Nutrition transition, obesity & noncommunicable diseases: 
Drivers, outlook and concerns

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Introduction

Food and nutrition issues are perceived in developing societies as those relating to inadequate food or nutrient deficiency diseases. Now, however, diet and nutrition along with lifestyle changes are recognized as the principal environmental component affecting a wide range of diseases of public health importance in developing countries. The emerging epidemic of noncommunicable diseases (NCDs) is adding to the burden of malnutrition and, unlike what was previously believed, are no longer a problem restricted to affluent, industrialized countries but increasingly also affect developing countries. Thus in developing societies, diseases caused by caloric inadequacy and deficiency continue to persist, but co-exist with the growing presence of diet related chronic diseases among adults; hence contributing to the ‘double burden’ of malnutrition. Many of these NCDs are the result of changes in diet and lifestyle that characterize the ‘nutrition transition’ which accompanies economic development, the increasing urbanization of societies and the globalization of food systems.

NCDs take an enormous toll in lives (33 million premature deaths worldwide) and account for about 59% of premature deaths due to heart disease, stroke, cancer, diabetes and obesity. NCDs account for at least 40% of all deaths in developing countries and represent an even greater proportion of loss of disability adjusted life years (DALYS); they constitute an immense and growing global health problem imposing additional economic and health burden on developing countries. NCDs are largely preventable and require committed policies and targeted action by all stakeholders, public and private, national and international. Strategies that are aimed at promoting healthy diets and lifestyles will affect all sectors of society from food and agriculture, to transport and leisure sectors, not just the health sector. They require inter-sectoral dialogue and action and may affect the growth of several sectors that contribute to the economies of societies. Hence the relative costs and the consequences of both the emerging burden and the preventive solutions offered need to be considered if developing societies want to succeed in tackling this rising epidemic of NCDs. The ‘double burden’ of global malnutrition is a challenge that needs to be addressed by the food and nutrition community both in developed and developing societies, and must be addressed together.

Drivers of the nutrition transition in developing countries

RAPID PRODUCTIVITY GROWTH IN AGRICULTURE AND FALLING REAL PRICES FOR FOOD

The last two centuries have seen a fundamental transformation of diets in all affluent countries. At the beginning of this transformation was the agro-industrial revolution of the 19th century which brought about both the know-how to produce more and the income to consume more food. The modernization of agriculture has played a pivotal role in bringing about change. The rigorous application of scientific advances to traditional agriculture, mechanization, genetic improvements and the development of fertilizers and pesticides allowed a doubling and redoubling of food production within a few decades. In fact, productivity growth was so strong that growth in production comfortably exceeded growth in demand and afforded a rapidly growing population more and better food at declining real prices. Agricultural productivity growth also promoted the industrialization of the then largely agrarian societies. It helped accumulate capital, free up labour and provide ever more nutritious food. Eventually, productivity growth, rising incomes and better nutrition became mutually supportive and thus spurred overall economic development. These developments remained, however, largely limited to industrial countries, at least for much of the 19th century.

It took more than a century before the agro-industrial revolution started to reach developing countries. With the beginning of the 60s, the same factors that had initiated the agro-industrial revolution in the
developed world helped transform the food and agricultural sectors of parts of the developing world. The combination of modern varieties, expansion of irrigation, more and improved input supplies and the widespread mechanization of production brought about an overall boost in food production in developing countries. Since the early 60s, the average caloric availability in the developing world has increased from about 1,950 to 2,680 kcals/person/day while protein availability nearly doubled from about 40 to 70 g/person/day. The prevalence of undernourishment declined from 37% in 1970 to 17% in 2000 and, while more than 840 million of people are still food insecure, this is more often the result of adverse local production conditions, such as war and civil strife, lack of income and of access to food rather than the inability of the world as a whole to produce and provide enough food.

As in the industrial world of the 19th century, consumers in developing countries have benefited most from advances in agricultural productivity. In real terms, food prices have declined to the lowest levels in history and, together with gains in broader economic growth, have enabled consumers today to eat better while spending less of their budget on food. However, not all countries and regions have benefited from these advances. In parts of the developing world, notably in Sub-Saharan Africa, these advances have not yielded a meaningful impact. But in many developing countries, the progress in access to more, better and cheaper food has been impressive. The rapid decline in real food prices has allowed consumers in developing countries to embark on food consumption patterns that were reserved for consumers in industrialized countries at much higher per capita gross domestic product (GDP) levels. Today, a consumer in a developing country can purchase more calories than ever before and more than consumers in industrialized countries ever could previously at comparable income levels. In China, for instance, consumers today have about 3000 kcals/day and 50 kg of meat per year (FAOSTAT, 2004) at their disposal—at less than US$ 1000 income per year.

DEMOGRAPHIC CHANGES AND POPULATION GROWTH

The latest UN population projections suggest a marked slow-down in population growth over the next decades. World population growth is forecast to slow to less than 0.8% by 2030, less than 0.5% by 2050 and may come to a complete halt by around 2070. The slow-down in population growth should allow to maintain and even increase food production per person in the future. The FAO outlook to 2030 predicts that the average dietary energy availability could increase from 2800 to 3050 kcals/person/day globally over the next 30 years; in developing countries the increase will even be more pronounced with an increase from 2680 to 2980 kcals/person/day. But the results of this study also suggest that there will be vast differences between countries and regions as well as within countries.

Another aspect of the demographic change in populations that will influence food availability and consumption, is the shift in the demographic pyramids of countries in the developing world. One of the most dramatic changes of the 20th century in developing countries is not merely the demographic transition that has contributed to the rapid increase in population size and density but also the contribution of improvements in public health that impacts on the age structure of the population and of families. This process, can either help or handicap the escape from poverty. Early in the transition—with many more children than adults (ie, a high dependency ratio) and rapid population growth—the demographic structure handicaps poverty reduction. The situation reverses later in the transition, when the age structure is less heavily weighted towards the very young. Countries in the later stages of the transition have succeeded most in bringing down mass poverty. Developing countries like India and China are in the phase of a rapid demographic transition. Life expectancy is increasing while birth rates are on the decline. The share of population above the age of 60 is growing at a rapid rate and those who cross the age of 60 today are expected to live up to or over the age of 75 years. These changes in the demographic profiles of developing countries will impact both on the food needs and consumption patterns but also on the related health burden of these societies.

A crucial driver of the income growth in developing countries is the shift in the population structure. A large portion of the overall population will be economically active, earning incomes that are being spent on a rapidly shrinking number of children. In Asia, for instance, buying more food is often seen as a first ‘investment’ in the younger generation which is increasingly suffering from overweight and child obesity. The problem has become particularly acute in urban China, where 20 years of a strict one-child policy and a booming economy have meant that growing incomes are often spent on the family’s only child. The result is a sharp rise in child obesity for a whole generation of “little emperors”. The Shanghai Preventive Medical Association, for instance, found that nearly 30% of city’s children were overweight with almost half of them obese.
ACCELERATING URBANIZATION

Even more dramatic than the slow-down in overall population growth will be shifts in the urban–rural population balance. Globally, virtually all population growth between 2000 and 2030 will be urban (Figure 1a). As for total population growth, the aggregate picture of a rapidly urbanizing world masks large regional differences. Urbanization will proceed slowly in many developed and transition countries, where the vast majority of the population is already living in urban areas. At the other end of the scale are Sub-Saharan Africa and Asia, where urban populations will be growing at an astounding rate of nearly 5% per year. Also remarkable is the outlook for Latin America: while already the most urbanized amongst all developing regions, urbanization is expected to continue a rate of more than 2% annually (Figure 1b).

Urbanization also means a higher female participation in the work force and with that a shift away from traditional time-intensive food preparations towards precooked, convenience food at home or fast food and snacks for outside meals. Particularly for the urban poor, the shift towards fast and convenience foods is also a shift away from fresh fruits and vegetables, pulses, potatoes and other roots and tubers towards a much more sugary, salty, and fatty diet. It is also often a shift from a diet rich in fibre, minerals and vitamins towards one rich in energy, saturated fats and cholesterol. But urbanization not only affects changes in dietary patterns within a country, it also promotes changes and convergence across borders. Urbanization provides infrastructure, transportation facilities, ports and roads, trains and airports, thereby facilitating trade both within and across countries. It affords international suppliers advantages of the high proximity to locally concentrated masses of consumers, allowing their foreign distribution channels (international supply chains, supermarkets, fast food chains) to operate efficiently and profitably. Foreign distribution channels bring foreign diets, ie, more processed, sugary, fat, and in general, energy rich food.

Urbanization is also likely to heighten the burden of NCDs regardless of the shifts towards an urban diet and a more sedentary lifestyle. What is known as the “Roseto effect”\(^8\) in a more general context, applies to the socio-economic changes associated with urbanization. The “Roseto effect” describes the role of cultural factors related to a stable family structure, social cohesion and the supportive nature of the community protecting against risk of heart disease and being conducive to longevity despite similar dietary and lifestyle risk factors. Urbanization affects many of these factors. It severs the traditional family links and creates a new geographic, social and cultural environment that affects existing family structures and social cohesion. Loosening of family ties and a loss of social cohesion predispose to increased risk in the same population.\(^9\)

GLOBALIZATION OF THE FOOD SYSTEMS

The acceleration in the nutrition transition is driven by a radical change in the food-marketing and distribution system. The emergence of supermarkets in developing countries is at the heart of this development with Latin America taking the lead. Reardon and Berdegué\(^10\) summarize the most important
changes for the region. They find that, over the 90s, supermarkets have been taking over much of food retailing in Latin America. In 2000 they had roughly 60% on average of the national retail sectors in South America and Mexico, up from 15% in 1990. This rapid expansion was only possible as supermarkets moved far beyond their original niches, expanded from large to small and poor countries, from metropolitan areas to rural towns and expanded the customers from the upper/middle to the working class.

Reardon and Berdequé also venture into the likely developments for other regions. They suggest that East and South East Asia as well as Eastern and Central Europe are only five to seven years behind the developments in Latin America and expect that the transition will even be faster in these regions. Even South and East Africa are seen as catching-up to Latin America over the next decade, albeit at a slower pace. Where supermarkets have made such massive inroads into the food retailing system, they affect the entire food economy. In Brazil for instance, supermarkets have provided a boost to milk consumption, which was driven by a rapid increase in yoghurt and UHT milk (Ultra High Temperature). Here the expansion of supermarkets created a very positive outcome making safe and cheap milk available to the poor. But Reardon and Berdegué also find that supermarkets are often also distribution channels for cheaper, unhealthy snacks and provide theplatforms for fast food chains and junk food.

ROLE OF THE FOOD INDUSTRY

Urbanization also means more frequent eating outside of the home, often under time and budgetary constraints. The fast food industry has catered to these constraints providing fast access to cheap meals, take away services and home delivery services. The fast food meals also cater to other needs, most importantly the desire to eat a salt-, sugar- and fat-rich diet, an old, evolutionary craving to benefit from access to these formerly scarce resources. The growing processing of foodstuffs itself has an increasing influence on food consumption patterns. Vegetal oils, for instance, are important sources of essential fatty acids, but are as such not readily useable as ingredients for many sophisticated food products. Hydrogenation allows to convert fluid oils into spreadable margarine but the same process can turn valuable unsaturated fatty acids into harmful trans-fatty acids. Likewise, the almost universal shift to refined grain flour has a direct impact on the nutrient intakes, particularly where wheat and maize are staple foods. Modern milling procedures produce refined flour which has better digestibility but destroys its texture, structure and valuable fibre and decimates minerals and vitamins.

Changes in dietary consumption patterns

INCREASES IN FOOD ENERGY SUPPLIES

At the macro level, dietary changes can be attributed to the evolution of per capita energy supplies. The comparison of today’s per capita energy availability with the one 40 years ago (Table 1) reveals an almost universal trend towards higher dietary energy supply (DES) levels. At the beginning of the 60s, the entire developing world—with the exception of Argentina, Uruguay and a handful of small countries in the Middle East and the south Pacific—was suffering from substantive calorie deficits, chronic undernourishment and in some cases outright famine. Particularly Asia’s population was frequently hit by periodic famines affecting large parts of its population giants, India and China. The entire African continent was heavily undersupplied, without exhibiting the today’s differences between a well-supplied North African region and the grossly undersupplied Sub-Saharan Africa. All in all, nearly 40% of the population in developing countries was chronically undernourished, while over-nutrition and obesity were marginal and geographically narrowly defined problems.

<table>
<thead>
<tr>
<th>Year</th>
<th>Countries</th>
<th>Pop (millions)</th>
<th>Countries</th>
<th>Pop (millions)</th>
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<td>1789</td>
<td>39</td>
<td>401</td>
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<td>15</td>
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<td>40</td>
<td>1373</td>
<td>56</td>
<td>1473</td>
<td>41</td>
<td>906</td>
<td>22</td>
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<td>1990</td>
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<td>1643</td>
<td>37</td>
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<td>1893</td>
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<td>15</td>
<td>462</td>
<td>45</td>
<td>892</td>
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<td>4509</td>
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<td>1313</td>
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<td>2030*</td>
<td>5</td>
<td>196</td>
<td>39</td>
<td>1189</td>
<td>54</td>
<td>3366</td>
<td>43</td>
<td>3477</td>
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*The number of countries for 2015 and 2030 available is lower than for historical years due to the fact that for certain countries projections are made on an aggregate basis (EU-15).
By contrast, the DES levels in many developed countries were already approaching or even exceeding the mark of 2700 kcals/person/day. But even amongst the rich countries, large differences remained. While the some advanced industrialized countries (US, Canada, Germany, etc.) already attained DES levels of 3200 kcals and more, DES levels in the less advanced industrial countries like Greece, Portugal or Spain remained at or below the 2700 kcals mark. The diets of the latter group resembled then those of advanced developing countries today (Mexico, Brazil, China). But it was also the group of low-income industrial countries that experienced the fastest nutrition transition, catching up rapidly to the group of the richest countries, both in terms of energy supplies and food components. The nutrition transition in many of these countries could be a harbinger for dietary changes in many developing countries over the next 15 years and for most developing countries over the next 30 years.

The 80s and 90s brought about a radical change in the nutritional situation for many developing countries. Energy supply improved swiftly throughout much of East Asia, Latin America and the Near-East/North African region. Probably the most important drivers of these improvements were the production boost brought about by the “Green Revolution” and the shifts towards more market-oriented agricultural sectors in developing Asia (eg, the so-called “household responsibility system” in China). By the end of the 90s, the rather homogeneous picture of undersupplies and hunger of the 60s had changed completely. The prevalence of undernourishment had fallen in all regions except for sub-Saharan Africa and a few countries in south Asia to levels below 10%. Outside these areas, energy supplies have surged to levels that are giving rise to new concerns. The more rapidly growing developed countries, in particular, are beginning to suffer from an oversupply of food energy and a growing rate of obesity. And where incomes are unequally distributed, hunger and obesity now often co-exist in the same country or region.

Even a cursory inspection of Table 1 reveals that many developing countries will have accomplished energy supply levels of 2700 kcals and more. All in all, average food energy supplies in 43 countries, home of about 3.5 billion people, will be above the 3200 kcals mark. At these high levels of average DES, overnutrition is likely to become a growing problem also in developing countries. And, where the income disparities remain high, undernourishment and overnutrition are likely to co-exist within the same country. The outlook for rapid urbanization may mean that overnutrition will largely be concentrated in urban areas, with a shift towards an energy-rich, convenience and fast food diet and an increasingly sedentary lifestyle, while hunger will be more prevalent in rural areas, where food energy supplies may barely match the continuously high requirements for physical work. Overall, high energy supplies combined with an increasingly sedentary lifestyle could result in a rapid increase in obesity and related NCDs.

Changes in the composition of the diet

The rapid increase in food energy supply has been accompanied by a shift in the composition of the diet. The principal steps of change seem to follow a common pattern: the first step could be described as an “expansion” effect. At low income levels, the main thrust of change is one towards higher energy supplies whereby the additional calories come largely from cheaper foodstuffs of vegetal origin. This has been an almost universal development and seems to take place regardless of cultural, religious factors, food traditions or agricultural production patterns. This first step applied as much to the developing countries as it applies to the ongoing shifts in many developing countries over the next 15 years and for most developing countries over the next 30 years.

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The dietary shifts in Portugal, Spain or Greece witnessed over the past 40 years are a perfect case in point. With growing affluence, DES rapidly rose from about 2500 kcals per day in the 60s to more than 3000 kcals in the 80s and 90s. The expansion was largely based on higher consumption of vegetal products. In the next step, the total energy supply rose only slowly but was characterized by a strong substitution effect from calories of vegetal origin to calories of animal origin.

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*a* The dietary shifts in Portugal, Spain or Greece witnessed over the past 40 years are a perfect case in point. With growing affluence, DES rapidly rose from about 2500 kcals per day in the 60s to more than 3000 kcals in the 80s and 90s. The expansion was largely based on higher consumption of vegetal products. In the next step, the total energy supply rose only slowly but was characterized by a strong substitution effect from calories of vegetal origin to calories of animal origin.
underlines the rapid expansion of consumption of animal products in essentially all regions. Growth was particularly pronounced in East Asia where calorie availability from animal products has increased over the last 40 years from 57 to 360 kcals/person/day, ie, by a factor of six. The outlook for the next 30 years suggests that the importance of animal products will continue to increase in the region with a further increase to about 530 kcals/person/day, ie, close to levels that have long been reserved to developed countries’ diets.

Up to a certain level, the shift towards higher meat and milk consumption reflects a desirable nutritional development, increasing both the quantity and quality of protein of the diet. It benefits infants and children by promoting steady growth in the first years of life. It improves the dietary availability of micronutrients in general and of iron in particular, an advantage to women who are liable to anaemia in their most productive years. But these benefits decline rapidly as intake levels rise and, when and where intake reaches adequate levels, there are no good arguments for further increases. To the contrary, high intakes are associated with considerable risk and detrimental health effects. Increased consumption of red meat tends to increase the risk of colon cancer and increased intakes of saturated fat and cholesterol from meat, dairy products and eggs increases the risk of coronary heart diseases.

More meat, milk and egg consumption was indeed associated with a marked shift towards higher intake levels of saturated fatty acids and cholesterol. Table 3 provides a headcount of countries where the daily intake levels for cholesterol, total fat and saturated fatty acids exceed the maxima recommended by the WHO/FAO expert consultation. The estimates in Table 3 suggest that the number of countries with average availability of dietary energy from fat in excess of 30% has more than doubled over the last 40 years; even more pronounced was the increase in the number of countries with average cholesterol availability above 300 mg/person/day; also the number of countries where more than 10% of the dietary energy come from saturated fatty acids increased significantly, albeit at a somewhat slower pace.

The same analysis of cholesterol and saturated fat consumption for the next 30 years is unfortunately not possible without risking major data problems. However, as both cholesterol and saturated fat intakes are highly correlated with meat, milk and egg consumption, the projections implicitly suggest a swift and substantial increase in intakes of these nutrients. The most pronounced increases can be expected for East Asia and Latin America, driven by further increases in meat and egg consumption (Table 2). But even developed countries are likely to top the already high levels of intake of saturated fatty acids and cholesterol as consumption of animal products is expected to increase further.

Conclusions
The last few decades have seen fundamental changes in food consumption patterns around the world. The changes are characterized not only by an increase in the amounts of food consumed but also by a shift in the composition of the diet towards more meat, eggs, dairy products as well as more fats and oils. The result was an increase in the calories consumed in tandem with a shift towards diets that are much richer in saturated fats and cholesterol. The main drivers for this transition include factors such as: (i) rapidly falling real prices for food; (ii) urbanization with the development of new marketing

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Table 2

<table>
<thead>
<tr>
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<th>Calories per person and day</th>
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<tbody>
<tr>
<td>World</td>
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<tr>
<td>Industrialized Countries</td>
<td>670</td>
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<tr>
<td>Developing Countries</td>
<td>117</td>
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<tr>
<td>Sub-Saharan Africa</td>
<td>106</td>
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<tr>
<td>Latin America</td>
<td>315</td>
</tr>
<tr>
<td>Near East/North Africa</td>
<td>215</td>
</tr>
<tr>
<td>East Asia</td>
<td>57</td>
</tr>
<tr>
<td>South Asia</td>
<td>113</td>
</tr>
<tr>
<td>Transition Countries</td>
<td>525</td>
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* 3-year average centred on the year indicated
** Meats, eggs, milk and dairy products (excluding butter and fish)
Source: Bruinsma (2003) (5)
channels and the spread of supermarkets into developing countries; (iii) and freer trade and globalization with the emergence of large, transnationally operating food companies. This diet transition also brought about a rapid increase in the prevalence of overweight, obesity and related NCDs. Initially, these problems were limited to developed countries, but more recently a growing number of developing countries is experiencing a similar transformation process.

The growing health concerns have also given rise to an intense debate about possible remedies to stop and reverse the obesity epidemic in developed countries, and, perhaps even more importantly, to prevent similar developments in developing countries. Some of these policy options have been examined in this paper. While much of the policy analysis was limited to a discussion of conceptual issues and problems, it allowed to identify the principal strengths and weaknesses of the various policy measures that are currently being discussed and considered for implementation. Perhaps most importantly, the discussion underlined that more empirical work is required before recommendations for a particular or a combination of policy measures to address the growing obesity problem can be made. Given the speed of growth of the obesity/NCD problem, this lack of knowledge needs to be addressed urgently.

References

Contact: Prakash Shetty (Prakash.shetty@fao.org) or Josef Schmidhuber (Josef.Schmidhuber@fao.org)

### Table 3

<table>
<thead>
<tr>
<th>Limits(a)</th>
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<th>1969/71</th>
<th>1979/81</th>
<th>1989/91</th>
<th>1999/01</th>
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<td>158</td>
<td>158</td>
<td>158</td>
<td>158</td>
<td>178</td>
</tr>
<tr>
<td>Total fat &gt; 30%</td>
<td>28</td>
<td>31</td>
<td>43</td>
<td>54</td>
<td>61</td>
</tr>
<tr>
<td>Saturated fatty acids &gt; 10%</td>
<td>47</td>
<td>49</td>
<td>50</td>
<td>55</td>
<td>62</td>
</tr>
<tr>
<td>Cholesterol &gt; 300 mg/day</td>
<td>26</td>
<td>30</td>
<td>41</td>
<td>44</td>
<td>64</td>
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</table>

Notes:
(a) All results are based on total availability rather than actual intake. This can result in a misclassification of countries, particularly where recommendations are defined in absolute terms.
(b) Limited to countries for which FAO produces Supply-Utilization Accounts (SUAs).
(c) The disintegration of the Former Soviet Union and other countries in Eastern Europe increased the number of countries for which FAO provided SUAs in the 90s to 178.