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THE COMING LIVESTOCK REVOLUTION

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The Coming Livestock Revolution

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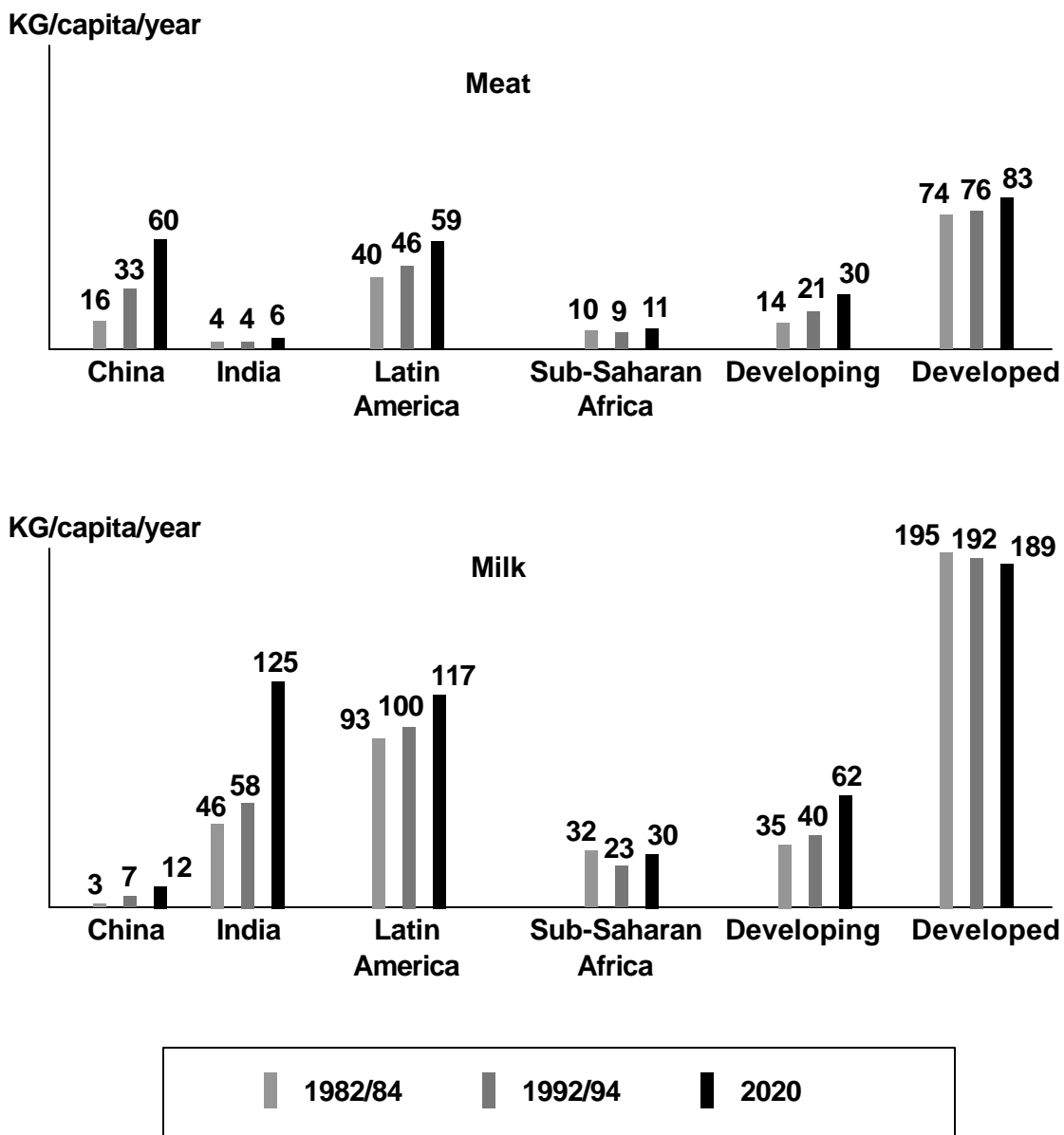
The Coming Livestock Revolution¹

A persistent and widespread change in global agriculture with enormous aggregate impact raises profound issues for human health, livelihoods, and the environment. From the beginning of the 1970s to the mid 1990s, consumption of meat and milk in developing countries increased by 175 million metric tons, more than twice the increase that occurred in developed countries, and over half as large as the increase in consumption of cereals made possible by the "Green Revolution." The market value of the increase in meat and milk consumption over the period in the developing countries was approximately \$155 billion (1990 US\$), more than twice the market value of increased cereals consumption under the Green Revolution. The population growth, urbanization, and income growth that fueled the increase in meat and milk consumption are expected to continue well into the new millennium, creating a veritable Livestock Revolution. As these events unfold, many people's diets will change, some for the better, but others for the worse, especially if food contamination is not controlled. Farm income could rise dramatically, but whether that gain will be shared by poor smallholders and landless agricultural workers who need it most is still undetermined. The environmental and public health impact of rapidly rising livestock production in close proximity to population centers will also have to be controlled.

The Livestock Revolution is propelled by demand. People in developing countries are increasing their consumption from the very low levels of the past, and they have a long way to go before coming near developed country averages. In developing countries people currently consume an average of 21 kg meat and 40 kg milk, one-third the meat and one-fifth the milk consumed by people in developed countries (Figure 1). Per capita consumption is rising fastest in regions where urbanization and rapid income growth result in people adding variety to their diets. Across countries, per capita consumption is highly correlated with per capita income. Aggregate consumption grows fastest where income and urban growth are augmented by rapid population growth.

¹This article is a summary of *Livestock to 2020: The Next Food Revolution*, a 40,000 word report in the 2020 Vision discussion paper series of the International Food Policy Research Institute (IFPRI). The longer report was produced jointly by IFPRI, the Food and Agricultural Organization of the United Nations (FAO), and the International Livestock Research Institute (ILRI), under the same authorship as the present paper. It gives the detailed references for the data and citations drawn upon.

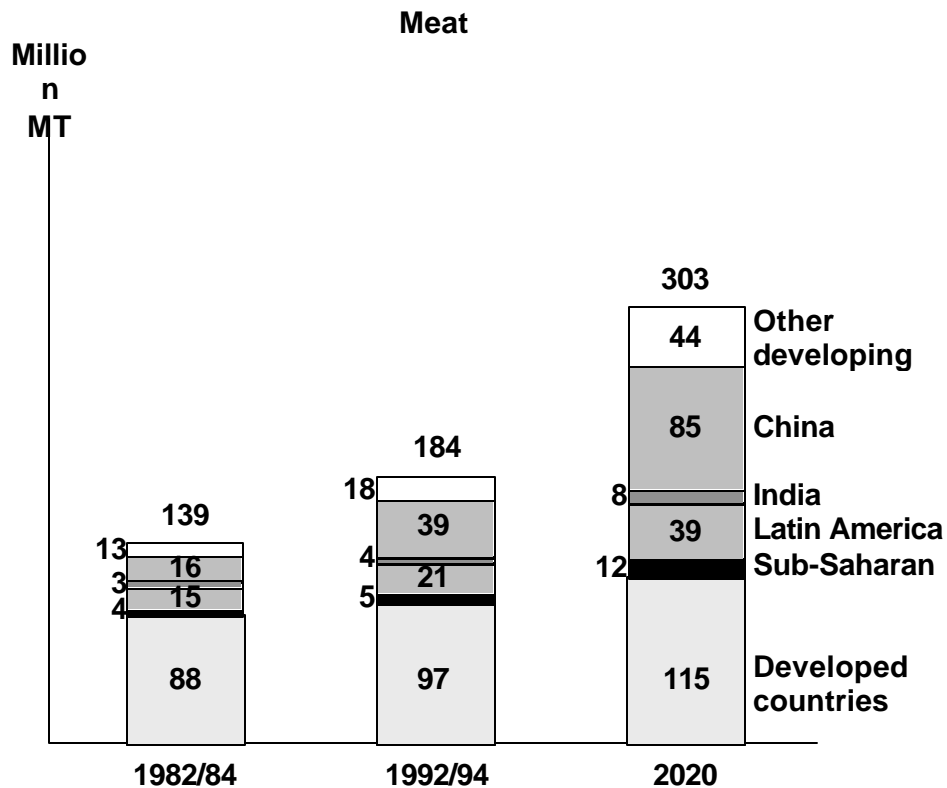
Figure 1—Per capita consumption of meat and milk, 1983, 1993, and 2020



Sources: FAO data and IMPACT projections reported in Rosegrant and Ringler 1998 and Delgado et al. 1999.

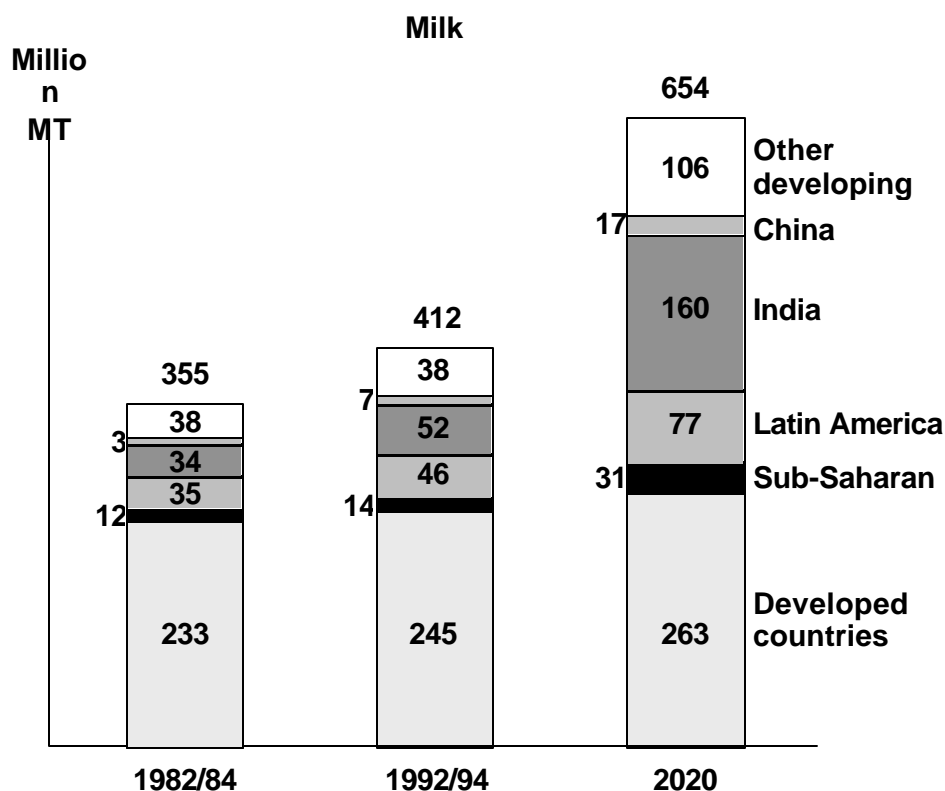
Since the early 1980s, total meat and milk consumption grew at 5 and 3 percent per year respectively throughout the developing world. In East and Southeast Asia--where income grew at 4-8 percent per year, population at 2-3 percent per year, and urbanization at 4-6 percent per year--meat consumption grew between 4 and 8 percent per year. Between 1983 and 1993, the share of the world's meat consumed in developing countries rose from 37 to 47 percent, and their share of the world's milk rose from 34 to 41 percent (Figures 2 and 3).

Figure 2—Total meat consumption 1983, 1993, and 2020



Sources: FAO data and IMPACT projections reported in Rosegrant and Ringler 1998 and Delgado et al. 1999.

Figure 3--Total milk consumption 1983, 1993, and 2020



Sources: FAO data and IMPACT projections reported in Rosegrant and Ringler 1998 and Delgado et al. 1999.

The Livestock Revolution Ahead of Us

Whether these trends will continue into the future is explored with IFPRI's International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT), a global food model first reported in Rosegrant, Agcaolili-Sombilla, and Perez (1995). The IMPACT model details the interrelationships among the supply and demand for both livestock and feed over time. For the 1992/94 to 2020 period, IMPACT projects "most likely" developing country aggregate consumption growth rates of meat and milk to be 2.8 and 3.3 percent per year respectively, compared to 0.6 and 0.2 percent in the developed countries. Aggregate meat consumption in developing countries will grow by about 100 MMT between the early 1990s and 2020, whereas the corresponding figure for developed countries is 18 MMT (see Figure 2). Similarly, additional milk consumption in the developed countries of 18 MMT of Liquid Milk Equivalents (LME) will be dwarfed by the additional consumption in developing countries of 224 MMT. As Figure 3 suggests, the experience will vary widely among different parts of the developing world, with China leading the way on meat with a doubling of the total quantity consumed. India and the other South Asian countries will drive a large increase in total milk consumption.

Production patterns closely follow consumption patterns. Because of the relatively high cost of handling perishable final products and taste factors, most meat and milk will be produced where it is consumed, aided by increasing feed imports. By 2020, people living in developing countries are projected to produce on average 38 percent more meat and 62 percent more milk per capita than in the early 1990s. Much of the expansion in meat production comes from monogastric livestock, such as pigs and poultry. Production of pork, poultry, eggs, and milk creates heavy demand on high-energy feed such as cereals. IMPACT projects a worldwide expansion of an additional 292 MMT of cereals used as feed per year by 2020 (Table 1).

Even with these large increases in animal food product consumption and cereals use as feed, inflation-adjusted prices of livestock and feed commodities to fall between 1993 and 2020 (Table 2), though not as rapidly as they have during the past twenty years. Maize prices fall the least, reflecting high demand for feed.

IMPACT Estimates are Robust

We tested the sensitivity of IMPACT projections to possible extreme scenarios such as a prolonged and severe economic crisis in Asia, a rapid increase in meat consumption in India, or a global decrease in feed conversion efficiency stemming from increased use of grain in animal rations under industrialization (Table 2). Even then the growth of aggregate consumption of livestock products remains strong in developing countries, although consumption growth in Asia is lower and prices fall further than in the baseline projection. The model also shows that a dramatic shift in tastes in India toward meat consumption would have the opposite effect, raising projected world prices.

Our study shows that changes in production efficiency and cost matter greatly to the competitiveness of individual countries, to the use of cereals as feed, and to world trade patterns, but barely affect world livestock consumption. Assuming that between 1992/94 and 2020 the amount of feed required to produce a unit of meat and milk in developing countries rises by 60 percent, world maize prices are only 21 percent higher in 2020 than the baseline projection. In real terms, that level is still half the prevailing prices in the early 1980s.

Table 1—Actual and projected trends in the annual use of cereal as feed

Region	Projected Annual Growth of Production		Projected Annual Growth Rate of Cereal Use as Feed 1992/94-2020	Total Cereal Use as Feed	
	Meat	Milk		1992/94	2020
	(percent per year)			(million MT)	
Developing	2.7	3.2	2.8	194	409
Of which China	2.9	3.2	3.4	73	178
Developed	0.7	0.4	0.6	442	519
World	1.8	1.6	1.4	636	928

Sources: FAO data and IMPACT projections reported in Rosegrant and Ringler 1998 and Delgado et al. 1999.

Notes: Meat includes beef, pork, mutton, goat, and poultry. Milk is cow and buffalo milk in liquid milk equivalents. Cereals includes wheat, maize, rice, barley, sorghum, millet, rye, and oats.

Table 2--Inflation-adjusted prices of selected items as projected by the IMPACT model

Year	Wheat	Rice	Maize	Soybeans	Beef	Pork	Poultry	Milk
(constant 1990 US\$/MT)								
Actual base prices								
1992-1994	148	275	126	263	2,023	1,366	1,300	234
IMPACT baseline ("most likely") projections								
2010	146	293	127	244	1,835	1,260	1,175	217
2020	133	252	123	234	1,768	1,209	1,157	199
Extreme scenarios:								
Asia severe crisis scenario projections								
2020	124	248	114	221	1,676	1,104	1,074	187
India high meat consumption scenario projections								
2020	148	268	139	267	1,927	1,287	1,259	219
Decreasing feed conversion efficiency scenario projections								
2020	141	262	149	242	1,802	1,233	1,183	202
Sources:	The IMPACT baseline projections and the Asia severe scenario are from Rosegrant and Ringler 1998. The India high meat and the feed conversion simulations are from Delgado et al. 1999.							

These projections are confirmed by events in world markets over the past 25 years. Demand increases for meat and milk have largely been met through expansion of feed production or imports at world prices that have declined in real terms. Historically, livestock has been one of the main factors stabilizing world cereal supply. Evidence from years of cereal price shocks in the 1970s and 1980s suggests that reductions in cereal supply were largely absorbed by reductions in feeding to livestock.

A key assumption of the model is that the most important forces driving increasing consumption of animal products--population, income growth, and urbanization--will likely continue during the next twenty years, albeit at reduced rates compared to the past 20 years. The key conclusion from the model is that even with only modestly increasing productivity, large amounts of additional meat, milk, and feed will be supplied without dramatic price increases. The issues then are not whether sufficient animal products and cereals will be available, but what impact increased production and consumption will have on the environment, human health, and the incomes of the poor. Because developing countries will produce 60 percent of world meat and 52 percent of world milk in 2020, the brunt of the benefits and costs of the Livestock Revolution will accrue in those regions.

Risks of the Livestock Revolution

The Livestock Revolution may worsen environmental problems. Animals will likely be produced more intensively in places where financial capital is cheap relative to land (such as Holland), worsening waste and air problems. In places where land is "free" (such as most of the African Sahel), more intensive use of the land without additional inputs could further degrade its productivity.

The past rapid expansion of livestock food production in developing countries came primarily from increased numbers of animals rather than higher carcass weights. This increase contributed to large concentrations of animals and people in urban environments in many cities of developing countries with weak regulations governing livestock production (such as in Beijing, Mumbai, Lima, and Dar-es-Salaam). More livestock also degraded rural grazing areas and encouraged deforestation. Growing concentrations of animals and people in the major cities of developing countries also notably increased the incidence of zoonotic diseases such as infections from Salmonella, E-coli, and Avian Flu--diseases that can only be controlled through enforcement of zoning and health regulations.

The Livestock Revolution raises other major public health concerns. Greater intensification of livestock production has caused a build-up of pesticides and antibiotics in the food chain in many places of both the developed and developing world (de Haan et al. 1997). Furthermore, as the consumption of livestock products increases in tropical climates, food safety risks from microbial contamination become more prevalent. Some critics also extend the concern with excess animal products consumption in developed countries to the rise in consumption in developing countries (see Delgado et al. 1999 for a discussion of this literature). However, for the majority of people in developing countries, whose consumption levels are still very low, little evidence supports this view. On the contrary, protein and micro-nutrient deficiencies, which tend to disappear with increased consumption of livestock products, remain widespread in developing countries.

Others worry that increased use of feed to produce animal products for the relatively rich puts upward pressure on prices of cereals, the staple food of the world's poor. Feeding cereals and soybeans to animals typically creates fewer calories and less protein than animals absorb. However, the idea that reduced demand for feed would overcome the complex income, infrastructure, and food distribution problems that result in calorie malnutrition is an unrealistic oversimplification of the problem.

The Livestock Revolution Creates Opportunities

Far from being a drain on the food purchasing power of the poor, increased consumption of animal products can improve the incomes of poor farmers and food processors. Considerable evidence from in-depth field studies of rural households in Africa and Asia shows that the rural poor and landless presently get a higher share of their income from livestock than do better-off rural people (von Braun and Pandya-Lorch 1991; Delgado et al. 1999). The exception tends to be in Latin America, where relative rural wealth correlates more clearly with cattle holdings. In most of the developing world, a goat, a pig, some chickens, or a milking cow can provide a key income supplement for the landless and otherwise asset-poor.

Rapid industrialization of production, however, could harm this major mechanism of income generation for the poor. There are large economies of scale in processing livestock-origin food products, but far less in production once market distortions favoring powerful producers are removed. Poverty policy can promote vertical integration of small producers with livestock food processors, through contract farming or participatory producer coops. The alternative might be that the poor are driven out by industrial livestock producers and the one growing market they presently supply will be closed to them. Simulations with IMPACT show that policies affect the costs of livestock production and thus, the location and type of production at home and abroad. Policies towards infrastructure, pollution, access to capital, and rural organization will affect the comparative advantage of smallholders versus large industrial enterprises.

Livestock products presently contribute about 40 percent of the value of food and agricultural production in the world, but receive a disproportionately small allocation of public investments for facilitating production (Fitzhugh 1998). Educational, veterinary, research, extension, and specialized input provision are not yet fully privatized in developing countries and probably will not be for some time to come. Incorporating smallholders into this increasingly commercialized business will require public action to support technical and marketing organizations for farmers.

Distortions in domestic capital markets often promote inefficient, large-scale pig, milk, and poultry production in the peri-urban areas of developing countries. These policies distort the pattern of livestock development and ultimately cannot be sustained. Further, poor environmental regulations, distortions in the marketing chain that preventing competition from rural areas, and lack of legal accountability for pollution promote urban piggeries and dairies that cannot adequately dispose of waste materials. Over-grazing often results from inadequate property rights or enforcement mechanisms, or politically motivated subsidies to large producers. Policy needs to focus on removing the overt distortions that produce problems, while promoting institutional change in property rights in commercializing smallholder areas.

Governments and development partners wanting to help the poor in commercially viable activities need to follow the Livestock Revolution closely. The rapidly growing demand for livestock products is a rare opportunity for smallholder farmers to benefit from a rapidly growing market. The worst thing that well-motivated agencies can do is to cease public investments that facilitate economic, sustainable, and small-operator forms of market-oriented livestock production. Lack of action will not stop the Livestock Revolution, but it will help ensure that the form it takes is less favorable for growth, poverty alleviation, and sustainability in the developing countries.

For more information:

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