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Whither Food and Agriculture? - Trade and Technology

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Ladies and Gentleman, good morning.

I am extremely honoured to be invited to present this 24th Campden Lecture. This is a lecture series with a very proud tradition and I'm also proud to have the chance to get to know more of the leaders in this industry in the United Kingdom and around the world who are gathered here this morning. It's truly impressive what this Institute does and the support it commands from throughout the industry all around the world; it truly is a reflection of meeting the test of the marketplace in order to have this kind of private sector support. My topic this morning is "Whither food and agriculture? - trade and technology". While the topic was chosen several months ago, I think the theme is particularly timely. The World Food Summit is going on this week even as we speak down in Rome; we have the first negotiating session of the special agricultural trade negotiating committee of the WTO meeting next week; we have a great deal



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of concern around the world of where international agricultural trade is going, and what the problems of poverty in developing countries are in the relationship to food and agricultural sector and ultimately to the problem of poverty around the world. So this morning I am going to take the long view: I'm going to look out several decades into the 21st Century. We just finished reviewing our World Development Strategy at The World Bank and I'll draw heavily on that work as I make my presentation this morning, but will divide my comments into three sections. First, a general view of where the demand for food seems to be heading in the world, and second I'll talk about the broad brush stroke view of where the food and agricultural sector needs to go to accompany that

This paper is a transcript of the speech given by Dr. Thompson

demand. We'll follow that with a tour of the horizon, continent by continent, talking about the supply and demand outlook for food in each of those continents, then finally wrap up with some implications for relative international food and agricultural trade and the role of the WTO agricultural trade negotiations therein.

On the demand side

OK, first on the demand side. The United Nations is projecting that there will be 48% more mouths to be fed by 2050 than there were in the Year 2000. Almost 50% increase in the population of the world. The population growth alone does not a market make: you've got to have purchasing power to go with that population growth to translate the growth in population into realised demand for food. In our review of our world strategy at the Bank, under fairly conservative assumptions about broad based economic growth which lifts several hundreds of millions of presently low income consumers out of their present poverty over the next several decades, we concluded that the world's food and agricultural system is going to have to be prepared to double supply of food by 2050. About half for the growth of population, the other for income growth. If we're low in our estimate of the speed of economic growth and we actually see several hundreds of millions of more low income consumers lifted out of their poverty then we could get to a doubling of food demand sooner than 2050, but we're operating on the assumption that the world's farmers and food industry are going to have to double it by the middle of the Century.

Today we have about one and a quarter billion consumers who live on less than \$1 a day, and about 3 billion people in the world, about half the world's population, that live on less than \$2 per day. This is where the potential growth in demand for food comes from, practically for the food industry that's your future market. If we're successful in lifting several hundreds of millions of low income consumers out of their poverty they will upgrade the quality of their diet. They will not only increase their consumption of animal protein, fruits, vegetables, edible oils, sweets but they'll also increase their demand for processing services and packaging services, food preservation services - things delivered by the food industry. There will be demand for greater diversity in the diets. At the same time that this is going on, a larger and larger fraction of the world's population is going to be living in cities and so the food industry is also going to have to figure out how to provision more and more cities of multi-millions of people. So these are the basic trends that we're seeing from the demand side; they are going to create the environment in which the world's food system is going to have to work.

Hunger gets a lot of press, particularly this week with the World Food Summit down in Rome; and there are an estimated 800 million people who go to bed hungry at night. Now it's important to recognise that the hungry of the world are not hungry for lack of food production, but for lack of purchasing power in order to access available food that would otherwise be feeding them. The rich in no country go hungry. Only in times of war, natural disaster and politically imposed famine do the rich ever suffer food insecurity. So it's very much a challenge of not only being sure that we have enough food produced to ensure global food security by the middle of the Century and at the individual level if we're going to solve the problem of food insecurity, it's the challenge of reducing poverty to ensure that the low income consumers of the world have the wherewithal to access the food that is being produced.

Where world agriculture's moving

So that's the background from the demand side. Now let's turn to the broad brushstroke view of where world agriculture's moving. And first before I get very far into the lecture, I want to talk about the relationship between agriculture and world poverty. There's a lot of confusion in much of what we read about this issue, suggesting that if only we could solve the problem of agricultural development we take care of world poverty. In one of the important lessons that came out of our review and revision of our World Development Strategy at the World Bank over the last year and a half or so was that whereas agricultural development is a necessary condition for successful economic growth in low income countries, there is no country in the world that has solved the problem of rural poverty in agriculture alone. Every country that has successfully solved the problem of rural poverty has not only raised productivity in agriculture but it's also created non-farm employment, both in far away cities as well as within the rural areas themselves. You've got to create jobs so that most of the smallholders of the world can supplement their farm income with income from non-agricultural employment, or migrate out of agriculture definitively. Now we don't believe that the answer is to move everybody out of agriculture to the cities like Calcutta, São Paulo, Mexico City and Lagos. There is simply diseconomy of size once you reach a certain number of millions of people in those large cities and you create problems of social unrest and crime and pollution etc. etc. So we have the challenge of creating non-farm employment within rural areas, in many cases adding value to the raw products of the land, but also in completely unrelated industries in those rural areas. So the point I want to make here is that to effectively solve the problem of hunger and of poverty in the world we've got to develop agriculture; but agriculture development alone is not going to solve the problem, we also have to worry about the rest of the non-farm economy in those rural areas. We need small cities and market towns that are attractive places to live and work, widely dispersed through the countries, but I'm not going to dwell more on that but just that we have to be realistic about what agriculture can and what it cannot do, because you simply cannot grow

enough physically on 1 acre of land, or even 2 acres of land, to feed a family and generate enough cash income to lift that family out of poverty.

Prospects for the world's farmers

So next I want to address the issue of what are the prospects for the world's farmers to double food production in the first half of the 21st Century and to do it in a manner that's consistent with maintaining the quality of the environment.

First, land

There are two issues we have to address. Land and water in particular. First land. According to the FAO there's at most 10% more land that can be brought into food production in the world which is not erodable, not subject to desertification and not presently forested. Now there would be no problem doubling food production on this planet by doubling the number of acres under cultivation if we are willing to sacrifice a large percentage of the world's forest. But from an environmental perspective this is completely unacceptable. Because if we were to destroy those forests we destroy wildlife habitat, we destroy biodiversity and we destroy carbon sequestration, vastly further accelerating global warming. This would be moving in the wrong direction. We also have to recognise that the same forces of population in income growth that are increasing demand for food in the world in the first half of the Century are also increasing demand for things made out of wood, furniture, building materials, not to mention the increasing demand for environmental amenities that our increasingly urban societies are demanding. So the conclusion is (and many would argue we need to increase the forested area not reduce it) that we have to find a way to double food production on at most 10% more land, so that means close to doubling the average productivity of all the land in the world that's in agricultural production.

Water is a much bigger challenge

But the land constraint isn't the one that concerns us the most; water is a much bigger challenge. Here we have to acknowledge that farmers are both the largest users and the largest wasters of water in the world. Agriculture uses fully 70% of the fresh water used on this planet. But with the rapid rate of urbanisation going on we believe that cities are going to successfully outbid agriculture for available water and so we're going to have to double food production on this planet using less water than today. We're going to have to have more crop per drop produced if we're to be successful in feeding the world's population and doing it in a manner that's

consistent with maintaining the quality of the environment. So we are going to have more than double the average productivity with which the farmers of the world use the water they use, close to double the average productivity of the land the farmers use for food production. And also, of course, if agriculture is to make the necessary contribution that it should make to poverty alleviation, we'll have to raise labour productivity as well. So you've got to raise labour productivity, land productivity and water productivity to be successful.

Public policy

Now there are two keys to success here from our perspective. One of these is in the area of public policy, the other is in technological change. First public policy. It's ironic that in the high income countries of the world, farmers who represent such a small fraction of the employment are so successful in extracting income transfers from the governments, and from the consumers in the form of often artificially supported prices and income transfers in the form of direct payments. At the same time developing country farmers are taxed net by their government. But the reality is that the political cloud in the low income countries resides in the cities and it's much more important for the governments in power to keep the urban masses quiescent, to keep the price of food as cheap as possible and they really don't have to worry about the political implications of the farmers because they're out there in rural areas and they really don't matter politically in most of the developing countries. Therefore government policy in most developing countries turns the terms of trade against their farmers, making the farmers pay more than the world market price for their inputs and getting less than the world price for their outputs that they produce. This is effected through several means; one through direct intervention in markets, in effect directly influencing market prices. We in the high income country also help get the governments of developing countries off the responsibility of doing something about their agricultural development because we give them either a subsidised exports of food or we dump a lot of food aid into those countries, in effect getting the governments off the hook. But price policy is not the only form of public policy and perhaps not even the most important. Under-investment in public goods, particularly in the form of infrastructure, is impeding agricultural development in so many of the low income countries. We take for granted the existence of rural roads, rural telecommunications, rural electrification, of the public's role in our quality oversight and enforcing honest weights and measures, of providing and enabling public or legal environment that facilitates private sector investment - a positive investment climate if you will. The public has a role in investing in R&D and we take these for granted in the high income countries. But yet in many low income countries, under-investments in these very areas are one of the principal barriers to successful agricultural and food system development. For example I was in Western Kenya over by Lake Victoria last fall over a weekend visiting some farmers who were talking about what they were paying for

fertiliser. And it turned out that they were paying 500% of the world market price for their fertiliser, mainly because the cost of transportation was prohibitively high due to the miserable state of rural roads. Additionally, there was significant underproduction relative to its potential.

In fact this is a theme we found throughout our review of world agriculture, for our strategy review, and that is that most of the developing countries of the world are under-performing relative to their potential in basic food production and that this is not an argument for self-sufficiency but simply that the incentive structure is such that they're under-performing relative to the potential that would be consistent with both economic efficiency and environmental sustainability. So a basically positive conclusion is related to what the developing countries could do if their farmers were given appropriate incentives.

Technological change

But now let me turn to technological change. Over two Centuries ago a very pessimistic conclusion was reached about the ability of the world to feed itself, noting that the world's population was growing geometrically but crop yields were growing only arithmetically and as a result that the world's population would outrun the food production capacity of the world's farms and eventually this is what would stabilise: in effect starvation would stabilise the world's population. The Club of Rome early in the 1970's reached some similarly pessimistic conclusions. Lester Brown does regularly. But they've all been wrong, and they've been wrong because of one thing, - they've all assumed static technology; they've all assumed or ignored the reality of what science could do. And in reality of course when we look at what's happened to food prices or at least the long term price of grain over the last 150 years it's been on a downward trip. Of course there's been bouncing around the trend variability mainly due to weather conditions but the long term trend in the price of grain has been downward, mainly because agriculture research and development and the resulting technological change has raised productivity in agriculture faster than demand has grown from the combined impact of population and income growth. Therefore we conclude that there's absolutely no reason that the world's population cannot be fed better than today without harm to the environment and at no higher real cost in the long term trend international price of cereals - which by the way is higher than today's prices - but there's no reason to expect that this couldn't happen as long as the public and private sector could continue to invest in agriculture research and development. We're in the golden age of the biological sciences as well as the information sciences and as a result we should be able to continue to raise productivity to apply inputs in a more precise manner to ensure that we don't overfeed plants for example and cause spill-over into the environment. Of course the information access at low cost has also done wonders for facilitating the growth of a truly global international trading system, one in which we have

instantaneous movement of information at negligible cost that facilitates the operation of the global food system. But we see several areas where the biological research capacity of the world's scientists today can help ensure that we have the doubling of food production by the middle of the Century. And clearly productivity, growth of labour and land and water is important. But all of that said, we can also pack more nutrients into the content of our staple foods. We've already seen how we can increase vitamin A and iron content in rice and by so doing reduce the problems of night blindness and iron deficiency anaemia in the millions of people in Asia who are dependent on rice as their staple.

But with the increasing variability of global climatic conditions and increasing average temperature this also means that we need to increase the tolerance of the plants and animals we grow to drought and heat, also to salinity, to luminum toxicity and so on to ensure that we can use all the land that's available, that's not erodable and not subject to desertification. And finally we need to increase the investments in research to reduce post-harvest losses. We often focus only on the productivity that occurs at the farm level. But the total productivity of the food system, 25% and more of what's grown at the farm level is lost before it gets to the consumer due to everything from rats and insects and rotting and so on and just physical losses through the marketing system. All of this means that we have to use our technological resources, as well to improve the shelf life, if you will, and reduce the post-harvest losses of the raw materials.

What's happening in the various regions of the world

Now lets take a quick tour zone by zone to look at what's happening in the various regions of the world. First Asia. In East Asia let's focus on China. It gets most of the press, there are a billion and a quarter people in China, and it's an incredible accomplishment that they've achieved so far in feeding their populations and providing and ensuring the food security. With the rapid growth in income in the coastal provinces we've seen tremendous changes in the diet, and significant increase in demand for food. There has been significant productivity growth inside that country, but under any reasonable long term assumptions China is going to need to import more of its cereal supply. The government is already committing some of the land growing cereals to shift out of cereals into other higher value per hectare crops, whether it be fruits, vegetable, aquaculture, intensive livestock and poultry production and so on but China consumes half a billion tonnes of grain per year. The current policy of the government is to try to achieve 92% self sufficiency domestically. That leaves 8% left for imports, 8% of half a billion is still £40m of grain imports, not a trivial amount. Not difficult but the important thing is to recognise that the most likely outcome in China will be larger net imports of cereals and also tremendous opportunities for the food industry as incomes continue to grow in the coastal provinces and as incomes begin to grow in the interior.

But looking around Asia further south we need to remember that India is a giant that also has to be considered. China gets all the press but don't forget India. The long term projections suggest that India will have a billion and a half people to China's 1.4 billion by the middle of the Century. But India is likely to have 100 thousand more mouths to be fed than China and there's at least half a billion people in India today who live in abject poverty while on the other hand there are quarter of a billion people who are middle class consumers in India. The numbers are striking when you consider the magnitudes, but the analysis we've seen suggests that animal protein consumption in India will rise as incomes rise. Most people who don't eat meat in India appear not to eat meat mainly by reason of poverty, not by reason of conscience, and so whereas India won't consume much beef or pork they will become an immense consumer of dairy products and poultry and a lot larger consumer of sheep meat and goat meat. So, the conclusion we reach is under any reasonable assumptions about broad-based economic growth in South, South-East and East Asia that these countries will certainly increase productivity and provide more food production but that they will not be able to supply the entire food need, basically because they have so much more of the world's population than they do of the arable land and that even with successful productivity growth there will be larger net imports.

Now continuing our tour around the world. North Africa and the Middle East have extremely difficult conditions, with water being the main constraint and limited potential for much increase in food production and therefore again likely to be larger net food importers. But they are aggressively looking for export opportunities for high value products that can be produced under irrigation using their extremely scarce water supply: it makes much more sense for them to use their water that way than to try and grow cereals at extremely high cost when they can get their cereals at lower cost from the world markets - if only they can sell the things that they have a comparative advantage on.

South America, one of the two regions that has, we think, the most untapped agricultural production potential, mainly in the southern cone of South America. There's more land that can be brought into production, it's one of the few places that has more land that can be brought into production without causing environmental damage, and yields are not nearly as high in that region as they have the potential to be. So we see the southern cone of South America as we move through this Century being an even larger net exporter of cereals and also of processed agricultural products.

Central and Eastern Europe is the other region that we see as having the most untapped agricultural production potential and in fact if we had to name the two countries of the world which we think have the most untapped potential they'd be Ukraine and Argentina in that order. But we have to remember Ukraine was the largest wheat exporter as recently as 1930 but over the ensuing years that soil has been reasonably well protected and the inherent productive

capacity is there in that deep black fertile soil. In fact the Pampa of Argentina, the maize belt of the United States, and the turnisam soils of Ukraine are probably the 3 most fertile soil zones on this planet.

A lot of people look at Russia and they say “Oh it’s got a cold climate” and that “There’s simply not that much potential” but I say “Look at Canada” - Canada’s got basically the same climate and don’t do all that badly in agriculture production when they bring the paw of agricultural research to bear on adopting plant breeding to ensure that high productivity under less good conditions, perhaps, than in some of the slightly warmer regions to the south of those regions. So both Russia, Ukraine in particular, and several other countries in Central and Eastern Europe we see as having significantly more food production potential and export potential if and when they get the public policy and environment straightened out. And we’ve got to have privatisation of land ownership, we’ve got to have the banking systems and marketing system that work, there’s an awful lot that’s got to be done with the extremely low prices of food and agricultural products in the world today. It’s probably just as well that they haven’t come on more strongly than they have so far but their productive capacity is available to meet future food needs when they get the public policy straightened out.

Now the three remaining regions of Oceania, North America and Western Europe. Let me quickly offer a few comments about each of those and then implications. Oceania of course is an important agricultural exporting region but not that big; New Zealand is the most efficient producer of dairy products in the world and will continue to be in all likelihood but as I say it’s not that big. Australia, though it has reasonably big land area, so much of it is so dry that it severely limits their capacity, so these will continue to be important exporting areas but not that much larger.

North America has some additional productive capacity but at the moment my assessment is that particularly the United States is going backwards in agriculture policy and in a manner that’s going to undercut the competitive position of American agriculture in world markets. These immense payments that are going to farmers are all being capitalised into the land values. The response of the Congress to the farmers which can be interpreted only as a political move but its justified on the basis of low net farm income. The land prices have been bid up 4% per year for the last 5 years, something that doesn’t quite calculate when an industry in financial crisis, according to its own assessment, bids up the price of its most fundamental asset 4% per year. So whereas the productive capacity remains large and probably could export more, public policy is actually carrying it in the wrong direction in terms of international competitiveness and at some point before United States agriculture is able to really exploit its comparative advantage again land prices are going to have be written down by a significant amount, and that will be an extremely painful process.

Western Europe, our operating assumption - a conclusion based on our analysis - is that Western Europe is probably not likely to be a larger net agricultural product exporter but continue to be an important processed food exporter. With the extremely tight environmental regulations, the declining subsidies going to farmers, the declining incentives to apply as intensive input use Western European agriculture will be fairly static in terms of its total participation in world markets. With the likely further reduction in export subsidies, whether they're phased out or not I think is too early to tell, but there's certainly further reduction in the implementation of the next WTO round.

So, when we add it all up from across the continents we see East, South East and South Asia being larger net food importers, we see North Africa continuing to be significant importers, we see South America, Central and Eastern Europe as potentially significantly larger agricultural exporters, we note particularly the proximity of Ukraine to the Asian markets, we see Oceania not with much additional export potential, Western Europe probably not exporting much more, North America a bit more, we have one region we haven't talked about and is the biggest question mark, Sub-Saharan Africa.

This is the most difficult region we deal with at the World Bank. It's an immense region without a huge population - if you're looking at sheer numbers of poor people, India's the place to look or South Asia - although in terms relative to a total population the problem of poverty in percentage terms is greater in Sub-Saharan Africa. Agriculturally, you've got the oldest and most weathered soil resource on this planet, basically because of the longer period of weathering, undisturbed surface of that soil without geological folding and upheavals that soil is pretty well down to minimum hydroxide, there's just not much NPK in that soil. Acidic, highly acidic in many places, so your basic resource needs a lot of reinvestment if you are going to be very successful at agricultural development. The organic matter is pretty much all gone, so you're going to need to rebuild organic matter and rebuild the fertility, that soil has been basically mined down to the point that there's not much there to work with. So a tremendous challenge needed in an Africa soil fertility initiative if it's going to reverse the trend of recent years which has been declining per capita food production for 3 going on 4 decades. As I said the under-investment in rural roads has certainly been an immense constraint on African agriculture's performance and in fact I think you would have to say that the African governments in general have been the biggest enemy's of the African farmers. There's an awful lot of rhetoric about the adverse impact of high income country policies on African farmers and it certainly is an important factor but our conclusion is that probably two thirds of the problems of African agriculture are domestically imposed and about one third externally imposed. So there's a tremendous challenge of fixing public policy, both in price policy as well as infrastructure policy in Sub-Saharan Africa an incredible need for restoring African soil fertility, arresting the desertification that's going on. There's a need for greater agriculture research but

one should not overstate it because there's a lot better technology available in many parts of Africa than are in use. Because it simply hasn't paid to adopt the improved technologies that are already available. So our conclusion is the Sub-Saharan Africa could produce a great deal more of its food supply. Technologically it's not impossible, but how likely is it to happen? A lot is going to depend on the stability of those governments, the reduction in corruption and also the extent to which the high income countries of Europe and North America continue to dump low price commodities into those countries undercutting the incentives to their own farmers. So our conclusion is Africa is likely to continue to be a net food importer but on concessional terms, food aid terms rather than commercial terms, but it could produce a much larger fraction of its food supply.

So the bottom line of all of this is that we conclude that a larger percentage of the world's food production will move through international markets as we move through the 21st Century but a large part of this trade will be oriented in the direction of Asia and likely also Africa but not on commercial terms and that the two big gainers will be Central and Eastern Europe and South America in meeting that growing demand. Now to what extent the world market grows will be influenced by what happens in these WTO Agricultural Trade Negotiations.

Developing countries

Let me just make a couple of comments related to this and then I'll wrap it up. This round of WTO Agriculture Trade Negotiations are called the Doha Development Agenda. They're not even called the Doha Development Round. One can ask why is it that developing countries are so important they're not that big a factor in international trade so far at least. Probably in terms of crass politics the reason that the developing countries are so important that they're now the majority members of the WTO and there will be no agreement until and unless the developing countries think it is of value to them, and frankly they don't think they've gotten much out of it past rounds of agricultural trade negotiations in the GATT in previous rounds. But that's not the only reason. Trade is a vastly more powerful engine of economic growth than aid. Countries that aren't receiving foreign aid or official development assistance year after year are basically living on the dole. They're living on welfare. And there's a tremendous dependency that's built up, particularly in Africa, on these handouts from the rich countries. If a country can export products in which it has a comparative advantage and earn its way in the world it will have a lot more self respect for one thing and also it will have a much more powerful impact on accelerating income growth, poverty reduction in those countries. So we need a freer more open trading system from the developing country's perspective to stimulate economic growth in order to get the purchasing power that's ultimately going to solve the problem of poverty. The world market can provide food security to those countries when their domestic productive

capacity is less than their total demand for food. And so the developing countries probably most want access to markets in the high income countries. Here in Europe your “everything-but-arms” initiative is an important move forward. It’s too bad that there is still agricultural exceptions in it but it is a move very far in the right direction.

But market access is not the only thing. We need greater investments in the developing countries to create the environment that will permit them to supply world markets as opportunities open up for them. Every country’s official development assistance except Denmark’s and Japan’s has significantly reduced their investments in agriculture and infrastructure, in agriculture research, the basis for the food and agricultural sector development over the last 15 to 20 years. The year I took over as Director of Rural Development at The World Bank when we initiated our strategy review lending for agriculture and rural development was the lowest in the history of the bank. When you look at the regional development banks, like the Asian, the African and Latin American Development Banks, all of them have also reduced their investments in the food and agriculture sector in developing countries. Agriculture has simply been off the agenda in most of those countries. This is an extremely important contributor to the under-performance of agriculture in those countries. There has been a pronounced urban bias in what their development assistance has been used for as well as an urban bias of what their own investments in the public investments have been put into. The point I want to emphasise here is if you provide greater market access tomorrow, unlimited market access tomorrow, in most developing countries nothing will happen. They simply don’t have the infrastructure in place. They don’t have the investment climate that will stimulate local or international investments and they don’t have the ability to respond so they need not only market access but they also need greater investments in providing the basic infrastructure so the rural economy can respond and so that those countries can take advantage of market opportunities. In other areas they certainly want in addition to market access they are concerned about the high income countries reducing their subsidies to their farmers. According to OECD a year ago, in the publication a year ago, the high income countries of the world were spending \$1 billion per day subsidising their farmers. \$1 billion per day - that’s almost 6 times the total official development assistance going to all countries of the world, so our handouts to farmers in high income countries are almost 6 times all development assistance going to all developing countries world-wide. We need to redress this imbalance and I’m not making the argument that we need to increase development assistance as much as we need to stop asking the low income farmers of the low income countries to compete with the Treasuries of the United States and of the European Union.

So they want to see subsidies dropped in high income countries; they want greater market access; they would like to see phytosanitary and sanitary barriers to imports restricted to those which are based on good science and not used as nuisance protectionist barriers and they also

are very concerned that if they are going to cast their lot with the world market, and depend on the world market for part of their food security, they have to have absolute assurance of access to supply in good years and bad. The United States has used export subsidies, the European Union has used export taxes in times when there were bad crops or limited supply availability in order to protect their domestic markets. The US has also used them for political reasons. We can't have it both ways. If we expect the developing countries to be willing to rely on the international market for part of their food security they've also got to have absolute assurance of access to supply in good years and bad.

They are also concerned that we in the high income countries do not use our concerns about the environment and labour standards as thinly disguised excuses for protectionism. There are a lot of very legitimate concerns in both areas in high income countries but I can tell you as a person who spends a lot of time travelling each year in developing countries there's a lot of concern that many of these proposals from the high income countries are nothing more than thinly disguised protectionism to protect industries in which the developing countries have a comparative advantage.

OK, in this presentation we've talked about where we see global demand for food going; we've looked at some of the challenges particularly of raising productivity of land and water for the world's farmers to reach to supply that food; we've had a quick tour of the world in terms of what the supply and demand prospects look like in different continents; and we've talked about some of the implications for the international trade negotiations and what the developing countries need out of them.

Conclusion

The conclusion is, there is no reason for pessimism about the ability of the world's farmers to produce enough raw agricultural products to meet the demand at no higher real prices than today and without environmental damage as long as we invest in agriculture and food sector R&D to ensure that productivity is raised and that we have a larger fraction of what farmers produced reaching the consumers.

We also conclude that food production alone will not solve the problem of hunger in the world, we have to address the problem of poverty, agriculture development is part of what's involved there but it's not sufficient, we also have to develop the rest of the rural economy.

Third, we do expect a larger fraction of the world's agriculture production to move to international markets but there's the important challenge to facilitate freer and more open trading environment if the potential is to be realised here.

At the bank we conclude that globalisation is real and will continue, the global sourcing of the food industry for raw agriculture products will continue to grow, but we do need to remove barriers to trade not only in raw agricultural products but also in processed foods if we're going to be successful in that in achieving its potential. But the bottom line for all of this is that your growth market, all of you in the food industry, is in the 3 billion people who live on less than \$2 a day today. That's half of humanity and that if the market opportunities of the future are located in those areas which have those large numbers of poor people and if we can be successful in lifting several hundreds of millions if not billions of people out of the abject poverty they are living in today, that their income growth will translate into greater demand not only for fruits and vegetables and animal protein and edible oils but also for processed foods.

That's your market of the future. You have a tremendous interest in successfully reducing poverty in the low income countries and in fact that's probably the most important market development tool at your disposal today.

Thank you very much.

Robert L. Thompson

Robert L. Thompson is currently Senior Advisor on Agricultural Trade Policy at the World Bank in Washington DC, a position to which he was appointed at the beginning of this year. Prior to this he had been Director of Rural Development providing technical and strategic leadership to the Bank's rural development efforts, including human resource development, knowledge management, sector strategy and policy, and quality assurance. He joined the World Bank staff in June 1998 as an advisor on rural development strategy and policy, working extensively on the financially stressed countries of East Asia and in preparation for the forthcoming international agricultural trade negotiations under the World Trade Organization.

Prior to moving to the World Bank, Thompson served as President and CEO of Winrock International Institute for Agricultural Development, a not-for-profit institution which carries out projects in 40 countries worldwide to reduce poverty and hunger by increasing agricultural productivity and rural employment while protecting the quality of the environment.

From 1987 to 1993, Thompson was Dean of Agriculture at Purdue University, where he oversaw agricultural instruction, extension, research, international programs, and regulatory affairs for the State of Indiana. In addition, he was a professor of agricultural economics at Purdue University from 1974 to 1993, focusing on agricultural trade policy, U.S. agricultural policy, and world agricultural development.

Thompson was Assistant Secretary for Economics at the U.S. Department of Agriculture from 1985 to 1987 and was Senior Staff Economist for Food and Agriculture on the President's Council of Economic Advisers from 1983 to 1985. In these capacities, he played an instrumental role in writing the 1985 Farm Bill and preparing for the Uruguay Round of GATT (General Agreement on Tariffs & Trade) negotiations.

Active in all facets of agriculture, Thompson chairs the International Policy Council on Agriculture, Food and Trade. He is the immediate past president of the International Association of Agricultural Economists and is a member of the North American Agribusiness Advisory Board of Rabobank. He is a former board member of the National Cooperative Bank; PSI Resources, and its wholly owned subsidiary, PSI Energy; the Vigoro Corporation; Terra Industries, Inc., and the International Agribusiness Management Association. He also serves on the Council on Foreign Relations.

Thompson holds honorary doctorates from the Pennsylvania State University and Dalhousie University. He is a fellow of the American Agricultural Economics Association and the American Association for the Advancement of Science, and a foreign member of the Royal Swedish Academy of Agriculture and Forestry and of the Ukrainian Academy of Agricultural Sciences. In 1982, Thompson was the first recipient of Purdue University's Agricultural Research Award. The U.S. Department of Agriculture gave him its Superior Service Award in 1989, and its Justin Smith Morrill award in 1995, for "demonstrated leadership and significant contributions to food and agricultural science." In 1997, the National Forum for Agriculture presented its Agricultural Vision Award to Robert Thompson "whose effort and foresight have advanced the future scope and diversity of agriculture."

Thompson has extensive international experience and has completed long-term assignments in Denmark, Laos, and Brazil. He has lectured, consulted, or conducted research in more than 80 countries worldwide. He is author of over 110 research and popular publications. He has been frequently interviewed by the media on current agricultural policy issues, including the Washington Post, New York Times, Wall Street Journal, Time magazine, the Today Show, and National Public Radio's All Things Considered.

Thompson is a bachelor of science graduate of Cornell University and received its outstanding alumni award in 1988. Thompson earned both his master of science and doctor of philosophy degrees from Purdue University. He was raised on a dairy farm near Ogdensburg, New York. He is married to the former Karen Hansen of the Danish island of Bornholm.

