a particular situation has developed with respect to research on GE crops. While there has been a large research focus on GE technology advances such as developing GE crops

that may bring benefit, there has been rather less focus on biosafety research, i.e., looking at the health, environmental and socioeconomic risks. This is important, as in determining research priorities, it is critical to understand how new technologies, including GE, affect and influence the lives and livelihoods of the poor (Bruinsma, 2003). While the potential benefits need to be considered, so do the potential risks.

It is clear that any introduction of GE crops must assess not just potential health, environmental and socioeconomic impacts, particularly in the longer-term, but must also take into account structural, regulatory and economic evaluations that relate economic, political, social and scientific context of GE crops to their region of adoption.

3.4.5 Technology choice for sustainable agriculture: a pro-peasant research agenda.

The increasing shift to private sector-driven, GE technology research and knowledge generation privileges farmers that can take advantage of GE crops and these are unlikely to be small or poor farmers in developing countries. Would GE crops be able to increase crop production and, at the same time repel pests, resist herbicides and confer adaptation to stressful factors commonly faced by small farmers? Thermodynamic considerations suggest that they cannot (Jordon, 2002).

Traits important to indigenous and small farmers (such as resistance to drought, suitable quality for food or fodder, competitive ability, performance on intercrops, compatibility with household labor conditions and more advantageous maturity, storage quality, taste or cooking properties, etc.) could be traded for transgenic qualities that may not be important to farmers (Altieri, 2003). Under this scenario, risk will increase and farmers may lose their ability to adapt to changing biophysical environments and to produce relatively stable yields with a minimum of external inputs, while supporting food security.

A pro-peasant research agenda comprises the following elements: creation of safeguards against homogenization and in situ conservation and rural development in GMO-free centers of origin (Altieri, 2003). The maintenance of pools of genetically diverse material, geographically isolated from any possibility of cross-fertilization or genetic contamination by uniform GE crops, is necessary as genetic uniformity or changes in the genetic integrity of local varieties could have considerable impacts. Moreover, biological and cultural diversity and the associated local skills and resources, are needed for rural populations to maintain or recover production processes.

Furthermore, the maintenance of traditional agroecosystems is a sensible strategy to preserve in situ repositories of crop germplasm (Altieri, 2003). However, this cannot be done in isolation from the maintenance of sociocultural organization, including of the need to organize small farmers

into groups to strengthen their collective bargaining positions, particularly in facing corporate players (see 3.4.5). The process must be linked to rural development efforts that give equal importance to local resource conservation, food self-sufficiency and some level of market participation. In order for peasants to have a competitive edge, they need to be able to produce "unique" agricultural crops (i.e. GE-free) for niche markets. Such "uniqueness" is crucial for maintaining the stability of local farming systems in times of uncertainty.

AKST for sustainable agriculture should thus fully involve farmers and develop technologies that are low-cost, readily available and responsive to diverse local conditions, without posing risks, particularly to the diversity base of poor farmers. It is difficult to see how traded GE commodity crops can meet these criteria.

3.4.6 Fisheries and aquaculture

The liberalization of trade has led to a big increase in exports of fish and fish products from developing countries, as a whole and Asia in particular. Fisheries now generate more foreign exchange than any other traded food commodity, such as rice, coffee, tea or cocoa (FAO, 2004b) (see 2.2.4).

However, there are changes within this trade, though the geographical pattern remains the same. First, there is the shift from export of raw material to be processed in developed countries to export of processed fish. The development of fish processing capacity and knowledge in developing countries of Asia has enabled them to bring about a shift in the location of processing. The lower wages in Asian countries compared to the former processing countries (EU, Japan and US) has facilitated this shift in location. Moreover, the highly perishable nature of fish also favors the shift of processing to the source of raw materials. There is also a learning or capability-building process, whereby labor and management in Asia have learnt and invested in the technology of processing.

Second, there is also a shift to exports of live fish. Most of it is for ethnic markets in the developed countries. The migration of large numbers of Asians has led to the growth of a market for live fish from their countries of origin. Some of the live fish is also of the ornamental variety for aquariums. In both cases, the development of transport and logistics technology have enabled a growth in this sector of trade, which now accounts for about 10% of fish trade.

With the growing world fish trade and the possibility of reasonably elastic export earnings, there were initial trends towards over-exploitation of fish resources. At least 25% of fish varieties in the world are reported to be substantially over-exploited. There was an increase in the proportion of

overexploited and depleted stocks from around 10% in mid-1970s to about 25% in early 2000s (FAO, 2004b). Besides bans on fishing, often brought about by the collapse of certain sectors, such as cod in the North Atlantic, there have also been technological shifts towards aquaculture, both of the freshwater and marine varieties. This is a very major technology change in response to the growing demand for fish along with the relatively fixed fish resource available (see 2.2.4).

While the conduct of aquaculture has its own problems, which will be dealt with later, it has certainly enabled a growth of production without endangering available stocks of wild fish, as trade based on capture fisheries tends to do. So far, in Asia, aquaculture has developed substantially for freshwater fish. Hatchery-based marine aquaculture is not as developed. Most marine aquaculture, as for prawn and seaweed, still depends on collection of seed from the wild. The jump to true aquaculture, with hatchery rearing of fry, has yet to be developed for many marine species. The type of marine aquaculture developed for salmon and trout has yet to be developed for the fishes of Asia. Recently, Japan has developed technology for sustaining bluefin tuna broodstock in offshore cages, leading to the first closed-cycle breeding of tuna. In Indonesia, fishers are replacing cyanide harvesting of reef fish with hatchery-raised juveniles of aquarium fish.

As pointed out earlier, most of the global fish trade is from developing to developed economies. There are some technology and production concerns arising from this specific nature of trade. There are also other concerns arising from other aspects of global trade.

Two concerns that arise from the developing to developed nature of the trade relate to the meeting of quality standards, particularly those of Sanitary and Phytosanitary Standards (SPS) (see 3.2). A not entirely unrelated matter is that of traceability, something insisted on by the developed country fish retail chains that have to contend with supplier responsibilities.

SPS problems have led to many temporary bans on imports of fish from Asian countries, particularly shrimp from various countries. Fish and fish products represented the largest category, above 25%, of food safety and quality alerts in the EU. Frequently there have been bans on imports of fish from various Asian countries. Initially they were met with cries of trade barriers. But after some time, the various Asian countries have begun to take measures to comply with these SPS standards. While they add to cost, the reduction of pesticide or veterinary drug residues or elimination of growth hormones are certainly desirable in themselves.

With a large part of Asian aquaculture being carried out in small farms, traceability is certainly a problem. But as an example from Bangladesh, the Noakhali Gold Project, shows, this can be

tackled along with that of meeting SPS standards by linking groups of small producers with the larger processing and packaging units. The meeting of SPS and traceability, however, is more a matter of management methods than one of technology. This intervention was promoted by a donor-funded project.

Consumers in many parts of the world are concerned about the ecological impacts of different types of fishing and aquaculture. Endangered and charismatic species, like the sea turtle, often a by-catch (or collateral damage) of tuna fishing have aroused concern. This has led to the attempts to develop technologies that are more specific to the species to be harvested and eliminate or substantially reduce by-catch. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) requires certificates of origin for cultured species on the endangered list, before they can be traded.

A trade issue that has come up recently and is likely to play a more important role in the future is that of “dumping” (see 3.2). With not only lower wages, but also more efficient and large-scale processing and production techniques, Asian countries are low cost producers in a range of fishery products. Their exports at sustained lower prices threaten livelihoods of producers in developed economies.

With growing demand for fish and fish products (fish is a superior good, in that its consumption increases as world per capita income rises), capture fisheries obviously cannot meet market demand. The attempts to increase the quantity of capture fish has frequently led to the collapse of various fisheries, most spectacularly North Atlantic cod fishery. Subsidies to fishing boats have contributed to increases in the over the limited catch capacity over which countries are competing. This is a classic case of the tragedy of the unmanaged commons, compounded by subsidies. Aquaculture has developed as a technology that can increase production beyond the natural limits of capture fisheries. It can help reduce pressure on wild stocks and thus help ecosystem rehabilitation. However, aquaculture too has its own ecological problems.

The best-known ecological problem is related to marine shrimp culture. For one, it has been based on collection of fry and juveniles from the wild, leading to an over-collection of such stocks. With numerous individuals collecting wild fry in an open access manner, there is no way in which sustainable harvesting limits can be maintained.

More important, however, has been the degradation of coastal environments by shrimp farming. Mangrove forests, important as the spawning ground of numerous species of fish, have been destroyed in the course of shrimp farming. Saline water intrusion has further degraded coastal

lands. The inability to sustain productivity in shrimp farming has further led to the financial collapse of shrimp farming in many areas and a locational shift to other areas. More recently, attempts have been made to mitigate these negative impacts, through zoning and replanting of mangrove areas in Thailand.

There are other impacts of aquaculture, including marine aquaculture. There are concerns about escape of cultured into wild stocks, spread of pathogens from the former to the latter, discharge of effluents and solid wastes and so on. Some of these concerns have been met by improved site selection and improved management practices.

There is also the matter of dependence on fish meal prepared from “trash” fish, with the likely depletion of these stocks. This is the case for carnivorous fish, like salmon and shrimp. But, with the exception of marine shrimp, the bulk of aquaculture production in Asia comprised omnivorous/herbivorous fish, while 74% of aquaculture production in developed countries was of carnivorous species. There is a need to develop feed feeds that reduce dependence on fish meal. This would reduce dependence on capture fisheries.

With pressure to increase production per hectare of the earth’s surface and to increase the incomes of small cultivators, there has been an extension of aquaculture into systems of rice monoculture. This extension tries to utilize the synergies between rice and fish, either in simultaneous or in alternating systems of cultivation. While this is a new system of production, it is, however, a new management practice rather than a new technology.

Fisheries has seen little of the genetic improvement of stocks to increase yields. These have yielded spectacular results in agriculture, with wheat yields going up by 50% and rice yields by 25%. In terrestrial animal management, there have been higher yields of milk or meat with genetically improved stocks.

In fisheries the attempt to genetically improve stocks, through selection and breeding, was first undertaken in the North Atlantic for salmon and trout. Such an attempt was then made for tilapia, a fish of African origin, but now widely cultured across Asia. The genetic improvement of Tilapia was undertaken in the public sector, with the World Fish Center playing the leading role. This attempt resulted in what is known as GIFT (Genetically Improved Fish Tilapia), which was then distributed to various countries in Asia. The improvement in the rate of growing in GIFT as compared to other Tilapia, however, was just 10%. Possibly this rate of increase in yield is not enough to result in its widespread adoption by small farmers, as the increase in yield could easily be negated by poor management or insufficient inputs.

The success of the GIFT project, however, illustrates that it is not necessary, as some argue, that research and development of new technology be undertaken in the private sector and that the incentives of high rents from patents or licenses are essential to provide the incentives for investment in research and development. Scientists and officials working in public sector institutions can as well develop new technologies.

While GIFT itself is in the public domain, it is intriguing that its further development has been handed over to a Norwegian private sector company. Having made the necessary initial breakthrough there seems no reason why the further development of GIFT could not have been left also in the public domain.

The question of the relation between public and private domains is also raised by a new marine based medical development. Australian firms are testing the use of brown seaweed (*Undaria pinnatifida*) as an anti-viral agent, including its use in treating HIV. The medical use of *Undaria*, however, is an established practice, at least, in the Korean peninsula. This possibly is the original knowledge on the basis of which an innovation is being developed. What should be the relation between the original knowledge and the likely subsequent patent?

3.4.7 Forestry

In the ESAP region, a net loss of forests of about 792 000 ha per year in the 1990s was reversed into an annual gain of 1 million ha, largely due to increased plantation activity in the region, particularly in China. However, in South and Southeast Asia there continued to be an annual net decline in forest area of about 2.7 million ha per year (see 2.2.3).

With the growth of trade in timber, there was an initial (up to the 1990s) increase in wood extraction from forests. The revenue from timber was an important source of central government revenue in a number of countries, like the Philippines and Indonesia. This revenue was largely used for accumulation and infrastructure development outside of the forest areas themselves. The indigenous peoples who lived in and around these forests were marginal in the political equations of these countries. Consequently, forest revenue was not reinvested within the forest-based communities themselves, but outside for national interests. Extraction did not take account of sustainability considerations. Clear-felling resulted in the destruction of trees that were not the object of extraction and thus increased the extent of deforestation.

The extraction of timber was later followed by the transformation of forests into plantations, the best example being palm oil plantations in Malaysia and more recently in Indonesia. This has,

however, had implications for biodiversity and the ecological services that forests supply. Along with this, there was the development of tissue culture in order to propagate trees on a large scale.

The one country in which wood extraction was linked to local ownership of the forests is China. After the late-1970s reform, large areas of forest were handed over to either local collective ownership (i.e. village-based) or household ownership under the household responsibility system. Of course, under neither system of collective or household ownership did the owners have the right to sell or mortgage the forests, i.e. they had the right to manage the forest and the right to the income from it, but could not dispose off the forest. This truncated property right meant that forests could not become real estate, subject to speculation as, for example, urban land is.

The result of this property reform was that the immediate owners had an interest in sustainably harvesting the timber from the forests. This has led to China playing a leading role in the development of plantation forests, i.e. a subset of planted forests consisting primarily of introduced species. Thus, the technology change, from extraction from natural forests to the planting of forests for extraction, came about not just through the increased demand made by economic growth and trade but also by the change in property or institutional system. Had there been merely a change in availability due to depletion of natural forests, as has occurred in most other countries, there would have been just a shift in the origin of supply of timber to other countries that still had available forests. There need not have been a shift to plantation forests, as has not happened in India.

The shift of supply, however, is also one of the responses of the Chinese and Indian markets. Both countries have instituted some forms of “logging bans” in the aftermath of devastating floods in the late 1990s and have shifted to importing timber to meet local demand. The difference between the two is that, as pointed out above, in China there has been a growth of plantation forests, in India there has not been such a change.

With the technology of extraction of forest products one of extraction, costs are also restricted to those of extraction. Further, with the ownership of the forests in the hands of the state, the external diseconomies that are borne by forest-dwellers are not part of the relevant cost economies. This problem can be taken care of by the above-mentioned institutional change whereby property rights are allotted to the forest-dwellers.

There is yet another problem of costs that is related to technology change. As mentioned the costs of extraction are the relevant costs so long as extraction is the method of production, if it can be called that. But such extraction in the face of growing external demand and the attempts

of the producers to maximize their own incomes, leads to the depletion of the resource, certainly where the resources are extracted in an open access property situation. This has been frequently observed in the case of medicinal plants and herbs. There is often a sudden increase in demand, as the modern pharmaceutical industry discovers ways of utilizing indigenous knowledge to develop new kinds of drugs and medicines. This then leads to an increase in demand for the raw material, which the forest dwellers also collect in the largest possible quantities in order to maximize their own incomes and a consequent rapid depletion of the resource.

The way out of this situation has often been the domestication and thus planting of the required plant material. This then means a shift in production from collection to growth or culture of the plant material. This technology shift is necessary to be able to provide supply in a sustainable manner. This has occurred in numerous Non-Timber Forest Products (NTFP). A change in technology enables a shift to sustainable production for the market. Deforestation continues at an alarmingly high rate, but that the net loss of forest area is slowing down thanks to forest planting, landscape restoration and natural expansion of forests on abandoned land (Steinfeld, 2006).

Forests are increasingly being conserved and managed for multiple uses and values and they play a crucial role in climate change mitigation and in the conservation of biodiversity and of soil and water resources. If managed sustainably, forests also contribute significantly to local and national economies and to the well-being of current and future generations.

While Asia reported a decrease in wood removals in recent years, Africa reported a steady increase. It is estimated that nearly half of the removed wood was fuelwood. The question of fuel use, specifically that of use of wood for fuel, is usually seen in energy models as a function of household income. This is incorrect. Sample studies have shown that in many areas the proportion of wood as fuel does not go down with income in rural areas (Nathan and Kelkar, 1997). This is so when fuel is not purchased on the market, but is collected with household labor. This household labor is basically that of women and it has a low opportunity cost, i.e. its possible alternate uses yields very low income. It is this low-cost or even non-costed women's labor that is the cost to the household. As a result, unless income earning opportunities for women increase and their opportunity cost goes up, there is not much saving of women's labor in such activities.

In order to bring about the desired energy transition, i.e., away from wood to other commercial fuels, what is crucial is the increase in the income earning opportunities for women. This, for instance, has happened on a large-scale in China where women are part of what is called the labor force, participate in income earning activities. As against this, in India, the participation of

women in the labor force in much lower in many parts, even higher income areas, but there is still a high reliance on collected fuel (Nathan and Kelkar, 1997).

Along with the entry of women into the labor force, the household shift from collected to purchased fuel seems to play a role in the energy transition. Where a household begins to buy fuel, then the economies of inferior goods comes into play and as income rises, the proportion of wood as fuel goes down.

This analysis points to the importance of entry into the commercial world of trade, both as income earning producers and as buyers of fuel, for bringing about a change in technology adoption. A technology change, from wood as fuel to gas or other commercial fuels, depends on the gendered economic factors of women's income earning and household purchase of fuels.

3.4.8 Organic agriculture and fair trade

There are increasing opportunities in organic and fair trade products, which are emerging as important niche markets that are growing at a high rate around the globe. Asia alone has 20 countries producing organic produce with 60,000 enterprises and 0.6 million hectares under it, which is 15% of all farms and 2.6% of total area under organic farming worldwide (Raynolds, 2004).

Organic and fair trade movements contribute not only to environmental and economic sustainability, but also help rural livelihoods in a sustainable manner. Organic farming is one form of sustainable agriculture with maximum reliance on self-regulating agro ecosystems (Browne et al., 2000).

In globalized markets, whether or not local producers can gain access to global value chains and at which point, is likely to be an important factor in determining whether they will benefit from trade liberalization (Eapen et al., 2003). This has meant that the access of developing countries to enter developed world markets is dependent on their ability to enter the global value chains or production networks of lead firms. The newly emergent organic produce supply chains tend to exclude small producers due to reasons of high certification costs, smaller volumes produced and tighter control by the chain leaders in the absence of any local market outlets for the organic producers (Raynolds, 2004; Singh, 2006a).

There is therefore a need to mainstream organic and fair trade movements to ensure the participation of large number of producers in developing countries in these markets, without

bringing in the ills of conventional chains. Thus, there is need for policy thrust and support for such market-oriented sustainability and livelihood initiatives.

It is argued that organic production is suited for small farmer participation as it is labor intensive and compatible with traditional peasant practices. However, export of organic products involves certification, documentation, record keeping and auditing which makes it industrial in nature and counters the traditional norms and practices of peasant producers. Also, price premiums are likely to decline as economies of scale are attained in marketing and the supply base expands at a rate unmatched by market expansion (Krissoff, 1998).

The organic value chains are very complex due to the process importance in being organic. But, the farmers and the laborers are the weakest links in the chains driven by importers, exporters and retail chains (IDS, 2003; Kabeer and Mahmud, 2004). It is only the fair trade and alternative trade networks which still provide some scope for participation of the small and marginal organic producers (Yussefi and Willer, 2003; Raynolds, 2004).

Further, in international markets, increasingly, organic trade and ethical and fair trade concerns are beginning to overlap (Raynolds, 2004). An increasing number of fairly traded goods are also organic (70%) and the organic movement is moving towards including social rights and ethical trade in its standards. If there is consumer pressure for this overlap, then there would be considerable implications for the volume of trade, the developing country producers' ability to meet the requirements and for the working conditions and livelihoods of producers (Browne et. al., 2000). Whereas ethical trade is people centered, environment focused and animal centered, the fair trade approach emphasizes partnerships with producers for improving the status of disempowered groups through alternative trading organizations. It works though Self Help Groups (SHGs) for provision of fair price to primary producers, with focus on gender equality, market access and long term relationship (Tallontire, 2001).

The exclusion of small farmers from participating in global food chains does not appear to be, in any way, automatic. There have been cases of success when public or private assistance to the growers in terms of technical assistance and supply of input credit was made available. In some places in Brazil, small dairy farmers have gone for collective tanks to meet the scale requirement, though the large farmers will still have an advantage, as they do not face the transaction cost involved in collective use of physical assets. The dairy companies and cooperatives encourage the use of collective tanks, even by financing or facilitating credit for milk producers in some cases (Farina, 2002). Similarly, National Dairy Development Board (NDDB) in India is

implementing a clean milk production program with price incentives, in a small dairy cattle holder context.

Market access for small producers depends on: (a) understanding the markets; (b) organization of the firm or operations; (c) communication and transport links and (d) an appropriate policy environment (Page and Slater, 2003). In so far as the role of the government in the commodity chain is concerned, it can proactively help the stakeholders in the chain to identify the opportunities and threats in the global commodity chains. It can also assist producers to enter the chains (Kaplinsky, 2000). If, in a given country, a few chains command majority of the organic sector, then development policies and programs need to learn how to deal with this handful of big companies.

However, it is equally important to promote good business practices that optimize retailer-supplier relations, protecting both sides. This can be initiated by establishing or improving contract regulations and business rules of practice some of which are already available in the form of legal provisions in the US and Argentina. These practices can also be forced by private sector codes of practice. These changes and the basic requirements they impose on growers are conditions that will have to be met if the growers are to be able to tap the powerful market of the supermarkets. Therefore, it is crucial that government and donor agencies help small farmers and entrepreneurs to make the investments in equipment, management, technology, commercial practice and the development of strong and efficient organizations to meet the market requirements.

Global buyers can have a role to play in assisting suppliers to improve practices and become compliant. The standards need to be flexible and interwoven with local conditions if they are to benefit poor workers. They must also involve local stakeholders who reflect the interests of workers in the process of standards setting and monitoring. The policy challenges on standards include standard setting, monitoring compliance, providing assistance to achieve compliance and sanctions on non-compliance. Much depends on how standards are implemented, monitored and verified (IDS, 2003).

Thus, major conditions for successful interlocking between agribusiness firms and small producers include increased competition for procurement instead of monopsony, guaranteed market for farmer produce, effective repayment mechanism, market information for farmers to effectively bargain with companies, large volumes of transactions through groups of farmers, for lowering transaction costs and no alternative source of raw material for firms (Kristen and Sartorius, 2002).

The main requirements of small farmers in this changing environment are better access to capital and education. Management capacity is as important as physical capital but is the most difficult thing to provide. Further, collective action to deal with scale requirements needs to be designed to satisfy new product and process standards or to avoid exclusion from the supply chain. Collective action through cooperatives or associations is important not only to be able to buy and sell at a better price but also to help small farmers adapt to new patterns and much greater levels of competition (Schwentesius and Gomez, 2002).

Small farmers also require professional training in marketing and in technical aspects of production. There is also a need to strengthen small farmer organizations and provide technical assistance to increase productivity for the cost competitive market, provide help in improving quality of produce and to encourage them to participate more actively in the marketing of their produce in order to capture value added in the supply chain.

On the other hand, regulation of super market chains to control or mitigate their market power can be an effective tool to ensure the presence of small growers in value chains as seen in the case of the banana trade regime in the pre-WTO period in the EU policy, single channel (monopoly) exports by producer bodies in some exporting countries like South Africa and regulation of domestic import markets in France (Gibbon, 2003).

Though there are concerns about the ability of the small farms and firms to survive in the changing environment of agribusiness, there are still opportunities for them to exploit product differentiation with origin of product or organic products and other niche markets. However, the major route has to be through exploitation of other factors such as external economies of scale through networking or clustering and such other alliances like contract farming (Kirsten and Sartorius, 2002). The experience of contract farming across the globe suggests that it is not the contract per se which is harmful as a system but how it is practiced in a given context. If there are enough mechanisms to monitor and use the contract for developmental purposes, it can certainly lead to a betterment of all the parties involved, especially small and marginal farmers (Singh, 2006b).

3.4.9 Livestock

International trade accounts for only 8-13% of total production of livestock products. It is high in bovine and poultry meat and milk and low in pig meat. Livestock and Livestock Products (LLPs) account for about 1/6th of value of all agricultural trade. Meat exports make up about half of this total value with bovine, pig and poultry meat as three major types. The subsectors of pig meat and poultry meat have grown by 6 and 14% during the last decade. Dairy products account for

1/3rd of value of LLP exports and have grown at the rate of 3% during the last decade (FAO, 2001).

Major global players in exports of LLPs are Australia, USA, Canada and EU in beef and pork and Brazil, EU, China and Thailand in poultry (Perry et al., 2005). Developing countries are net importers of LLPs with dairy products and poultry dominating the scene. Though least developed countries have more pasture land per head of rural population than in the developing countries, but stocking density and meat production per animal are lower. Still LLPs account for 4% of their GNP. Thus, they may have comparative advantage in small ruminant production but productivity is lower (FAO, 2001).

Further, a large part of the global trade in livestock products especially dairy is intra-industry trade which is under the control of large global players. In many countries in Asia, export trade is with a few large players who are able to meet new quality standards like SPS measures. Still, even these large players have suffered from SPS restrictions in some markets e.g. UAE banning Indian meat imports from 10 firms by name for not meeting the hygiene standards. There is also growing vertical coordination of the sector especially in chicken and pigs where large processors and retailers work directly with primary growers of such products who essentially provide all inputs and the grower gets wages for his/her labor and supervision costs. In some countries like Thailand, there is almost 100% contract production in poultry and piggery sectors. In this process, small growers are getting marginalized due to small scale and lack of bargaining power due to lack of effective producer organizations. In some places like India, producers' organizations have been able to bring large number of milk producers under a common platform and are significant players in domestic markets and even are foraying into global markets.

Like crop sector, subsidies to producers in developed countries especially EU remain an obstacle to fair trade in livestock products. Even in ESAP, there are large exporters i.e. Australia and New Zealand which are globally competitive and do not subsidize their livestock producers. Once subsidies in the developed world go, developing world can benefit from freer trade in livestock products. Dairy exports are likely to increase from Oceania, South Asia, South America, Eastern Europe and Southern Africa. But, due to SPS measures, developing countries including those from ESAP face compliance costs related to export standards especially in meat and meat products (FAO, 2001; Perry et al., 2005). Within the ESAP developing world, net exporting countries like Thailand, press for reduction of trade barriers in developed countries and low income net importers like Bangladesh or Indonesia promote import substitution, wherever possible.

Though extensive grazing is still dominant, intensification and industrialization (known as 'factory farming' esp. in poultry and piggery) is growing even in the developing world to achieve higher efficiency in production as there is growing problem of direct competition for raw materials between food for humans and feed for animals/birds. There is also the threat to wild species due to competition for feed from commercialized livestock systems. There has been loss of genetic diversity in livestock which is a threat to the sustainability of the livestock sector. It is estimated that one livestock breed a month has become extinct over the last seven years. In Vietnam, the percentage of indigenous sows declined from 72 in 1994 to 26 in 2002. Of its 14 breeds, 5 are vulnerable, two in critical state and three face extinction. Similarly, in Kenya, introduction of Dorper sheep has eliminated the pure bred Maasai sheep. This is important for developing world as though less productive, many breeds at risk of extinction are unique in their characteristics which may be useful to deal with challenges like climate change, animal diseases and rising demand for specific products.

There have been many technological breakthroughs like cross breeding, Artificial Insemination (AI) and Embryo Transfer (ET) in the sector and the potential of biotechnology is immense not only in primary production but also in livestock product processing and value addition. Indigenous knowledge and its practice in livestock rearing, animal husbandry and hygiene maintenance come in as alternatives to the growing "factory farming" system. But, the dominance of trade by large players may not attend to these concerns unless there is market pressure on them. The environmental, animal welfare and intellectual property rights issues in LLPs are also becoming crucial to deal with for better benefits from trade as they present both threats and opportunities for developing countries.

Due to many problems in conventional supply chains like mad cow disease and foot and mouth disease, there is emerging organic or natural livestock products market which combines principles of ethical trade as well by focusing on ethical treatment of animals (Steinfeld et al., 2006). Organic dairy products have emerged as an important component of the livestock products market wherein dairy and poultry have shown greater growth rates than beef and pork. In USA, there is even certified organic livestock production in many states with eggs and dairy being the fastest growing sectors. In Europe, it is EU, Austria, France and Denmark which have large production of organic dairy and other livestock products. In Latin America, it is Brazil and Argentina which had significant organic livestock activity. On the other hand, in ESAP region, organic activity is not that widespread in livestock sector.

The success stories in LLP exports were the result of strong private sector efforts who contributed capital or state funded support like the NDDB in India, export of value added products not live

animals, management expertise and entrepreneurial drive, vertically integrated or coordinated systems including small producers and strong focus on marketing. Thailand is a good example of moving from frozen poultry meat to cooked products after the avian influenza outbreak (Perry, et al., 2005). The vertical coordination was achieved through contract production or corporate production.

But, the recent market pressure that livestock products emanating from environments that are not free from certain animal infectious diseases must be derived from compartments, rather than ensuring that products are safe regardless of the source, might tip the balance away from contract farming by smallholders and negatively impact rural livelihoods (Perry et al., 2005). There is also need to carry out assessments of different models of vertical coordination to assess their impacts on livelihoods of primary producers.

The newer issues of animal identification and traceability, differential safety infectivity of live animals versus products and animal health status at product source, besides product certification and animal welfare are challenges that have to be met in order to benefit from trade in LLPs. Capacity building would be important to meet global and other quality norms and more participation in standards setting bodies is required for developing countries to benefit from global LLP trade.

In ESAP, Australia and New Zealand, with their high volumes of livestock production and high per capita incomes, could take the lead in capacity building for the region. They could also pioneer research to reduce the GHG emissions related to current methods of livestock production.

3.5 Environmental, Health and Social Dimensions in Trade Agreements

3.5.1 Trade, environment and sustainable development

The relationship between trade and environmental, health and social dimensions, as well as with sustainable development, is complex. Actions in one area affect the other areas, directly or indirectly. Any impact assessment of trade in agricultural products would depend on which perspective is used as the starting point, whether it is environmental protection, or resource management and biodiversity conservation, or health concerns, or trade. Another issue to take into account would be whether short-term or long-term considerations are being examined.

While environmental, health and social dimensions are acknowledged to be important, they are often perceived as potentially conflicting with trade objectives (see Koester, 2001). In this regard, there is a need to move from a simplistic and selective “balance and trade-offs” approach, which cannot deal with complex realities, towards a more holistic approach, which implies a complex

integration of the various perspectives mentioned above, with recognition that there will be conflicts of interests requiring policy decisions that are in favor of long-term ecological and economic sustainability, human/animal health and safety, social justice, cultural rights and ethics.

The WTO's legally-binding rules impact on the economic and social well-being of a WTO Member and its dispute settlement system and enforcement mechanism (including trade sanctions) make the WTO a powerful body when compared to the United Nations which also has legally binding treaties on environment and natural resources management and on social issues such as the ILO (International Labor Organization) Conventions.

Therefore it is not surprising that "WTO-inconsistent" allegations are often made against environmental negotiators or WTO Members seeking to take strong national environmental or health or social measures at the international level. For example, in recent multilateral environmental agreements (MEAs) such as the Cartagena Protocol on Biosafety, there were intensive negotiations over the hierarchy of agreements (Mackenzie et al., 2003). Major developed countries that are producers and exporters of genetically modified organisms (GMOs) wanted trade agreements to prevail over MEAs. Developing countries and some developed countries, such as Norway and the European Union, wanted to ensure the supremacy of MEAs. The result is the approach of "mutual supportiveness" between trade agreements and MEAs, with a stated preambular paragraph affirming the equal status of all the agreements.

In practice and because of the WTO's formal and enforceable dispute settlement system, this could have the effect of creating a legal hierarchy through its decisions with respect to United Nations agreements, which was actually not the intention of countries that negotiated the trade agreements and the establishment of the WTO. Thus, the struggle between trade on the one hand and environmental, health and social dimensions on the other hand, continues.

3.5.2 Trade at any cost?

However, the WTO is not about "trade at any cost" even though the policy freedom of Members has been reduced. WTO agreements have a context for trade. For example, the preamble of the Marrakesh Agreement Establishing the World Trade Organization (1994) affirms "…the objective of sustainable development, seeking both to protect and preserve the environment…". A number of WTO agreements also provide for various types of review and amendments, such as the Agreement on Trade-Related Aspects of Intellectual Property Rights (see 3.3.1).

Article XX of GATT (1994), which provides general exceptions to trade liberalization, is of crucial importance. This is because the body of WTO-related rules does not contain general exemptions

of an environmental nature, nor does it provide a special status for MEAs. Article XX of GATT contains several general exceptions, among them for trade-restricting measures (a) “necessary to protect human, animal and plant life and health”; and (b) “relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption”.

This means that WTO Members may adopt or enforce measures for these purposes, even though they restrict trade. There are, however, conditions for measures (including import bans) taken under Article XX. First, there must be no “arbitrary or unjustified discrimination between countries where the same conditions prevail”. Thus a Member cannot put restrictions (on health or environmental grounds) on an imported product, without having the same restrictions on similar domestic products. Secondly, the restrictive measures must not be “a disguised restriction on international trade”. Thus, there is scope for WTO Members to take protective measures and to restrict trade of certain products, including agricultural products, for environmental and health purposes.

Despite the exceptions and special provisions in the WTO agreements, these are not enough and have limited scope in ensuring environmental protection, sustainable resource management and the safeguarding of human, animal and plant health. The current international trading system is also not able to ensure social equity; while inequalities between the developed world and Asia have gone down, there has been an increase in inequality within countries (Macgillivray, 2006).

Where there are possible conflicts between the WTO and other agreements, the situation raises even more concerns, as it could mean that the WTO could be effectively adjudicating on those other agreements. The WTO Dispute Settlement Mechanism cannot be the judge of non-WTO Agreements and may not be the best way to resolve disputes in these important areas of policy-making (Shaw and Schwartz, 2005). The difficulties were evident in the recent dispute led by the United States against the European Communities on the European approval procedures for GMOs. Although the WTO Dispute Panel did not rule on the legality of the procedures or on the right of national governments to ban GMOs or to take restrictive measures, the case illustrated the inappropriateness and even discomfort of the trading system in dealing with biosafety (and hence, environmental, health and socioeconomic) issues (Bernasconi-Osterwalder and Oliva, 2006; Friends of the Earth International, 2006; Lim and Lim, 2006; Palmer, 2006).

Therefore, MEAs and other social development instruments with their own compliance mechanisms are necessary (e.g. the Cartagena Protocol on Biosafety has a Compliance

Committee) to ensure that these agreements are implemented fully. Trade forums are not appropriate to be the judge and arbiter of sustainability.

3.5.3 Standards for environmental, health and social dimensions

It is important to recognize the validity of other standard setting bodies such as MEAs. For example, during the negotiations of the Cartagena Protocol on Biosafety, many countries wanted a provision on the setting of international biosafety standards under the Protocol. Major developed countries such as the United States, Canada, Australia and Japan rejected this, arguing that standard setting bodies such as the Codex Alimentarius Commission, the International Office of Epizootics and the bodies of the International Plant Protection Convention would be sufficient.

The compromise was Article 2(5) of the Cartagena Protocol: "The Parties are encouraged to take into account, as appropriate, available expertise, instruments and work undertaken in international forums with competence in the area of risks to human health".

Therefore, the standards set in UN MEAs such as the Convention on Biological Diversity and the Cartagena Protocol on Biosafety are arguably legitimate and thus actions taken under these MEAs are WTO-consistent. This is indeed what the European Communities argued in the WTO dispute on biotech products; it implied that MEAs such as the Cartagena Protocol are setting international standards and that its regulatory processes are consistent, with both WTO rules and the Protocol (Shaw and Schwartz, 2005).

The issue of trade and labor standards is highly controversial. The WTO Agreements do not deal with any core labor standards. But some industrialized countries believe that the issue should be studied by the WTO as a first step toward bringing the matter of core labor standards within its ambit. WTO rules and disciplines, they argue, would provide a powerful incentive for Member nations to improve workplace conditions.

On the other hand, many developing and some developed countries believe the issue has no place in the WTO framework. These countries argue that efforts to bring labor standards into the arena of multilateral trade negotiations are little more than a smokescreen for protectionism. Many developing countries believe that the campaign to bring labor issues into the WTO is actually a bid by industrialized nations to undermine the comparative advantage of lower wage trading partners.

In 1996, after heated discussions, WTO Members identified the International Labor Organization (ILO) as the competent body to deal with labor standards. WTO Members said they were committed to recognized core labor standards and that these standards should not be used for protectionism. The economic advantage of low-wage countries should not be questioned. The WTO and ILO secretariats were asked to continue their existing collaboration. There is currently no work on the subject in the WTO.

It is apparent then that when dealing with the interface of trade and social dimensions such as labor standards, that the WTO is not the appropriate forum. Nonetheless countries must have the adequate policy space to implement labor standards and the ILO Conventions, in order to promote opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security and dignity.

On the other hand, the effort to include socioeconomic considerations in the Biosafety Protocol was strongly resisted by developed countries. The result is a general provision in Article 26, as follows: (a) A decision on import under the Protocol or under its domestic measures implementing the Protocol, may take into account socioeconomic considerations arising from the impact of LMOs (living modified organisms, the term used for GMOs in the Protocol) on the conservation and sustainable use of biological diversity, especially with regard to the value of biological diversity to indigenous and local communities; and (b) The Parties are encouraged to cooperate on research and information exchange on any socio economic impacts of living modified organisms, especially on indigenous and local communities.

It would be important for developing countries to conduct research and studies to contribute to this international process of research and exchange of information among governments, international and NGOs on the socioeconomic aspects of GMOs (Second Conference of the Parties serving as the Meeting of the Parties to the Protocol, 2005). At the national level, decision-making on GMO policy and specific GMOs would also greatly benefit from such studies. Many countries allow for socioeconomic considerations to be taken into account when taking a decision on whether or not to allow the import of a GMO into the country.

The proliferation of bilateral and regional free trade agreements (FTAs) in ESAP countries may have implications for national policy space, making it more difficult for governments to implement and enforce environmental, social and health protective measures. Of particular concern are the FTAs between developing countries and developed countries like the United States. These North-South FTAs are very comprehensive in scope and extend into the realm of domestic policies (Gibbs and Wagle, 2005).

The investment chapter of US FTAs, for example, includes provisions on expropriation and mechanisms for investor-state dispute settlement. These have proved to be problematic in the NAFTA (North American FTA, which has been in force for more than 10 years) context, as foreign investors have successfully challenged government activities and public policies, such as those aimed at environmental protection (Gibbs and Wagle, 2005). It is not inconceivable that health or social measures may also be affected. Furthermore, FTAs that include compensation provisions for expropriation of investment by direct or indirect means could lead to claims against government regulations aimed at enhancing public welfare or protecting the environment, if they are perceived to affect an investor's profitability.

3.5.4 Pollution havens

Different countries have different environmental standards. These differences could be used in international trade systems to export products meant for disposal, for instance, to countries where environmental standards are particularly lax, so-called pollution havens. There have been instances of ships sent to Bangladesh or India for breaking-up not having the hazardous substances removed and dealt with in the originating country.

Ship-breaking, to take this example, creates many jobs in Bangladesh, India, etc. This is based on the lower labor costs involved in these developing countries. But the ship-breaking activities can still be carried out in developing countries with lower labor costs, with prior removal and proper disposal of hazardous substances in the originating countries. Obviously this would be more expensive that the export of these substances to "pollution havens". But examples show (e.g. that of the French aircraft carrier Clemenceau, that had to taken back to France for removal of asbestos and other hazardous substances, before being re-sent to India for breaking-up) and general economic analysis would bear out, stricter responsibilities for disposal of hazardous substances, which is also likely to be a more capital-intensive activity, can be combined with jobs for labor-intensive activities, like breaking-up ships. Along with action, often initiated by press and civil society organizations, to have more stringent environmental standards in existing "pollution havens", there could also be a role for international coordination of environmental standards to deal with disposal of hazardous substances.

3.5.5 Technology choices

When we look at the range of AKST and associated technologies, on what then should we base our decisions as to whether a particular technology is appropriate? It cannot be just on the basis of trade considerations. A holistic assessment of technology requires the careful and comprehensive examination of environmental, health, safety, legal, socioeconomic and ethical

dimensions. It also requires an understanding of the short, medium and long-term effects of a technology.

Concurrently, there is the possibility of a reform of international and national trade laws and policies where necessary, with courage and political will among decision-makers and implementation, with political will and commitment, of international environmental agreements and social development instruments. Finally, ensuring effective public participation and monitoring to ensure compliance with sustainable development principles, laws and programs can help guide policy-makers.

3.6 Climate Change and Trade

3.6.1 Asia in the global climate change equation

Developing Asia's economic growth has largely been based on carbon-biased technologies, developed in an era of cheap carbon. Though the per capita emissions of developing Asia are still much below the levels of the USA or Europe, yet the large size of the economies means that total emissions from developing Asia are very large.

In the pre-Kyoto discussions it was argued that the industrialized North were responsible for carbon emissions and hence it was these countries that should take action to reduce carbon emissions (Agarwal and Narain, 1991). Along with this it was proposed that the developing countries should be given incentives to adopt carbon-efficient technologies, through trading based on per capita rights.

The carbon-intensive growth of developing Asia has changed the global equation with regard to actions for reducing carbon emissions. The developing world as a whole now accounts for almost 50% of annual carbon emissions. China is the second largest emitter, after the USA; while India is the world's fifth-largest emitter. Further, land use change resulting in deforestation itself accounts for 20 to 25% of global emissions, with Brazil and Indonesia being the two largest emitters.

In designing policies for mitigating climate change or reducing carbon emissions, three factors now stand out. First, the developed countries bear historical responsibility for the magnitude of the problem; there is question of global justice in distributing burdens for reduction of carbon emissions. Two, without the involvement of the developing countries, particularly the large economies of China and India, not much of a dent can currently be made on the scale of emissions. Third, sectors of agriculture, such as forests (through conversion of land for agricultural use) and livestock also contribute substantially to global greenhouse gas emissions.

3.6.2 International trade instruments for environmental objectives

There is often, even usually, more than one way of producing a commodity, the negative environmental effects of which are different. But the price of the commodity would be the same, irrespective of the method used in its production. For instance, coffee grown in the shade of existing forests would sell for the same price as coffee grown in plantations. If the output of the latter process were higher, then the net income from the environment-friendly coffee process would be lower than from the environment-unfriendly plantation process. From the side of the producers there would be a dis-incentive to carry on the environment-friendly process.

One approach to this problem would be that of using the "polluter pays" principle in international trade. A tax or import duty could be imposed on each commodity, depending on the amount of carbon emitted in its production, the extent of forest clearance carried out, the loss of biodiversity through the production process and so on. The more negative externalities involved in a production process, the higher would be the import duties on its product. This requires a recognition that processes to produce a product can have different effects and that a product's effects are not restricted to its quality in use.

The "shrimp-turtle" case [in which the WTO panel ruled that the US had a right to take action to conserve exhaustible resources and could require the use of turtle-extruder devices in harvesting shrimp] provides a precedent, for extending trade measures, import duties or even prohibitions, to cover various environmental externalities in production processes (Stiglitz, 2006). There could import duties for carbon emissions, loss of biodiversity, clearance of forests and so on. Such an import duty, based on direct and indirect carbon use in production, could also be used as a manner of dealing with "free riders" who do not subscribe to international agreements on GHG emissions. The result would be to favor commodities produced with environment-friendly instead of unfriendly processes and higher costs for unfriendly processes. The tax would be paid by those who use environment-unfriendly processes and those who consume the resulting products. Such a tax on the production of negative externalities could make international trade somewhat more environment-friendly than it currently is. Low carbon-using processes, e.g. that of the Chinese village of Liuminying, which has developed an integrated gas- energy-fertilizer system, based on animal and field waste, would then have a price advantage over similar products of more carbon-using technologies; or bird-friendly coffee in managed agro-forests would be cheaper than sun-coffee in plantations (ICRAF, 2006).

Adding carbon taxes is also likely to make certain commodities les amenable to international trade. Transport to more carbon-using destinations, such as those covered by jet transport, is

likely to become less profitable than transport to less carbon-using destinations. This will promote low food-mile destinations over high food-mile destinations, affecting the existing pattern of international trade. Further, high-value commodities will be less affected than low-value commodities. Prices will go up of, say, cut flowers, which is likely to reduce demand for the same. This would affect developing Asia's export of cut flowers.

Utilizing import duties and other trade instruments in order to bring various negative (and positive) environmental externalities into the picture, would require building an accounting framework for environmental factors, something in which some progress has been made; but a lot still remains to be done (Daly and Cobb, 1989; McDonough and Braungart, 2002; ISAR, 2004; Bainbridge, 2007).

As agreed at Rio, there is a "common but differentiated" responsibility for reducing carbon or GHG emissions. The historical responsibility of the developed countries in having used up most available global carbon space means that they should bear the major burden of reducing emissions. At the same time, the large developing economies, such as China and India, also need to undertake measures to reduce emissions in order to make an impact on global emissions. A system of a global carbon tax (akin to the proposed Tobin tax on hot capital movements) could be instituted, along with a system to redistribute the revenues from the carbon tax. There is no reason why the country that pays the carbon tax should get the revenue. In fact, it should be the other way around and counties that emit the least should benefit the most from the revenue. The carbon revenue could then be distributed on the basis of both population and per capita incomes,

A carbon tax would have the disadvantage that it does not by itself set a limit to the total emissions. It would induce technological change, by making more carbon-intensive products and processes more expensive than less carbon-intensive products and processes. But there is no necessary limit to total emissions. On the other hand, a system of tradable emissions, with total emissions and its distribution, set through international decisions could have the same technology effect, but also set a cap on total emissions. In this case too, the tradable emission quotas could be distributed positively with population and negatively with per capita income. A negative relation of tradable emission quotas would mean that countries with higher per capita incomes, which have already more than used up their proportion of global emission space, would get less than developing countries, which have much lower per capita income and also lower per capita emissions.

There are various proposals in discussion on linking trade with climate change. But to be acceptable and workable, it would seem that a proposal needs to be based on an equitable distribution of burdens, based on both historical and present positions.

3.6.3 Carbon markets

In the Kyoto Accord, targets were set for the developed countries to cut emissions, along with provision for carbon trading through the so-called Clean Development Mechanism (CDM). The carbon market, as it has since developed, has three components: (1) project-based transactions in the CDM, where the buyers purchase additionality; (2) trading of greenhouse gas emission allowances under the cap-and-trade regimes as in the EU; and (3) voluntary carbon market, as in the US and Australia (World Bank, 2006b). The carbon market was a $325 billion market in 2005.

The CDM has shifted the emphasis on making the transition to a low carbon economy from polluting industries in the developed countries to industries in the developing countries, where the costs of such transformations are supposedly lower. In ESAP, China and India have been the main beneficiaries of CDM payments. This, however, does not result in any change in emissions from the developed countries, for whom it is a “business as usual” situation. Further, doubts have been raised about whether any real additionality has been achieved through CDM projects (see UNCTAD, 2006a; Carbon Trade Watch, 2007).

With regard to the EU emissions trading system, two points of criticism have emerged (World Bank, 2006b). First, the allowable emissions for each country have been set very high and therefore there has been little need to trade in or reduce emissions. In fact, the high level of carbon allowed resulted in a crash in the European carbon market, where the price of a ton of carbon fell from $30 in 2000 to just $2 per ton in 2006. Second, emission rights have been given free to industries, in what has been called a “grandfather” approach, i.e. as a patrimony. Instead of paying for emissions, polluters are given polluting rights as property (Carbon Trade Watch, 2007). This does not put any pressure on them to reduce emissions.

The carbon trade approach has not worked to stimulate investment in renewable-energy technologies. Again, as prices of carbon-using commodities are not affected, there is pressure to switch to a low carbon economy. As discussed below, another and probably more effective approach would be that of imposing a tax on carbon emissions.

3.6.4 “Avoided deforestation” in carbon trades

In the current carbon trading system, carbon offsets are granted for additional growth of forests. Under the Clean Development Mechanism (CDM) of the Kyoto Protocol, payments can be made

for reclaiming land to forests. But this does not take into account the incentive to clear existing forests – for the timber they provide or to convert the land to other uses, such as oil palm plantations, or, as is likely given the current emphasis on bio-diesel, to plantations for sugarcane or corn to produce ethanol or *jatropha* plantations.

A 15-country coalition of rainforest nations, led by Papua New Guinea (see www.rainforest.coalition.org) has proposed a change in the method of carbon credits for forests to include payment for "avoided deforestation." Such avoided deforestation has an opportunity cost, in terms of livelihoods foregone. This opportunity cost needs to be compensated in order to provide an incentive to maintain existing forests intact. Taxes on carbon emissions can be used to pay small landowners, local communities and indigenous peoples to keep their forests in tact, as is done in Costa Rica.

The introduction of the notion of opportunity costs in terms of livelihoods foregone is a shift from the Kyoto concern with simple costs of technologies. In the Kyoto-system, the costs of reducing a ton of carbon could be lower in the developing countries, when compared to developed countries. Consequently, a large part of CDM trade involved purchasing offsets from developing countries. But besides the cost of utilizing there is another notion of cost that comes into the picture, that is, of opportunity costs or the livelihoods foregone.

The method of financing such an "avoided deforestation" initiative could be of a number of different types, including payments out of a carbon tax, or even from a new environmental financing facility, based on, say, SDRs. These SDRs could be distributed not, as now, on the basis of existing credits with the IMF but on a combination of per capita income, population and the country's existing emissions (or non-emissions). The notion of the opportunity cost of livelihoods foregone in computing social costs (Coase, 1960) can be combined with that of the declining marginal utility of income as income increases, to argue (see Chichilnisky and Heal, 2000; Nathan, 2003) that the distribution of rights can be proportionately higher for low income countries or peoples, such as indigenous peoples.

3.6.5 Market for biofuels

The market for biofuels, while growing is still quite small when compared with the market for fossil fuel. Trade in ethanol, the major biofuel, was 3 billion liters in 2004, as against crude oil trade of 920 billion liters. But with various governments taking measures to increase use of biofuels (both China and India have policies for biofuels to account for at least 5% of total fuel consumption by 2015), the market for biofuel can only grow. The imposition of a carbon tax will, of course, give a strong boost to the market for biofuels.

Brazil is the main exporter of biofuel, ethanol. Its main export markets are the USA and India. The other internationally traded biofuel is palm oil. The palm oil consortium, headed by Malaysia, has a policy of subsidizing the use of palm oil as biofuel, whenever the price of palm oil falls in the market (Roundtable on Sustainable Palm Oil, www.rspo.org) In the early years of this decade there has been a surge of palm oil exports for biodiesel to the EU (UNCTAD, 2006a).

There are a number of issues that come up in this emerging biofuels market. First, is that of the conversion of forest lands into biofuel plantations. Such conversion would reduce the carbon-reducing impact of biofuels and needs to be taken into account. It could also lead to an increase in the prices of food and thus reduce well-being of buyers of food. The second is that of the role of communities and small farmers or corporations. Forms of technical and financial assistance may be required to enable local communities, including forest-dwelling indigenous peoples and small farmers to benefit from the growing biofuels market. Without such safeguards the benefits of this new market could end up being monopolized by the large corporations and thus reducing its likely contribution to poverty-reduction in developing Asia.

3.6.6 Options

The options discussed above (carbon trade, biofuels, compensation for avoided deforestation through a global fund, taxes on carbon and other environmental factors, tradable emissions and the required environmental accounting) together amount to a substantial shift (even a paradigm shift) in thinking on the interaction of trade and environmental issues. The big question mark is over whether the existing sets of institutions of international trade and finance can formulate and implement the required policies, or whether a new set of institutions (supranational, national and local) will be required to manage the new economic-ecological paradigm, which brings together economic and ecological issues, rather than separate them, as has so far been the basis of international trade. Further, as the Stern Review points out, with a business as usual approach, there is the very real likelihood of a world-wide depression, greater in intensity than that of the 1930s. The challenge before the global economy is whether the necessary measures and the likely institutional changes will be brought about only after such a crisis strikes, or whether these steps can be taken in advance of and thus, mitigate or lessen the likely effects.