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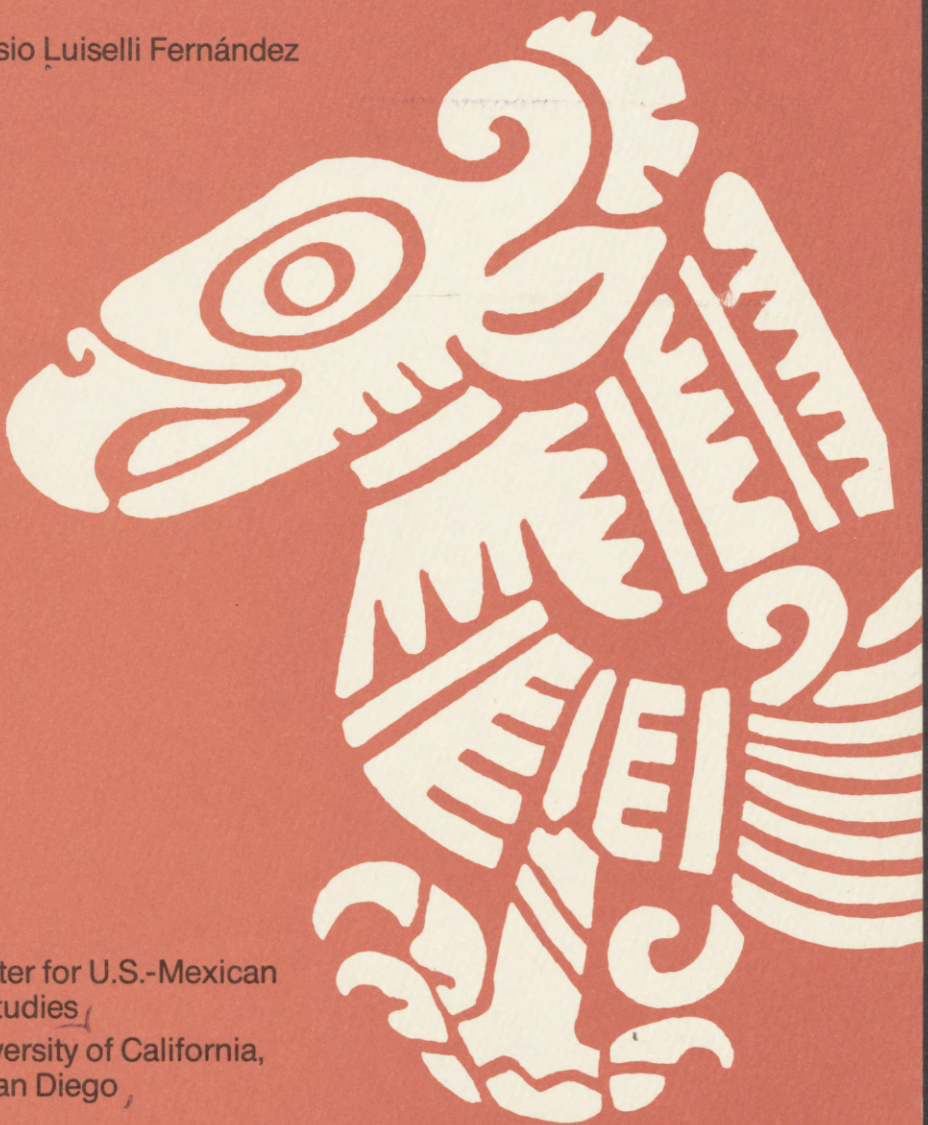
The Route to Food Self-Sufficiency in Mexico

Interactions with the U.S. Food System

Cassio Luiselli Fernández



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THE ROUTE TO FOOD SELF-SUFFICIENCY IN MEXICO: INTERACTIONS WITH THE U.S. FOOD SYSTEM

by

CASSIO LUISELLI FERNANDEZ

Comisión Económica para
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*PREFACE**

This paper outlines several strategies which might begin to set Mexico on the road to food self-sufficiency and thereby help to counteract the effects of its current economic crisis. After placing the crisis in its international economic context, the essay defines the essential elements for a strategy of self-sufficiency in Mexico's overall food system. The narrative also describes the basic characteristics of the U.S. food system, emphasizing its problems and its unsuitability for Mexico, and examines potential interaction between the two systems — especially in technology transfer and trade — from a Mexican perspective.

*The author wishes to thank Valeria Luiselli López-Astrain, whose encouragement and assistance in the preparation of this manuscript were invaluable.

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LIST OF ACRONYMS

ANDSA	Almacenes Nacionales de Depósito
BANRURAL	Banco Nacional de Crédito Rural
BANPESCA	Banco Nacional de Pesca
BIOMEX	Bioingeniería Mexicana
BORUCONSA	Bodegas Rurales CONASUPO
CEPAL	Comisión Económica para América Latina (Economic Commission for Latin America)
CESPA	Centro de Estudios de Planeación Agrícola
CONACYT	Consejo Nacional de Ciencia y Tecnología
CONASUPO	Compañía Nacional de Subsistencias Populares
COPLAMAR	Coordinación General del Plan Nacional de Zonas Deprimidas y Grupos Marginados
DICONSA	Distribuidora CONASUPO
FERTIMEX	Fertilizantes Mexicanos
IFPRI	International Food Policy Research Institute
IMCE	Instituto Mexicano de Comercio Exterior
IMPECSA	Impulsora del Pequeño Comercio
IMSS	Instituto Mexicano del Seguro Social
INIA	Instituto Nacional de Investigaciones Agrícolas
INIP	Instituto Nacional de Investigaciones Pecuarias
INIREB	Instituto Nacional de Investigación sobre Recursos Bióticos
INNSZ	Instituto Nacional de Nutrición Salvador Zubirán
INTAL	Instituto de Tecnología Alimentaria
IPN	Instituto Politécnico Nacional
ISI	Import-Substitution Industrialization
ISSSTE	Instituto de Seguridad Sociales al Servicio de los Trabajadores del Estado
LDC	Less-developed country
NUTRIMEX	Nutrición Mexicana
ONU	Organización de Naciones Unidas (United Nations)
PEMEX	Petróleos Mexicanos
PRONASE	Productora Nacional de Semillas
PROPEMEX	Productos Pesqueros Mexicanos
SAM	Sistema Alimentario Mexicano
SARH	Secretaría de Agricultura y Recursos Hidráulicos
SINE	Sistema Nacional de Evaluación
SISVAN	Sistema de Vigilancia Alimentaria y Nutriçional
SPP	Secretaría de Programación y Presupuesto
SSA	Secretaría de Salubridad y Asistencia

UNAM	Universidad Nacional Autónoma de México
UNICEF	United Nations International Children's Emergency Fund
USDA	United States Department of Agriculture

I

INTRODUCTION

The inescapable, undeniable bonds which unite Mexico and the United States have been recognized for many, many years. As familiar as they are, however, economic relations between these two countries must now be reexamined. The contemporary context of international economic crisis and its grim reflection in Mexico have made it imperative that policymakers carefully develop constructive proposals to guide future relations. This essay will begin to formulate such a proposal to address problems in one specific arena, that of Mexico's agricultural and nutritional needs in the problematic context of economic crisis. We shall begin with a brief look at today's international economic situation from the Mexican perspective so as to identify the essential elements for a development strategy focused on Mexico's food-producing sector.

Mexico has little to gain from a free-flowing exchange of food products with the United States. Rather, as I shall argue below, Mexico must begin to regulate selectively its extensive and ill-assorted trade relations with the U.S. Mexico is now well positioned to increase its exports to the U.S. significantly, while gradually decreasing its imports of grain, animal feed, milk, raw materials, and machinery. Imports could eventually be restricted to certain essential technologies, and even imports such as these could be regulated to assure that their value to Mexico transcends the immediate economic benefits accruing to a single industry. The relationship of food production to nutrition, employment, and income distribution in rural and marginal urban areas is far too important for Mexico to refuse to allow the introduction of foreign investments and technologies in this sector. The following brief look at some relevant aspects of the current worldwide economic crisis will help put food relations between Mexico and the U.S. in clearer perspective.

Without doubt, the present international crisis is the most severe to arise since the 1930s. Clear indications of its arrival first appeared in 1980: gross world product fell rapidly, and unemployment figures reached the tens of millions in industrialized countries and even higher levels in the less-developed countries of the South, where unemployment is aggravated by similarly high levels of underemployment. Trade flows decreased dramatically in 1982 and especially 1983, idling plant capacity and — perhaps more importantly — reducing investment levels, which will impede or postpone economic recovery.

Although monetary factors, especially high U.S. interest rates, are responsible for precipitating and exacerbating the crisis, the current economic situation is much more than a debt crisis. It is a product of a worldwide industrial and technological restructuring which first surfaced during the 1970s. Although the United States is still a primary economic power, this restructuring process has plunged the U.S. into a struggle to reaffirm its economic primacy, which has been gradually eroded since peaking during the two decades following World War II.

Viewing the economic context from this perspective also helps relate and explain two major economic crises of recent years: the 1970s energy crisis and the 1980s debt crisis. Confronted with rapidly rising oil prices, the advanced countries responded by retooling their industries and thus reducing their hydrocarbon needs. The economic slowdown of the 'seventies contributed to their reduced petroleum requirements, but it cannot account for them entirely; the conscious reduction of oil consumption also played an important role.

Concurrently, a financial "recycling" of oil-boom money gave many southern countries access to cheap and abundant foreign loans. In this period of economic downturn, these loans took the place of exports in these countries' balance of payments, and they have since become a major contributing factor in the current economic crisis. Moreover, these years witnessed discordant trends in the global economy: international financial markets were stimulated by the release of the dollar from the gold standard in 1981, which stimulated more open money and credit flows and free-floating exchange rates; international trade, however, was depressed by a rise in protectionism, which put to rest the myth of free trade as the organizing principle underlying international economic relations and contributed further to the ongoing economic crisis.

Faced with the resulting economic slowdown, the advanced countries, especially the U.S. and Japan, began restructuring their industries around a dynamic technological-industrial core. This transformation, which will eventually extend to the entire international economy, comprises microelectronics (the basis of robotics, teleinformation, and microcomputers); biotechnology (especially using recombinant DNA); and the use of lasers, optical fibers, and innovative materials such as space-age ceramics. Although this technological nucleus is as yet too localized to effect immediate and wide-ranging economic recovery or changes in the dynamics of industry, its growth will decisively affect future industrial development. As this transformation has spread, it has created serious problems for developing countries in the areas of employment, international competitiveness, and product marketability. Thus, the combination of economic recession, debt crisis, and technological-industrial transformation of

the world economy has magnified the disparity between rich and poor nations.

Unable to respond comprehensively to these challenges, and with the rapid impoverishment of large segments of their populations, developing countries have been forced into highly deflationary orthodox economic adjustments. Saddled with enormous external debts at virtually unmanageable interest rates, relatively more advanced LDCs such as Brazil, Mexico, and Argentina have been particularly hard-hit. Worse still, this crisis coincides with a period of vigorous demographic growth which will persist at least until the end of this century and drastically alter population distribution throughout the world. By the year 2000, the population of the Third World will burgeon to 5 billion, or 80% of the world total. This population explosion is occurring even more rapidly in urban than in rural areas (three times faster than average demographic growth rates), exerting enormous economic and social pressures on economies already exhausted by the external pressures noted above.

This combination of growth and rapid urbanization presents a formidable challenge for Mexico's food-producing capabilities and has in fact led to substantial food dependency. The challenge is heightened when a third factor, increased food demand, enters the equation. Rising individual income levels, especially in urban areas, have created a middle class with a voracious appetite, not only for greater amounts of food, but for a specifically "North American" diet rich in animal protein. This dietary change has exacerbated Mexico's external economic disequilibrium by stimulating increased imports of animal feed and specialized technology, and it has also compounded problems of social equity. According to calculations of the International Food Policy Research Institute (IFPRI), food demand in developing countries is growing at a faster rate than food supply; this situation will worsen in the 1980s as the population of developing countries reaches 800 million. While Third World countries have undeniably improved agricultural production by attaining increases which narrowly surpass their phenomenal rates of growth, these production increases remain below increases in consumption. Although their food exports are rising, moreover, they do not offset massive increases in food imports. These elements of production and consumption present a scenario of progressively eroding food self-sufficiency — or, to put it another way, "nutritional security" — in developing countries.

Unfortunately, these general observations regarding the world economic crisis and the Third World are especially valid for Mexico. Although it falls somewhere between the developed and underdeveloped worlds, Mexico has not evolved in a way that has brought generally improved living conditions to the majority of its population. Rather, a small but important minority

of some 25 million Mexicans displays consumption patterns characteristic of the First World, while an enormous portion of the population — 50 million people — experiences all the problems and deficiencies of the Third and Fourth Worlds. At once Old World and modern, Mexico displays this marked dualism not only in rural areas, but also in the urban sector, where starkly disparate consumption patterns and living conditions exist side by side.

The present crisis has imposed new and severe limits on Mexico's development. During the next five to seven years at least, Mexico will confront scarcer and more expensive foreign loans, a sluggish economic growth rate, and relatively restricted exchange with the outside. While the latter phenomenon may have positive consequences, it nevertheless implies difficult adjustments and high economic costs. Even after the belt-tightening response to the present crisis eases, this restrictive context will continue as Mexico encounters and addresses certain structural pressures which have been accumulating over a long period and can no longer be ignored. These pressures, which will persist until at least the end of this century, will dramatically challenge Mexico's ability and willingness to extend democracy and political participation to 50 million citizens marginalized in terms of well-being and the chance at a better life.

At the risk of oversimplification, five key problems generate the most telling pressures on Mexico's socioeconomic system. The first of these is Mexico's industrialization pattern. Although Mexican industry is already diversified and internationally recognized, it suffers from serious bottlenecks which impede its complete integration and development (in, for example, the machine-tooling and capital-goods sectors). High levels of concentration and transnationalization prolong the dependency and vulnerability of Mexican industry and interfere with the development of a competitive, national orientation. The bitter fruit of an excessive and ill-conceived protectionism and of restrictive import-substitution industrialization (ISI), Mexico's industry is ill-adapted to reap benefits from the ongoing global industrial and technological transformation; it has not even managed to adopt a national orientation which could satisfy the basic needs of Mexico's sizable but latent internal market.

A second key pressure on Mexico's system has been its inability to push ahead more rapidly toward a modern infrastructure, despite its efforts in this direction during recent decades. This lack of an adequate infrastructure is even more critical during periods of crisis such as the present one. To name only a few of its most severe infrastructural shortcomings, Mexico lacks essential roads, port facilities, housing, and urban services.

Technological backwardness, third in the list of critical problems to be addressed in Mexico's near future, impacts

nearly all aspects of the country's economic and social life. Mexico's imitative development process, an inadequate educational infrastructure, and the general isolation of centers of higher education from the productive structure stand out among the causes of this backwardness. These factors prevent Mexico from formulating constructive responses (adaptation, selection, etc.) to the current worldwide technological transformation. The gap between Mexico and other countries widens daily, with grave implications in terms of employment, equity, and productivity. Furthermore, Mexico's lack of technologies prevents it from maximizing the potential of its resources (an abundance of labor and natural resources) and overcoming its shortcomings (a scarcity of capital and foreign exchange). The lack of technologies also impedes the country from attending to the most immediate needs of its population: housing, food, health care, education, transportation, and clothing.

The fourth key constraint on Mexico's future development is its explosive and extremely costly urbanization process. Mexico City, the world's most populous urban center, will be home to 30 million people before the end of this century, and other Mexican cities are growing at an even faster pace. The costs of such urbanization — monetary, social, and ecological — will soon become intolerable if this level and type of urban sprawl continues to deplete the country's resources and ecosystems.

The final key pressure on Mexico's socioeconomic system can be described as the "agrarian-agricultural continuum." Barriers in the agricultural sector hinder the introduction of modern practices which could stimulate equity in the countryside rather than the preservation of an unfair and increasing concentration of resources. The ownership of agricultural land is highly polarized in Mexico, as are agricultural capital and infrastructure. Furthermore, continued land reform is hindered by several practices: land monopolization coupled with effective subterfuge to hide the facts of land ownership; an increasing incidence of landholding by emigrees and the elderly while young day-laborers work it; and extensive cattle-raising, which occupies large amounts of land appropriate for grain production. Mexico must link its call for agrarian justice to the modernization of agriculture, as will be discussed below.

Dynamic and equitable solutions to these five difficulties will inevitably introduce tensions over changing property rights, which will in turn require creative approaches and strong political will. This is particularly true in the present context, as demographic explosion wreaks havoc in the labor market.

This is the condition of Mexico today: immediate and legitimate needs combine with economic crisis and external disequilibrium. An understanding of this situation is essential if we

are to propose valuable and practicable strategies for the progressive transformation of the country's agrarian sector. To summarize, Mexico must respond to the present critical conjuncture by advancing rather than restricting structural transformation. Mexico must place priorities on developing alternative responses and alternative policies to address changes in the worldwide technological-industrial structure. In the process, the country can exploit certain advantages of its proximity to the United States, but it must always be aware that it forms part of the Third World and, more specifically, of Latin America. Accordingly, its development efforts must focus on endogenous redistributive strategies, not only in terms of income, but also with regard to public goods and traditional community patterns of property rights. If this nation of fifty million Mexicans, wealthy in culture, history, and natural resources, is to retain the rich and varied elements of its sovereignty, it must not remain by the wayside of social and technological development.

II

MEXICO'S CHALLENGE: PURSUING A POLICY OF FOOD SELF-SUFFICIENCY IN TIMES OF CRISIS

Food Production in Mexico: The Current Outlook

Despite Mexico's recent limited successes in agricultural development, a dualistic structure still characterizes its agricultural sector. A small group of modern producers controls most agricultural capital and resources, while the majority of producers — especially on ejidos and small, privately-owned landholdings in densely populated, unirrigated areas — endure a precarious balance between production and consumption levels. A large number of Mexicans, though still a minority, have access to an ample and varied North American-style diet, rich in animal protein and supplementary foods. The diet of most of the population, however, is inadequate and monotonous.

These two aspects of the dualism in production and consumption of foodstuffs in Mexico are functionally and causally related. For this reason, Mexico must resolve these differences in favor of the impoverished majority rather than the affluent minority. Doing so will not only respond to a legitimate need for equity and redistribution, but will also address the urgent problems of poverty at the society's core, increase employment opportunities, and expand the internal market. The surge in the value of the dollar and the sharp devaluation of the Mexican peso to levels acceptable in the world market make this moment propitious for putting forward a strategy of achieving food self-sufficiency and revitalizing the food-producing sector: this sector can dispense with foreign currency and directly employ Mexico's abundant natural and human resources.

The following narrative will describe an integrated food-producing system which can respond to the crisis and the restrictions it imposes. It will address issues of production, consumption, and rural income and will include general observations and justifications. It will also discuss the risks involved in returning to the old and worn model of "subordinate agriculture" or in attempting an impossible mechanical adoption in Mexico of the North American agricultural model. Further, the discussion will propose general production goals for 1982-1988 and agricultural, livestock, and fishery policies with which to meet them.

It will outline goals and strategies for harvesting, storing, processing, marketing, and distributing food, as well as for orienting consumption habits within the food system.

Over a period of ten years, Mexico, with some difficulty, reached a social consensus about the need to eradicate malnutrition and recognize the right of every citizen to an adequate diet. To realize this goal, Mexico must now construct an integrated food system as the pivot for both rural development and the redistribution of wealth. Taken in its entirety, Mexico's food system includes much of its overall productive structure: agriculture, animal husbandry, fishing, and food processing together account for more than one-third of the gross national product and employ nearly half of the economically active population. Although production levels in these sectors are low, they could increase more rapidly than those of any other sector — without substantial foreign currency investments. Food costs, moreover, directly affect the general price index and labor costs, which are decisive factors in Mexico's trade balance and its ability to compete in the international market.

A nationally integrated food system would support an expansion of Mexico's internal markets for inputs and capital goods, while conserving foreign currency through decreased imports of agricultural inputs, machinery, and processed foods. An integrated system would not just substitute native products for imports in the traditional manner; it would integrate internally produced "technological-industrial packages" to lessen the demand for imports and thus the overall need for foreign resources. This, in turn, would lay the foundation for Mexico to export processed and unprocessed foods, as well as other agricultural products, exports for which Mexico has a clear competitive advantage in the North American market.

Moreover, stimulating the food-production system would enable Mexico to provide a well-balanced and adequate diet for its people. Inadequate production, low income levels among the third of Mexico's population employed in agriculture, and malnutrition among half of the total population are dramatic expressions of the problems in Mexico's food system. Strong support to this sector could improve the nutrition of millions of individuals by increasing production levels, income, productivity, and employment, both directly and indirectly. Lastly, an integrated food system could rationalize consumption habits by directing resources to meet the true needs of the population, reversing tendencies toward artificially inflated food prices and reduced intake among the poor. Furnishing nutritional information and guidance would further support the distributive aspects of an integrated food system.

Failure to implement such a strategy for food production and consumption — that is, a return to the model of subordinate

agriculture — would sacrifice the recovery of this sector to short-term and questionable gains. That model would exacerbate the bipolar nature of production and consumption and impede efforts to redistribute income. A system of subordinate agriculture would have as its first priority the improvement of Mexico's trade balance. Such a policy would begin with cuts in government subsidies to agricultural inputs, credits, and prices in rain-fed areas, while such supports in areas of commercial agriculture (producing fruits and vegetables with high value-added in the export market) would increase. This narrow, short-term outlook would reduce current guaranteed prices for basic foodstuffs so as to control inflation and would decrease overall relative prices for products from the rural sector, forsaking the principle of risk-sharing between the state and poor rural producers. The strategy would welcome foreign investment in agroindustrial development, in the misguided belief that such investment would lead to improved efficiency.

This scenario, in addition to forcing Mexico's poorest producers and consumers to bear the brunt of the economic crisis, would contribute to the decapitalization of the countryside and increase food costs. It would thus actually hasten the outflow of foreign currency to pay for imported basic foodstuffs as well as foreign investment, imported equipment and technology, etc. This model, in brief, would support the indiscriminate duplication of the North American food system and would occasion severe problems of capital investment, foreign currency, technological dependency, and the introduction of consumption habits ill-suited to Mexico's resources or the needs of her people. The scenario provides Mexico with compelling motives for exploring the route to food self-sufficiency and the endogenous development of a sector amply endowed to respond.

General Strategies for Achieving Self-Sufficiency in Food Production

Three general preconditions apply before efforts at increased production and redistribution of wealth in Mexico can bear fruit. The first is to guarantee rural producers increased and more democratic participation by supporting rural organizations, strengthening ejidos, establishing cooperatives, and consolidating indigenous communities. Secondly, Mexico must move ahead with agrarian reform programs, accelerating land redistribution, breaking up latifundios, and opening new agricultural land to ejido tenure. Lastly, the relationship between agricultural prices (or rural prices in general) and urban prices must favor agriculture and the rural economy. To satisfy these three preconditions, decision-makers must formulate policies which can be selectively applied in a broad array of situations involving

heterogeneous groups of rural producers and other economic actors in the food-production chain.

For Mexico, embarking on the route to food self-sufficiency must begin with the consolidation of the agricultural and fishery expansion that has occurred over the last three years, as well as a redirection of the livestock sector toward intensive forms of production. These steps would produce multiplier effects in employment and in the country's economic recovery in general.

To implement these general proposals, Mexico must define specific production goals for agriculture, livestock-raising, and fisheries. These goals must reflect projected consumption needs — both intermediate and final — of consumers and various other economic sectors, including the export sector.

To meet projected intermediate, derived, and external demands for foodstuffs through 1988, Mexico's agricultural and livestock sectors must grow at an annual rate of 5 and 4.5%, respectively, and the fisheries sector at slightly more than 8%.[1] Given the debt crisis and economic slowdown, forecasts in the early part of the decade projected slow growth from 1983 to 1985 but accelerated rates of production increases from 1986 onward. Although the required growth rate is high, Mexico achieved such growth from 1940 to 1975 and from 1980 to 1981. Moreover, since this goal can be achieved with relatively little recourse to external credit and foreign currency, a determined effort has a good chance for success. Achieving these rates of growth would imply marked increases in food production by 1988, by which time Mexico should be producing at the levels presented in table 1.[2]

Foremost among the implications of these figures is the tremendous challenge presented by the goals of food self-sufficiency. To reach these goals, for example, agriculturalists must plant 23.7 million hectares in 1988 so as to harvest 19.2 million hectares, allowing for crop losses of approximately 19%. If such losses can be reduced to 17%, production goals could be satisfied through planting 5.8 million hectares of irrigated land and 17.3 million in raid-fed areas. This would require a concerted effort (similar to that undertaken from 1976 to 1982) to bring an additional 960,000 hectares under irrigation and add 2,470,000 new hectares to rain-fed cultivation before 1988. This goal is attainable if agriculture can register average

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[1] These growth rates, based on projected demand for 1983-1988, were derived using 1980 as the baseline. See "SAM 2000-Anexo I. Proyección de tasas de crecimiento: oferta, demanda y consumo," mimeographed (México, D.F.: SINE-SAM, 1982).

[2] Because of the pressures of anticipated demand, Mexico will probably not be able to achieve self-sufficiency in sorghum, oilseeds, and milk, even by 1988, and will continue to import these products.

TABLE 1
1988 PRODUCTION GOALS

Product	Production (1000 tons)	% Average Annual Growth Rate (1980-1988)
Corn	18,122	4.8
Beans	1,611	6.5
Wheat	4,800	6.1
Rice	900	8.8
Vegetable oil	675	3.9
Sorghum	9,028	6.5
Fruit	6,288	4.2
Vegetables	6,095	4.9
Meat	3,895	4.3
-Beef	1,392	
-Pork	1,561	
-Poultry	848	
-Mutton	43	
-Goat	51	
Milk (millions of liters)	9,555	4.5
Eggs	1,080	6.7
Fish and Seafood	2,040	8.5

Source: "SAM 2000-Anexo I. Proyección de tasas de crecimiento: oferta, demanda y consumo," mimeographed (México, D.F.: SINE-SAM, 1982).

productivity gains of 2.4% annually during 1983-1988. Such a growth rate is consistent with projections of the CHAC planning model and with the improved productivity observed during the last three decades.

This development effort would create 115,000 jobs per year in agriculture, a level sufficient to absorb 73% of the rural population entering the economically active population each year.[3] Opening new land to agriculture and increasing productivity imply the increased demands for basic inputs shown in table 2.

[3] See "Estrategia alimentaria 1983-1988," mimeographed (México, D.F.: SINE-SAM, Oct. 1982).

TABLE 2
CULTIVATED AREA REQUIRING
ADDITIONAL BASIC PRODUCTION INPUTS

Basic inputs	Thousands of hectares	
	1983	1988
Credit	10,369	13,433
Fertilizer	12,370	14,160
Improved seed	5,000	7,300

This agricultural development effort, as mentioned above, will require planning and organization, stepped-up agrarian reform, and favorable relative pricing for the rural sector. With the magnitude of the task now revealed, the necessity for two additional preconditions becomes evident: the first involves budgetary limitations, and the second, research and extension services.

Given the current climate of budgetary restriction, the development strategy presented here must be assessed in terms of fiscal needs; such an examination would reveal that the plan can be implemented without exceeding average 1980-1982 expenditures. In fact, financial outlays for the agrarian sector could increase by 5.6% annually by devoting increased attention to the distribution of financial resources.[4] Specific measures include: reducing the allowance earmarked by the Ministry of Agriculture and Water Resources (SARH) for administration and planning in the agrarian sector (nearly one-third of SARH's total budget); cutting the costs of infrastructure projects through controls and more efficient administration; reducing expenditures by related parastatal companies; and drastically lowering subsidies to highly profitable crops, irrigation areas, etc. In short, the strategy for food self-sufficiency outlined above remains economically viable within Mexico's current situation of severe budgetary restriction, imposed by economic crisis.

Research and technological development, the final precondition for an enduring strategy of food self-sufficiency, are critically important for supporting continued production improvements throughout the food system. Mexico still has great distances to cover in this regard. All technological changes introduced should be self-sustaining, which implies that the

[4] Ibid., pp. 24-26, 155-166.

sequence and direction of these developments must give rural producers and their organizations, as well as other related economic actors, as much control as possible over the components of the productive process. Placing control in the hands of these actors will ensure that profits benefit producers, rather than enriching middlemen.

Peasants must also participate directly in agricultural research, lending to the scientific endeavor the knowledge which they have gained from experience. Extension services linked with research and training must address all stages of the productive process as well; material compensation may provide additional motivation for innovations designed to increase productivity, especially through soil improvement. Unlike U.S. extension services, which are based in land-grant colleges and deal with previously uncultivated land, Mexico's extension services lack a network of research and teaching institutions and focus on lands long under cultivation. Mexico's efforts to build an extension service based on the U.S. model have failed; alien agricultural practices clashed with local rural customs, land-tenure patterns, and even the very ecology of the areas where new technologies were introduced. We will return to these concerns below when addressing policies for research and development in food production.

Policy Initiatives for Achieving Food Self-Sufficiency

With regard to the particulars of agricultural, livestock, and fishery policies which would permit Mexico to achieve food self-sufficiency, several factors emerge as important. The first is bringing new land under cultivation. With advances similar to those made between 1976 and 1982, much land now dedicated to extensive livestock-raising near the Gulf of Mexico and in other humid and semi-humid areas can be converted to the cultivation of basic grains. Regional development projects must identify specific zones within such regions for agricultural and livestock development in an attempt to foster better land utilization. Of Mexico's 30 million hectares of cultivable agricultural frontier,[5] several promising areas in Veracruz, Tamaulipas, Chiapas, and Tabasco can be brought under cultivation with low and short-term costs.

The second important strategy would be to improve rain-fed lands without neglecting Mexico's very important irrigation infrastructure. Through the construction of small dams and the drilling of wells in several rain-fed areas, especially in the North,

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[5] "La frontera agrícola en México," mimeographed (México, D.F.: SARH/SPP/Oficina de Asesores del C. Presidente, 1978).

Mexico could bring water to 400,000 hectares identified as suitable for agriculture. In combination with forestation, reforestation, and soil-conservation projects, such efforts can stimulate agricultural development in marginal areas. By using higher prices as an incentive to collect, distribute, and use water more efficiently, Mexico could further extend the frontier of irrigated agriculture. High prices would encourage producers to exploit small rivers, springs, streams, and subterranean aquifers to satisfy the water requirements of small irrigation projects. Present irrigation districts, meanwhile, must be upgraded and maintained; those currently being developed — especially in San Luis Potosí, Sinaloa, Tamaulipas, Guerrero, and Michoacán — should be completed according to the schedule presented in SARH's 1985 projects catalog.

The introduction of more efficient soil and water use will require some alteration in cropping patterns, including the shift of certain irrigated crops to rain-fed land and the relocation of certain productive areas. For example, rice and sugarcane can be moved southward from northeastern and central Mexico, releasing irrigated areas to the cultivation of fruit and vegetable crops with high income yields and export potential; sorghum should be restricted to regions where it is ideally adapted and excluded from irrigated areas in Tamaulipas and Sonora, as well as from areas optimal for corn cultivation in Michoacán and Guanajuato.[6]

Combatting the efforts of the economic crisis in poor rural areas of Mexico calls for a third key innovation, the creation of numerous small, semi-autarchic, integrated farms based on the Oriental model, which combines agriculture and fish-breeding. These agroecological units produce a supply of nutrients, especially nitrogen, phosphorus, and potassium, through integrated small-scale use of water and soil, including the recycling of mud deposits and the recovery of manure and other wastes. Employing these techniques, an integrated farm can produce fruits and vegetables, animal protein (poultry, pork, fish, shellfish, and even beef), and aquatic plants, while meeting all its fertilizer and methane gas requirements by using methane digestors for biomass management. Recycling, the ecological basis of this model, permits poor, isolated communities to produce sufficient vegetable and animal protein internally, without large investment and without recourse to the marketplace. In 1980, guaranteed prices for basic crops began to improve and motivated immediate increases in the production of corn, beans, and wheat. Such price supports, the fourth key policy on the road to self-sufficiency, must continue. The solution to the dilemma between

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[6] See "Modelo de programación agrícola 1980-88, SAM-CHAC," mimeographed (México, D.F.: SINE-SAM, 1982).

paying fair prices for agricultural products in rural areas versus maintaining low food prices for urban consumers should not fall on the shoulders of peasants in rain-fed areas. Nor should Mexico seek decreased supplies as a method for achieving equilibrium between these two populations. The only reasonable and effective response will be to eliminate indiscriminate subsidies to consumption and replace them with selective subsidies directed toward the poorest members of Mexico's population. This would conserve CONASUPO's scarce resources and eliminate misdirection of benefits, while providing an economic stimulus to the needy producer. A poignant irony of Mexico's current agricultural system is that the peasants who produce the country's basic grains are the most poorly nourished of Mexico's people. It is essential that guaranteed prices be set well in advance of plantings and that CONASUPO have the resources to make purchases at the guaranteed price level.

However, guaranteed prices cannot rise indefinitely; although subsidies are a universally popular method for promoting production and redistributing wealth more equally, especially in countries with highly inequitable income distributions, Mexico obviously cannot continue to distribute subsidies as generously as in the past. The size of Mexico's consumer-subsidy program offers ample justification for a drastic and highly selective reduction of indiscriminate subsidies to consumers. (The U.S. food stamp program provides an example of a potential alternative.) Subsidized *production* of basic foodstuffs, however, must not be eliminated abruptly, especially since such subsidies encourage technological advances in basic food cultivation, which will significantly increase production levels in the future. Subsidies thus must be combined with inducements to increase production through technological change until Mexico reaches the levels of productivity enjoyed by the most efficient agricultural systems of the world. Fortunately, the peso devaluation now makes efforts in this direction more promising than in recent years. Price guarantees should continue primarily to support corn, bean, wheat, and rice production. This focus would help halt the substitution of sorghum for corn and assure a price to the agricultural producer that would square with his production costs, thus assisting Mexico in meeting its self-sufficiency goals.

An example of how Mexico might shift its subsidy allocations may be illustrative. At 1982 prices, subsidized consumption of tortillas, bread, and sugar cost the federal government approximately 62 billion pesos. Yet direct subsidies to essential inputs in the production of these goods — including seeds, fertilizer, credit, and insurance — would have accomplished the same price effect and cost just over $4 billion, one-fifteenth of the subsidy expended. Moreover, by virtue of their temporary nature, subsidies can be used to stimulate production selectively. The temporariness of subsidies is important to preserve, since any

support which remains in effect for a prolonged period loses its impact and becomes very difficult to set aside.

Fortunately, Mexico's nationalized banking system can assume a central role in this process by granting credit, the fifth crucial factor in the equation of Mexican food production. Agricultural credit must support not only the development of the agricultural, livestock, and fishing sectors per se, but also a nationally integrated food system. To overcome current limitations on foreign credit, the nationalized banks can give preferential financing to the food-producing sector, an investment which not only makes sense developmentally but also promises a good return. Loans from nationalized banks would be free from obstacles, such as guarantees for ejido and community loans, to rural borrowers. The banking system, with its network of branch offices and its proven efficiency, could advance development strategies in association with CONASUPO, peasant organizations and cooperatives, or the SARH. BANRURAL, BANPESCA, and fiduciary commissions experienced in making agricultural loans should continue their lending operations for the present, but the nationalized banks should eventually constitute the sole lending agency. The umbrella of credit must be expanded significantly in the immediate future, with preferential treatment accorded to peasant organizations.

Credit for secondary inputs has strategic importance as a partial substitute for public spending in the relatively more advanced sectors of agriculture, and it should increase, stimulating the in-situ capitalization of production units. Banks should also review their systems of loan guarantees and offer preferential interest rates and extended amortization and grace periods in order to stimulate investment in basic infrastructure.

Additionally, the banking system should move ahead in extending crop insurance and the practice of shared risk,[7] which, besides promoting class solidarity and income redistribution, stimulates technological change and productive investment in poor areas with unexploited agricultural potential. Shared risk is a concrete expression of the state-peasant alliance and a very powerful mechanism for stimulating redistributive modernization; it is as essential as sharing the risks of devaluation, investment, and technological innovation in other sectors of the economy.

A sixth high-priority factor in this production strategy is to create a nationally produced supply of strategic inputs for basic agriculture — especially fertilizer, since Mexico has plentiful endowments of the raw materials (nitrogen, phosphorous, and sulphur) for its manufacture. These resources are

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[7] For a detailed description of the concept of shared risk, see *SAM: planteamientos básicos y primeras medidas operativas* (México, D.F.: Oficina de Asesores del C. Presidente, 1980).

underexploited, and what exploitation has occurred has taken place generally in rich rather than poor areas, though this pattern has begun to change over the past three years.

Within the next five years, Mexico must cease importing fertilizer and begin exporting it, while simultaneously increasing internal application of this product. Calculations based on the CHAC-SAM model[8] project an 8.7% annual increase in fertilizer utilization from 1983 to 1988 (see table 3). The national production goal for nitrogen is attainable with output from plants now in operation and under construction, with any surplus to be applied to pasturelands. However, reaching export production levels would require an ambitious plant-construction program. Current phosphorous and sulfur production levels are inadequate for the goals specified, especially when the needs of the livestock sector are taken into account. Achieving these levels of fertilizer production and utilization would also require an improved distribution system,[9] which should accompany the expansion program of FERTIMEX, Mexico's parastatal fertilizer producer. These efforts must include the active participation of the various state governments, as well as that of producers' organizations.

In the area of agricultural machinery — mainly tractors and related farm implements — Mexico's installed capacity is sufficient to satisfy current demand. New efforts should focus on the production of small machinery, such as implements to be used with draft animals, and on expanding the network of service centers for organized peasant groups. Special attention should be given to those equipment, parts, and repair centers which peasant groups own or manage.

As the experience of recent years has demonstrated, Mexico's supply of improved seeds can expand at the same rate as demand. By strengthening the integration between the INIA (National Institute for Agricultural Research), PRONASE (National Seed Producer), and SARH, Mexico can gradually dispense with transnational corporations as suppliers of improved seeds. Impetus is needed as well in programs to develop native hybrid seeds and promote their export.

Similarly, Mexico has the wherewithal to become self-sufficient and technologically autonomous in the production of pesticides. Research efforts in this area should center on chemical agents with very specific actions, as well as on biological control systems for pest control in the cultivation of basic crops.

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[8] See "Modelo de programación agrícola."

[9] Mexico could undertake an ambitious program to fertilize rain-fed land with liquid ammonia, drawing on PEMEX's experience and vast network of pipelines located precisely in these areas of Mexico's agricultural frontier.

TABLE 3
CURRENT AND PROJECTED LEVELS
OF SUPPLY AND DEMAND FOR
FERTILIZERS IN MEXICO

Product	(Thousands of tons of nutrients) 1980 Total Demand	1980 National Production	1988 Demand (Goal)	1988 Production (Goal)
Nitrogen (N)	940.7	548.5	2,100	2,118
Phosphorus (P_2O_5)	300.6	200.9	625	560
Potassium (K_2O)	71.1	--	141	--

FERTIMEX could undertake cost-effective production of basic pesticides, insecticides, and fungicides.

A summary of Mexico's increasing needs for strategic inputs in agriculture between 1983 and 1988 appears in table 4. Although the table projects high growth rates in several factors of production, a well-managed plan of technological development would enable Mexico to sustain a rapid advance toward modernity and autonomy of production, and even enable the country to export these essential inputs.

A basic requirement and the seventh key strategy for reaching food self-sufficiency in Mexico will be to rationalize the distribution of natural resources among crop cultivation and livestock production. Livestock-raising must not receive preferential treatment or expand at the expense of basic grain production. On the contrary, given that one hectare of land dedicated to cultivation yields eight times as much food as the same hectare devoted to cattle, agricultural acreage must increase, even if it means decreasing the amount of land dedicated to livestock-raising. Extensive cattle-raising has introduced conflicts over land tenure and led to overexploitation and an ecologically degrading use of summer pastures, especially in areas of ejidal and communal farmland, which throughout the country totals nearly 40 million hectares. These conflicts can be resolved, however, by grazing cattle, sheep, and goats on uncultivable lands and by supplementing their diets with agricultural by-products. Mexico has large extensions of land well suited to this type of livestock-raising, in which animals would not

TABLE 4
PRINCIPAL AGRICULTURAL INPUTS

Productive input	Projected average annual growth rate (%) 1983-1988
Fertilizer	8.7
Hybrid seeds	7.9
Credit	5.4
Water	
-from runoff	4.1
-pumped	3.5
Machinery	4.3
Pesticides	3.2
Draft animals	2.9

Source: "Modelo de programación agrícola, 1980-1988, SAM-CHAC."

compete directly with cultivation; they occur primarily in the arid regions of northern Mexico and some humid tropical areas unsuitable for grain production. This approach is also valid for increasing milk production in pasture-fed dairy cattle.

SARH data indicate that 127 million hectares are available for pasture and that 500,000 hectares of marginal land could be planted with yucca for pasturage; in addition, annual production of agricultural by-products totals 27 million tons. These figures clearly indicate that Mexico could sustain large-scale cattle-raising without threatening basic grain production. Also, abundant and underutilized resources such as hydrocarbons and solar energy could assist in creating extensive and fertile artificial prairies from arid and semiarid land.

Within the overall scope of livestock production, the breeding of sheep and goats should receive special attention. The importance of these animals lies in the fact that they can be raised in the poorest areas of the rural economy, areas with high levels of population density and malnutrition. The successful expansion of goat- and sheep-raising in rural areas will require a major research effort and technical assistance in several specific regions. This technical effort, which must emphasize fodder production and the use of agricultural by-products, is essential in mountainous regions in south, central, and northern Mexico, as well as in Baja California. Programs for technical

assistance from New Zealand and Australia could improve the genetics, health, and management of the flocks.

Over the short term, beef, pork, and poultry will remain important protein sources, and their production should be encouraged in small production units such as ejidos. Unfortunately, these animals compete directly with man in grain consumption and will require 15.5 million tons of grain by 1988: that is, a six-percent increase each year. However, their feed requirements could be met by increasing the production of alternative feeds not consumed by humans. Such alternatives include yucca flour, milled by-products, molasses, and substitutes for oilseeds and fish flour, such as feed made from vegetable and blood flours, slaughterhouse discards, urea, unicellular proteins, methanol, etc. Production of these products in Mexico is essential; along with selective breeding, these inputs are strategic elements in developing a strategy of pork and poultry production compatible with basic grain production and food self-sufficiency.

At present, poultry and hog breeding depend on transnational companies for genetic material — a dependency which Mexico can and should break by developing its own national supply. NUTRIMEX, a recently created state company, could develop national stocks of each species, including breeding animals. Through cooperation with INIP (the National Institute for Cattle Research), NUTRIMEX could become the primary supplier of genetic material and the official regulator of the importation and distribution of breeding stock in Mexico.

Financial and fiscal incentives are also essential for stimulating the growth of intensive livestock-raising. Growth in this productive sector depends on stable ownership of land devoted to livestock, which Mexico could promote through modifications in the Agrarian Reform Law. A rational system would permit the establishment of specified livestock areas by region, based on the amount of pasture available.

Another food sector which has long offered great promise — and the final key link in the chain of food self-sufficiency in Mexico — is the fishing industry. Although still far from realizing its enormous potential, fishing has grown rapidly during recent years, especially in the area of exports of products such as shrimp. Mexico must sustain such exports, but it must also expand and diversify the industry by stimulating development in three other areas. The first is the cultivation of fishing grounds plentiful in sardines, anchovies, squid, dogfish, shark, and other highly marketable species. These products must be distributed widely; when dried and salted, smoked, or canned, they can reach populations in rural and marginal areas not yet served by the country's refrigerated delivery system. Just as in the case of agricultural products, these excellent protein sources, especially

sardines and anchovies, must be directed to human consumption and not to processed cattle feed. In this regard, the government agency PROPEMEX (Mexican Fish Products) performs a crucial role in supporting the fishing of species preferred by the middle and lower classes.

The second major effort necessary for developing this sector involves improving Mexico's port infrastructure and fishing fleet. The same infrastructure now utilized for catching fish for export could be reoutfitted to serve a dual purpose, combining export fishing with supplying the internal market. Freshwater fishing can complement sea fishing through improved distribution to make the catch available beyond the immediate lake and river areas. The construction of small fishing boats and river ports could stimulate this sector even more. Although Mexico will be unable to expand its fishing fleet over the next few years, existing vessels can be upgraded immediately to serve multiple functions.

The final area of fishing-industry support compelled by the requirements of food self-sufficiency is the promotion of aquaculture, an invaluable system of producing proteins in poor areas far removed from the sea. Aquaculture, in addition to its implementation as part of an integrated, Oriental-style farm, can also be adapted to reservoirs in irrigation districts or other bodies of water and can even be employed in brackish waters. Fish from these waters can provide food for local populations, and certain species may also serve as valuable marketable commodities.

III

COLLECTION, STORAGE, MARKETING, AND PROCESSING: LINKS IN THE FOOD-SUPPLY CHAIN

Enabling peasants to retain a greater share of the aggregate value of their product is a crucial element of a systematic food-production strategy. One way to realize that goal is to create companies owned by ejidos, cooperatives, and communal farms. These would draw peasant producers into the input-output flow so that they could control the crucial points where inputs and products are transferred. Producers could thereby lower their costs for inputs and machinery as well as keep a larger share of their products' selling price. More importantly, such a move would increase efficiency and productivity by bringing into operation buyers and sellers who until now have remained fragmented and deprived of any real bargaining power.

Promoting increases in the nation's food supply along the entire length of the production-consumption chain will raise income and employment levels among peasants and small-scale farmers. One key to achieving these increases will be to create a broad network for collecting and storing foodstuffs, in regions with potential for future production as well as existing production areas, and then to distribute them widely. The central goal of this effort should be the handling and storage of inputs and foodstuffs in a manner which reduces the heavy losses and high costs currently prevailing in the management of grains, oilseeds, and perishable foods. A network of small storage centers and a packaging and transport system adapted to the conditions and resources of each area could be constructed solely with national technology.

In the framework of such a strategy, CONASUPO would control enough of the food supply to be able to regulate the market. During the collection of foodstuffs in the rural sector, CONASUPO should regulate, through guaranteed prices and their reflection in rural-sector prices generally, the establishment of contingency reserves to be held in situ. These locally held reserves, complementing the national reserves collected by ANDSA (National Storehouses) and BORUCONSA (CONASUPO's Rural Storehouses) would remain in local-level storage facili-

ties[10] under peasant ownership. These stores constitute a powerful key for rural development and peasant organization. Their strategic value lies in the fact that a small reserve at the ejido or community level would offset the impact of speculation or hoarding. These local reserves held by rural communities can serve as collateral when rural producers seek credit from ANDSA and the nationalized banks for agricultural costs and for consumption needs.

Calculations based on Mexico's reserve needs and the state's strategic reserves indicate that Mexico will require an increased storehouse capacity of 3.2 million tons, with a minimum turnover of 2.53 million tons, by 1988. The cost for such an increase was calculated in 1980 pesos at nearly $8 billion. However, the same data set indicated that local-level storage facilities constructed during this 6-year period could store half a million tons of grain.[11]

The participation of the private sector in this strategy will focus on the construction of a series of strategically located refrigerated storage units to be built between 1983 and 1988, each of which will hold up to 100,000 tons. The development of refrigerated food storage facilities in Mexico is central to the production, consumption, and export of fruits, vegetables, fish, and shellfish. The projected network of local-level granaries, central storehouses, and refrigerated storage facilities is attainable with minimum imports. Although currently lagging behind schedule, the construction of such an infrastructure would play a crucial role in stimulating numerous national industries. The entire strategy for food collection and storage rests on the participation of the private sector, which must provide for the collection and storage of up to 2,200,000 tons of food by 1988.

The marketing phase of this strategy would emphasize the improvement of knowledge about the market by increasing the availability of price information. Such information would encourage the development of a functional pricing structure in which prices reflect costs, a development which would also benefit from the organization of regional supply centers and the improvement of the country's transportation system. A key element of the marketing dimension will be to reduce CONASUPO's subsidies to purchases of primary materials by agroindustries, a sector requiring extensive discussion, to which we will now turn.

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[10] See *Programa unificado de almacenamiento* (México, D.F.: SAM, 1981). The local-level storage facilities designed jointly by the SAM and Mexico's National University are simple, inexpensive, and multifunctional structures constructed by the peasants using locally available materials. Several prototypes built in Chihuahua have proved successful.

[11] See note 3.

Agroindustry and Food Self-Sufficiency

The food industry is one of the leading industries in Mexico. Nearly one-half of Mexico's food products undergo some type of processing, and food industries account for 22% of the country's manufactured goods and employ a large labor force. Furthermore, this industry is at the core of the food-supply chain, with both backward and forward linkages.[12]

Food-related agroindustry suffers from a marked internal polarization: a small number of very large companies, 1% of the total number, produce two-thirds of the industry's output and employ 50% of its labor force, while 70% of the companies are cottage industries and account for only 20% of production.[13] Several studies have pointed out the low level of productive integration between this industry and agriculture, with each failing to support the other.[14] Rather, the food processors have turned to imports for both capital and industrial inputs.

Despite these past problems, this industry can grow rapidly, substitute national inputs for imports, and become a key element in Mexico's economic recovery. If they could achieve average annual growth rates just above 4% from 1983 to 1988, food-related agroindustries could satisfy projected demand while increasing their level of integration with the agricultural and livestock sectors. Such growth levels might even enable them to export significant quantities of processed foods and beverages.

The dynamic growth of the food-processing industry will respond to and rely on three primary factors: the enormous public-sector demand for these products, which totalled 51 billion pesos in 1982; financial incentives, including preferential interest rates and shared capital risks offered by the nationalized banks; and fiscal and other government policies supporting activities in the industry. The private sector and organized peasant producers, who must be brought into the processing phase, will also play significant roles in the development of integrated agroindustries for agricultural, livestock, fish, and forestry products. Such integration would result in redistributive modernization, with producers retaining a fair share of profit.

These agroindustries could adopt any of several legal forms: companies of primary producers from cooperatives, collective ejidos, or groups of ejidos; companies co-owned by federal or local governments and peasants as entities

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[12] *Escenarios económicos de México. Perspectivas de desarrollo para ramas seleccionadas 1981-1985* (México, D.F.: SPP, 1981).

[13] *X Censo Industrial* (México, D.F.: SPP, 1982); and "Encuesta de la industria alimentaria," mimeographed (México, D.F.: SINE-SAM, 1982).

[14] See, for example, Manuel Gollás, *La economía desigual* (México, D.F.: CONACYT, 1983).

constituted to guarantee financing or access to specific technologies, etc.; agroindustrial companies partially owned by small rural landowners and Mexican entrepreneurs, under cooperative forms of association; companies jointly owned by ejido producers, communal farmers, and small private landowners cooperating in the industrial transformation process; and, lastly, state companies which could develop in fields which, because of high capital requirements or their strategic nature, call for greater governmental involvement. These company types could replace oligopolies and transnationals in Mexico's food-processing sector.

Priority areas of production include highly nutritious basic foods consumed by the middle and lower classes which have received special designation in the SAM's "basic food basket";[15] strategic products such as balanced foods and alternative animal feed, seeds, fertilizers, etc.; capital goods such as machinery and equipment; and, finally, products with high import-substitution or export potential. Concomitant with these efforts, Mexico should attempt to make full use of its installed industrial capacity, which even in 1981 — before the crisis — measured only 60%. This underutilization reflects severe barriers to obtaining a timely and adequate supply of raw materials; these obstacles will disappear with the attainment of a fully integrated food-processing system.

Mexico should examine closely the activities and contributions of the transnational companies involved in this industrial sector, especially in terms of technology. A close examination will reveal that, for the most part, their contributions to the food-processing industry have been minimal. The participation of transnationals should be excluded from strategic areas such as basic genetics, biotechnology (especially bioengineering), canning, and packaging. In priority areas such as machinery, balanced and alternative feeds, etc., transnational investment should be limited to minority ownership, with national capital, public and private, controlling majority ownership. Transnationals should never retain majority control, much less exercise a monopoly in the market, as is now the case with dairy products (97% of the market), instant coffee (93%), and corn-based products (74%), among others.

A final concern regarding the food-processing industry is choosing appropriate new technologies. Innovations have been introduced sparingly, with only one-fourth of large and mid-sized

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15 The basic food basket includes nearly 40 products and their derivatives, the most important being corn, tortillas, tortilla dough, wheat flour, crackers, white bread, pastries, pastas, rice, sugar, beans, oranges, limes, bananas, apples, tomatoes, vegetable oil, beef, pork, chicken, eggs, milk, cream, cheese, fish, chili peppers, and onions.

companies and one-fifth of small companies in this sector incorporating technological changes into their procedures over the last five years.[16] Explanations for this low degree of technological change include an inadequate supply of national capital, the lack of government support for research and development beneficial to this industry, and general financial difficulties. Moreover, Mexico's scientific and technological development policy has tended to be relatively out of touch with on-the-ground production efforts.

The food-producing sector needs a dynamic new technology policy which can combine the expertise of Mexico's educational and research institutions with the relatively open and unsophisticated food-processing sector to help this industry realize its full potential. The optimal policy would in this case constitute "food technology" with a broad perspective, a view which could identify the advances and shortcomings of research and development efforts when applied to various segments of the food-production chain. This policy could support specific inter-institutional programs to fill technology gaps for individual products, especially those forming the SAM's basic food basket and the other strategic products mentioned above.

The buying power of state companies and the financial weight of the nationalized banks can induce technological development and advance technological autonomy by identifying needed kinds of machinery and equipment and by giving preference to selected projects. The National Commission for Foreign Investment and the National Registry of Technology Transfers would necessarily assist in formulating technology policy for the food-processing sector by promoting those technologies which provide real benefit to the country and excluding those which all too often imply only foreign exchange losses, unnecessary displacement of local producers, and production and consumption patterns which do not relate either to the resources or the basic needs of most Mexicans. No better method exists for regulating and adapting foreign technology than to stimulate and develop endogenous scientific research and technology design while training and organizing businessmen and workers in the food-processing sector.

Distribution and Consumption of Basic Foods

The primary lesson learned from recent efforts to implement a basic food strategy is that such efforts must address both supply and demand equally if Mexico's food problems are to be resolved. Demand and consumption are valid reflections of an inequitable distribution of income and the other distortions that

[16] See "Encuesta de la industria alimentaria."

occur in young societies undergoing demographic growth and rapid modernization. Even when viewed from the perspective of consumption, Mexico's food problems go beyond the varying degrees of malnutrition suffered by over 35 million Mexicans; they encompass as well poor diet selection and even excessive consumption of certain food products acclaimed in pseudo-modern and misleading advertising campaigns. When not harmful, these products are at best very expensive per nutritional unit. Thus, a strategy for directing and responding to food demand and consumption parallels in importance the need for increased food production.

Improving the basic diet of Mexico's malnourished "target" population[17] can be accomplished through a combination of five procedures: improving and expanding the food distribution network; extending subsidies to the most needy groups in the target population; enriching or fortifying basic food products; providing nutritional information; and regulating advertising for foods, beverages, and other foodstuffs which compete with an adequate basic diet. The forthcoming discussion will explore strategies for effecting each of these steps in the context of the current financial crisis.

Improving the food-distribution network must begin with increasing CONASUPO's role in the agricultural and agroindustrial sectors in order to channel products to poor consumers. Increased demand provides a strong stimulus to the development of small and mid-sized agroindustries; production from these industries can be utilized through supply agreements not only with CONASUPO, but with private distribution networks as well. An affiliate of CONASUPO, IMPECSA (the Promoter of Small Businesses) can work with small businesses to broaden private networks and thus improve the distribution of products in the basic food basket. By bringing such businesses into the system and providing them with financial aid and administrative assistance, IMPECSA can make private-sector distribution more efficient and reduce prices through bulk purchasing and other similar measures.

CONASUPO's distribution affiliate, DICONSA, can also help create an efficient food-distribution network. With its 15,000 stores, DICONSA can regulate and distribute foodstuffs, gather and concentrate supplies, and offer the consumer educational programs on nutrition. The agency's outlets, including stores operated jointly with COPLAMAR in rural areas, must continue their gradual increase in numbers and should strengthen their

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[17] Estimates by SAM and COPLAMAR place the size of the target population at approximately 50 million people, of whom 35 million suffer various types of malnutrition. Twenty million of these individuals require immediate attention.

ties with storehouses and processing firms in the rural communities themselves. Rural programs which DICONSA currently operates could satisfy nearly 60% of existing basic food needs in two-thirds of critically impoverished rural areas.

In urban areas, distribution strategies should aim at decentralizing food-supply centers. By working with the private sector to create strategically located "semi-wholesale" distributors, Mexico's distribution agencies can weaken the monopolies held by a limited number of distributors, especially in larger cities.

This is the only route open for modernizing the commercial food distribution network in favor of the poorest and largest sectors of the population. Food costs can absorb as much as 60% of personal income among these individuals,[18] who usually obtain their food through three channels: small shops, public markets, and DICONSA (including COPLAMAR). The state must develop distribution networks to serve these channels, an effort which will necessarily involve the private sector in the selective distribution of basic foodstuffs, especially since income levels correlate strongly with specific distribution channels for basic food products. Calculations indicate that in order to assure an adequate supply of basic foodstuffs to the low-income population,[19] the distribution network would have to handle 25 million tons of food by 1988. DICONSA and IMPECSA would have to distribute approximately 70% of the total — primarily corn, sugar, beans, and wheat.

A strategy to orient food consumption should emphasize the redistribution of income and selective application of subsidies. Such policies not only support the overall strategy proposed but also are consistent with today's economic restrictions. The production goals outlined above correspond to Mexico's productive potential; they also respond to the nutritional needs of the population, including the 35 million in dire need of an improved diet.

The distribution of family income, as presented in Mexico's 1977 Income-Expenditure Survey, reveals a regressive tendency in absolute terms for the lowest three income levels,[20] a pattern

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[18] See *Encuesta Nacional Ingresos-Gastos, 1977* (México, D.F.: SPP, 1979).

[19] See "Correlación estratégica entre canales de distribución y población demandante por nivel de ingreso y status ocupacional," mimeographed (México, D.F.: SAM, 1981).

[20] Presenting data by strata increases the comparability of results from the many surveys of family income and expenditures. The pattern followed by the SAM is an adaptation of that used in the Encuesta Nacional de Ingresos-Gastos de Hogares in 1977, which identified 13 income strata. After interpolating from the 1963-1977 data, SAM calculated the projections for 1982-1988.

which, to a lesser degree, also affects levels four through seven. This signals a "nutritional gap," which has prevented — especially in this time of crisis — any resolution of dietary deficiencies among these seven population strata. Based on 1981 prices, the income subsidy required for individuals in the three lowest income levels to receive the minimum caloric and protein requirements from the basic food basket amounts to 12 pesos per person per day, or 47 million pesos per year. This expenditure could nearly close the nutritional gap.

Thus Mexico's food strategy should operate on two fronts simultaneously. On the one hand, it should stimulate production and, along with it, the income received by peasants plagued with malnutrition; on the other, it must increase the supply of foodstuffs and selective subsidies available to the three poorest social strata in the country. Such a goal — ambitious but attainable even under current circumstances — would diminish the per-capita food-budget shortfall from 37% in 1981 to 6% in 1988.

As emphasized above, Mexico's strategy for production, income distribution, and consumption cannot involve indiscriminate offers of subsidies, as has occurred in the past. Subsidies to consumption in particular could be awarded more selectively and through a more rational set of procedures including conditions for receiving them, limits on their duration, and evaluation over time. Such moves would benefit the target population, while also reducing significantly the fiscal burden by making subsidies more accurately reflect costs. Such modifications in subsidy policies must occur if countries at Mexico's level of development are to solve their shared dilemma of escalating food prices.

Modifying the way in which subsidies are applied to tortillas, bread, and sugar — transferring them from intermediate stages to the final product[21] — would permit greater selectivity in terms of distribution channels and the types of products and consumers benefiting. By introducing this policy, moreover, Mexico could cut these subsidies by 70%. Measured in 1981 prices, subsidies to these three products in 1982 alone cost 62,450 million pesos: $35,750 million to tortillas, $7,200 million to bread, and $19,500 million to sugar. If the status quo prevails, the fiscal burden for these three products would become unmanageable, nearly 450,000 million pesos by 1988 (at 1981 prices). By reforming subsidies, however, Mexico could not only subsidize the poorest consumers' purchases of tortillas, bread, and sugar, but also add a few very important products to the list

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[21] These methods for subsidizing the consumer do not exclude a program similar to the U.S. food stamp program, imperfect but an improvement on the current costly, inequitable, and indiscriminate system of subsidies.

for subsidy and distribution in rural areas and marginal urban areas. Included in that list would be powdered milk, soup pastas, rice, beans, and vegetable oil. Unfortunately, the perishability of meat, fish, and eggs make them inappropriate for direct subsidies. A better method for ensuring their supply in rural and marginal urban areas is to promote small-scale integrated farms, as discussed above.

Mexico could easily distribute these food products with its current administrative capacity, infrastructure, and institutions, such as CONASUPO, the Social Security Administration (IMSS), the Ministry of Health (SSA), the Social Security Administration for Government Employees (ISSSTE), the National Institute for Indigenous Populations (INI), and others. Moreover, schools, churches, and private institutions could aid the distributive effort. Salaried urban workers could be reached through factory lunchrooms and a system of coupons for basic food items, with individual companies receiving incentives for implementing such programs.

Another element of an overall nutrition strategy, the enrichment or fortification of basic foods, was attempted in recent years, while the SAM was in operation. This effort, still in a somewhat experimental stage, should be expanded. The enriching materials can be provided by the state company NUTRIMEX or, alternatively, by private companies motivated by fiscal or credit incentives. Soy protein, amino acids, minerals, and vitamins can be added to basic foods, such as tortillas,[22] sugar, teething crackers, and perhaps milk, bread, etc. The advantage of using a basic food product as the vehicle for increasing the general nutritional level or correcting regional dietary deficiencies[23] in our target population cannot be overstated. Nevertheless, these programs can succeed only if they receive systematic evaluation from the National Nutrition Institute.[24]

Unfortunately, in a modernizing, highly mobile market economy such as Mexico's, even the policies presented here will not provide adequate support to the food system. Although poverty is the primary cause of malnutrition, the situation has been aggravated by the influx of commercial advertising seeking to reach high-income consumers. Unfortunately, this advertising reaches the entire population and has distorted some consumption patterns; poor families often spend their food budget on

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[22] The amino acid content of tortillas can be increased by adding potato flour (up to 20%) and soybean flour (up to 10%).

[23] Principal vitamin and mineral deficiencies in Mexico are inadequate intakes of iron and vitamins A (in Yucatán) and C.

[24] Another significant nutritional program with tremendous potential for Mexico is increasing the distribution and availability of potable water in rural areas, where 11 million people still lack this basic service.

widely publicized and costly "junk food" of little nutritional value. In today's Mexico people of all income levels are being attracted by convenience foods, which are making increasing inroads throughout the country.

State-supported nutritional education through both the media and educational institutions is basic to the strategy of optimizing food consumption. Numerous recent surveys and research efforts[25] examining the cultural patterns of food consumption have identified several causes of malnutrition apart from insufficient family income. These non-economic causes can be rectified through better nutritional education, improved diet for pregnant and nursing women and sick children, and hygienic food preparation and preservation. The state must intensify its efforts in the area of nutritional information and education, cooperating with the various agencies involved in this field. The SAM provided the conceptual coherence for a plan to improve the public's orientation toward nutrition; what is needed now is to provide the nuts and bolts of an educational program by training a substantial number of medical and paramedical professionals to implement it.

These educational campaigns can deliver a simple message: adopt a balanced and varied diet based on the traditional Mexican diet and elements from all basic food groups. Such programs should be accompanied by campaigns to list nutritional information on packages of popular foods and non-alcoholic beverages. No attempts have been made as yet in Mexico to provide the public with nutritional information via package labelling.

According to a UNICEF-SAM study, nearly 20% of Mexico's children are undernourished at birth due to malnutrition in pregnant mothers. Further, in nearly one-third of marginal urban families, breast-feeding has given way to the use of infant formula, gravely affecting infants' health as well as family finances. Breast-feeding, the best and most economical method of infant feeding, must receive support.

In this time of crisis, consumer organizations, both urban and rural, can protect consumer interests by purchasing food in bulk and thus reducing food costs for all members. The cooperative system and the experiences of CONASUPO and COPLAMAR could serve as examples for organizations of this type.

To return briefly to the effects of publicity, the advertising of highly processed foods and non-alcoholic beverages frequently exercises a harmful effect on the Mexican diet. The state should discourage such advertising through legal

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[25] See "Cultura alimentaria y publicidad televisada," mimeographed (México, D.F.: SAM-UNICEF, 1982).

restrictions and the regulation of advertising activities. Mexico has not yet developed a legal definition of advertising, and the absence of guidelines for advertising and the often conflicting or redundant inputs from various government agencies with authority in this area muddy the waters still more. In summary, the first issue to resolve is the conflict among government agencies that deal with product publicity; the second is the legal regulation of advertising itself.

Lastly, an efficient consumption strategy must include the ability to monitor levels of consumption, nutrition, and food supply at all times. The SISVAN (Food and Nutrition Monitoring System) permits continuous monitoring of principal food variables at the national level. In combination with the newly created National Planning System (Sistema Nacional de Planeación), SISVAN would enable the government to evaluate its policies and provide it with information essential to decision-making.

IV

TOWARD A NORMATIVE VIEW OF THE INTERACTION BETWEEN THE U.S. AND MEXICAN FOOD SYSTEMS

The preceding description of a working strategy for food self-sufficiency in Mexico through 1988 makes clear not only that agriculture is a dynamic sector in terms of production and employment, but also that it can grow without foreign currency inputs. As stated at the beginning of this essay, Mexico's agricultural sector need not enter into broad exchange with the U.S., and to the degree that it is open, its balance of payments should be positive. This sector will undoubtedly continue to interact with the U.S. food system, but this interaction should become increasingly selective. Mexico can change its status from food importer to exporter, buying only those technologies which are essential to its development. Before discussing Mexico's export potential, let us look at the basic characteristics and trends in the North American food system which support these recommendations for Mexican agriculture.

A Brief Outline of U.S. Agriculture

Despite its size, richness, and complexity, U.S. agriculture is basically rain-fed and grain-oriented. Aside from these two characteristics, however, North American agriculture has little in common with that of Mexico. The employment, capital, technology, and energy-consumption characteristics of the two nations' agricultural sectors are radically different. While Mexico struggles to attain food self-sufficiency, the U.S. is the hegemonic actor in an increasingly active and important world grain market.

Recent decades have witnessed the emergence of a new international division of labor in agriculture, a process which has transformed Third World countries from net exporters of food and raw materials into net importers. Other countries, especially semi-industrialized countries, have received growing investments from transnational food-producing companies. Their activities have affected cropping patterns (often increasing agricultural dualism), technology, and, most importantly, consumption habits and diet among certain sectors of the population. Within this international dynamic, U.S. grain power reigns supreme.

Why and how numerous countries are becoming importers of agricultural goods is too complex a question to be answered

with generalizations, but it certainly involves their responses to a combination of four relevant factors. The first is the rapidly accelerating demographic explosion occurring in the Third World, which has increased food demand precipitously. A second and even more significant factor is the rapid urbanization of developing countries, which, combined with increasing incomes for the middle class, raises food demands dramatically in urban areas. Third is the model of industrialization via import substitution (ISI) followed by many developing countries. The ISI model has resulted in prices unfavorable to peasant agriculture and a consequent move toward cash crops for foreign trade, undermining traditional agriculture, which produced basic food crops for mass consumption. The last of the four interacting elements is the impact of transnational companies in Southern-Hemisphere countries; these companies promote crops (and consumption patterns) oriented toward high-income groups, increasing the importation of inputs, equipment, technology, and even some processed foods.

These factors have been reinforced since the mid-1970s by an undervalued dollar (and by U.S. legislation and incentives), which strengthened the U.S. export market.[26] These developments have had especially severe impacts on Mexico, which has a special vulnerability to U.S. currency and market fluctuations because of its very close relationship with its northern neighbor. Mexico is the third most important trading partner of the U.S. overall, and second in terms of agricultural products.

A few figures indicating the proportion of world production filled by the U.S. in 1980 will illustrate the preponderant position of U.S. agriculture in the world market. In that year, U.S. production accounted for 30 percent of total corn production; 55% of all wheat and other basic grains; 80% of all soybeans; and 20% of world rice production. This domination is even more marked and strategically important in terms of U.S. control of world reserves, which amounts to 60% of feed grains (including corn), 30% of wheat, and 85% of soybeans.

In fact, one of every three acres planted in the U.S. produces agricultural export goods, valued in 1980 at 40 billion dollars, with a profit of $20 billion. Agricultural exports alone offset 60% of the cost of U.S. petroleum imports. Agricultural profits stem not only from exports, of course, but also from decreasing imports, such as coffee and sugar. These data and the growing presence of transnational food companies constitute the reality of U.S. "food power."

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[26] When the dollar increases in value, as it has recently, this tendency is reversed; if this overvaluation continues, it will facilitate Third World efforts to achieve self-sufficiency.

The U.S. economy is so large, however, that its vigorous export sector holds a minor position relative to the economy as a whole. The relative weight of agriculture within the U.S. economy, moreover, is slight and decreasing: it accounted for 10% of gross national product in 1929, 5% in 1950, and only 2.8% in 1980. The decline in the percentage of the economically active population employed in agriculture is even more revealing: 21% in 1929, 11.5% in 1950, and 3% in 1980. Even today, the corresponding figure for Mexico is not comparable with that of the U.S. in 1929. While the weight of agriculture in the domestic U.S. economy is less overwhelming than in its export economy, the agricultural sector is very important internally as a consumer of U.S. inputs, such as capital, energy, transportation services, etc.

Agriculture has had a strongly positive impact on productivity in the U.S. economy. This impact has resulted both from the systematic freeing of agricultural labor for the industrial and service sectors, and to the sector's growth rate, which hovers around 5.5% annually, 5 times greater than growth in the remainder of the economy. Moreover, each million dollars in demand for agricultural products generates 30 agricultural jobs, 32 jobs indirectly related to agriculture, and others further downstream. In the balance of payments and certain other areas, agriculture plays a central role in the U.S. economy.

The recent history of U.S. agriculture helps explain its role and impacts in the U.S. economy. Spurred by numerous technological advances, U.S. agriculture has enjoyed tremendous production levels, particularly in the period following World War II. This success, however, was achieved at the expense of the celebrated "family farm," as agricultural production became infused with high concentrations of capital and land. Thus, the number of farms fell rapidly, from 5.4 million in 1950 to 2.7 million in 1970, and to only 2.3 million in 1980. This reduction in absolute numbers corresponds to a notable increase in average farm size, which now measures 450 acres. Correspondingly, the farm population decreased to only 3.9 million, and with this reduction the rural population declined by nearly 70 percent, from 23 to 7 million. While the rural population declined, mechanization spread dramatically: the number of tractors (4.4 million) now surpasses the number of farmers. Voracious agribusiness has supplanted the family farm, monopolizing land and concentrating resources; by the year 2000, 50,000 large agricultural units will produce 63% of agricultural output, doubling their share of 1974 production.

Concomitantly, the U.S. agricultural sector has witnessed a major expansion of livestock-raising, partially in response to external demand. The acreage dedicated to animal feed crops has doubled since 1950. At the same time, this branch of agricultural production has undergone intensive mechanization and

the introduction of highly productive improved seeds, which have led to regional specialization in certain crops or varieties within crops. The suppression of variety within agricultural regions implies a very limited genetic base, with increased susceptibility to disease and other ecological problems. Mexico should avoid this situation at all costs.

The rapid expansion of U.S. agriculture has caused many experts to question whether this sector can sustain the accelerated growth of past decades. Although their doubts stem from concerns about restrictions on land supply and productivity, this question might be better phrased in terms of costs,[27] since the country actually has an adequate supply of the necessary resources.[28] Five specific factors could influence agricultural expansion in the future, in terms of either risk or cost.

The first is the availability of suitable cropland. The U.S. has approximately 540 million acres of cultivable land — 7 times the area cultivated in Mexico, and 4 times Mexico's total "agricultural frontier," estimated at just under 30 million hectares. In 1980, U.S. agriculturalists were cultivating 391 million acres, or 72% of the total, with much of the remainder occupied by livestock or forest. Estimates of cultivation requirements in the year 2000 vary between 26 and 113 million additional acres. While land will not become a limiting factor before the end of this century, cultivation will compete with forestry and livestock for land during this period. Urbanization,[29] as well as industrial and transport needs, will increase land costs, which will also affect agricultural patterns. Interestingly, urbanization is most rapid in Florida and California, states which compete with Mexico in fruit and winter vegetable production.

Other factors affecting land availability in the U.S. include soil erosion, compaction (due partly to intense mechanization), and salinity. The problem of erosion has stimulated a polemic which asserts that massive grain exports to the U.S.S.R. and elsewhere represent a dangerous and nearly irremediable export of the land's fertility. Additionally, extensive use of fertilizers and pesticides leads to contamination and other problems requiring

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[27] This observation assumes that demand, especially from abroad, would continue increasing. However, a more expensive dollar and economic problems in the Third World could significantly lower external demand.

[28] On this topic, see Sandra S. Batie and Robert G. Healy, eds., *The Future of American Agriculture as a Strategic Resource* (Washington, D.C.: The Conservation Foundation, 1980).

[29] "Urbanization" in this case includes the process of "ruralization" now occurring in the United States. This term refers to the development of relatively remote suburbs designed around large green areas, communities which consume tremendous amounts of land.

costly land conservation programs and labor-saving technologies. The rural sector is now feeling the effects of the application of agrochemicals and the intensive cultivation of the 1970s. Their impact will affect agricultural growth in the immediate future, decreasing its rate and increasing its cost.

Among the most important limiting factors is water. Irrigated cropland has tripled in area over the last 40 years, and irrigated crops account for one-fourth of the value of harvested crops and an even higher percentage in the critical regions of agricultural production of the western United States. The era in which water was widely considered a free and unlimited input has ended. Water supplies will henceforth have profound impacts, not only in terms of cost, but also in terms of cropping patterns and meat production. California and other western states will probably feel these impacts first. The depletion of the Ogalala aquifer[30] marks the beginning of an important change for livestock-raising states and the Central Plains; as rising water costs push up the prices of feed grains such as soybeans and corn, livestock will depend increasingly on grains supplied by the Corn Belt. Rising feed prices would also reinstate the comparative advantage in the U.S. market of cattle from northern Mexico. Mexico's lower production costs, especially in comparison with costs in Texas and New Mexico, are mainly responsible for this competitive advantage.

Observers agree that the U.S. food-production model rests on an excessive, wasteful use of energy. This pattern evolved when energy costs were low in relation to the prices of other inputs. From 1950 to 1978, energy costs increased at only half the rate of labor costs, stimulating the intensive utilization of energy resources such as electricity, agrochemicals, fuels, and fertilizers. This pattern of energy consumption is not amenable to change in the short term, but high costs have not yet begun to dampen energy's role in U.S. agricultural production. While energy use, chemical inputs, and mechanization investments in U.S. agricultural productivity are extremely high, possibilities for using such inputs have not yet been exhausted.

Given increasingly expensive water and land for agricultural use, production increases in U.S. agriculture in upcoming years may be less than spectacular. In anticipation of this eventuality, the U.S. is already preparing for a new stage of agricultural technology. Led by the fields of biology and agroecology and relying on innovations such as genetic engineering, nitrogen fixation, and other processes affecting growing methods and

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[30] The Ogalala aquifer is an enormous subterranean lake which sustains a major irrigation district — of both agriculture and cattle-raising — extending from the Dakotas in the North to New Mexico and Texas in the South.

plant varieties, these new technologies will allow the resumption of rapid increases in agricultural output. No one knows when these technological breakthroughs will occur or what effects they will have on the present agricultural model, dominated as it is by mechanization and agrochemicals. Predictions indicate a flattening of the production growth curve, at least during a short transition period. While the evidence does not suggest that the current U.S. agricultural model is depleted, land and resource concentration and an overdependency on energy resources bode ill for the future, in which the cost of basic inputs will increase and productivity will fall.

Concentration in the U.S. Food-processing System

A recent USDA study of industrial organization in the U.S. food and tobacco sector has revealed heavy concentration in major U.S. agroindustries, paralleling the concentration of the agricultural sector itself.[31] Annual production in this sector is valued at 180 billion dollars, which in 1975 amounted to 12% of the aggregate value of all manufacturing. This share of manufacturing production far outpaces that of Mexico's food-processing sector.

Furthermore, the U.S. agroindustrial sector is tending toward increasing concentration: in 1978 the 50 largest agroindustrial firms held 63.7% of shares in this area, compared to 12% in 1963. If industrial concentration continues to occur at 1.5% per year, it will reach 100% by the end of this century. The 200 largest food-processing companies currently realize two-thirds of this industry's sales and control 80% of its stock. Moreover, the absolute number of companies devoted to this undertaking decreases by 3 percent per annum.[32] Thus, while the number of companies in the manufacturing sector on the whole is on the rise, those in the food industry decreased from 41,147 in 1947 to 23,320 in 1972, leaving the remaining large companies with even greater manipulative power in the marketplace. Important to any oligopolistic sector are advertising and research and development; the food-processing industry is no exception to this rule. Food and beverage ads make up half of all television advertising, and four-fifths of all advertisements acclaim the products of the 200 largest food-processing companies.

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[31] John M. Connor, "The U.S. Food and Tobacco Manufacturing Industries: Market Structure Change and Economic Performance," Agricultural Economic Report Series, no. 451 (Washington, D.C.: USDA, 1980).

[32] A large part of this decrease is due to mergers and takeovers, especially during the second half of the 1970s.

Another important structural characteristic of the food industry is its tendency toward product differentiation and related plant diversification through forward linkages, exemplified in distribution through restaurant chains, etc. However, even though this industry processes 68% of the agricultural sector's total production, its backward linkages are very weak in terms of land ownership. The two sectors are virtually separate from one another and interact with each other only through commodities markets and labor contracts.

This oligopolistic structure has profoundly affected the sector's performance. Recently, profits have been rising more rapidly in this sector than in the rest of the manufacturing industry for the first time in nearly a decade. And the earning potential of the sector's larger companies, those with assets valued at over 100 million dollars, was higher than that of small firms. The average annual growth rate for agroindustries, 4.7% between 1950 and 1973, has been somewhat slower but more stable than that of the non-food-related industrial sector. Among the most dynamic subsectors are poultry, frozen foods, breakfast cereals, carbonated beverages, and fish. The USDA study mentioned above estimates that wholesale food prices are inflated approximately 10% because of the oligopolistic nature of the industry.

The degree of transnationalization in this sector is also very high, with 187 of the 200 major companies holding investments abroad, many of them in Mexico. In 1975, these companies derived 16% of their income from offshore operations. Although foreign investment in the U.S. food industry is high, especially British and other European investment, foreign participation in no way compares to U.S. investments abroad: these totalled approximately 5 billion dollars in 1976.

Thus, the U.S. food system exhibits high degrees of concentration in both the agricultural and agroindustrial sectors, with the food-processing sector also being highly oligopolistic. These characteristics carry obvious implications in terms of equity, pricing, and concentration of resources.

Evolution of Food Demand in the U.S.

Economic development throughout the world has brought with it a nearly universal "North Americanization" of diet. This generalization is perhaps less valid in Asia, but it certainly holds true in Mexico, at least for consumption patterns among high-income sectors of the population.[33] The spread of U.S. dietary

[33] My research has revealed no acceptable theory to explain this "North Americanization" of consumption patterns. The trend is clearly linked to income level, advertising, transnational activities, etc., but these factors do not completely explain the phenomenon. For present purposes, we can view this dietary trend as a more or less general and verifiable phenomenon, as yet unexplained.

patterns throughout developing countries makes it imperative for development planners to understand the basic U.S. diet and its evolution in the North American food system.[34] Moreover, interesting changes in dietary trends have occurred over the last ten years; if they continue, they not only will impose changes on food production and consumption habits in the United States, but also will impact agricultural and processed food trade with Mexico. An examination of these trends can also provide guidelines for anticipating probable dietary changes in Mexico.

Generally speaking, malnutrition is not a problem in the United States. Food supply in the U.S. is stable and abundant. Food is also becoming relatively less costly: food purchases consumed 24% of family income in the 1950s, but by 1981 the share of family income spent on food had decreased to 18%. Unlike Mexico's, U.S. food demand has increased gradually, averaging 0.9% per year, with the most dynamic increase occurring in food consumed outside the home: restaurants receive one-third of food expenditures in the U.S.

Rather than shortages, dietary problems in the U.S. tend to be related to excesses or substitutions. Only in extremely poor areas suffering economic depression and high unemployment does one find malnutrition due to lack of food. In general, nutritional density in the U.S., that is, the amount of nutrients per thousand calories, indicates that North Americans of all ages, races, and regions of the country receive adequate diets. It is worth noting that income level has no significant effect on dietary quality. In fact, the U.S. diet is monotonously similar across income levels or any other socioeconomic indicator.[35] In nutritional terms, dietary habits continue to improve: caloric intake in 1980 averaged 3,520 per individual per day[36] — only slightly above the 1910 figure of 3,480. This trend, however, represents a reversal of the pre-1970 pattern of slight but persistent tendencies toward lower caloric intake. This caloric intake is more than adequate; its marginal change after seven decades results from the transition toward a more sedentary society, in which services represent the preponderant economic activity. The recent increase in caloric intake stems from rising consumption of fats and sugars, although the consumption of

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[34] I would like to acknowledge the valuable assistance of Kathleen Maloney, of the Food Research Institute of Stanford University, in analyzing U.S. dietary patterns.

[35] See Carol T. Windhan et al., "Nutrient Density of Diets in the U.S.D.A. Nationwide Food Consumption Survey, 1977-78: Impact of Socioeconomic Status on Dietary Density," *Journal of the American Dietetic Association,* Jan. 1983.

[36] This figure excludes alcohol consumption, estimated at a daily average of approximately 200 calories.

carbohydrates as a group is down. This situation is summarized in table 5.

The proportion of carbohydrates in the U.S. diet has gradually decreased throughout this century, with recent increases in carbohydrate consumption due primarily to increased sugar consumption. Between 1909 and the 1970s, average carbohydrate consumption fell from 492 grams per day to 374; by 1981, however, the daily average had rebounded to 406. The critical element here is not the level of carbohydrate consumption but its composition: the proportion of simple carbohydrates (which represent a health threat) has shot up with the increased consumption of refined flours and sugars.

Since the 19th century, individual consumption of proteins has been more than adequate in the U.S. and has varied little since that time. Fluctuating over time between 88 and 104 grams daily, average protein consumption in 1980 was 103 grams. Its composition, however, has changed. At the beginning of this century, animal proteins, especially red meat, accounted for one-half of the protein consumed in the U.S.; by the beginning of the 1970s, this proportion had risen to two-thirds. However, during the last 10 years, demand for animal protein as a proportion of all protein consumed has declined, due primarily to a reduction in the consumption of red meat. Whether or not vegetable proteins are supplanting meat consumption is as yet unclear, but if this is occurring, it represents a vindication of a typical Third World diet, not unlike that of Mexico. Other nutrients, including vitamins, minerals, and amino acids, are (with a few exceptions) plentiful in the U.S. diet.[37]

Few changes have occurred in the U.S. diet during this century, but certain interesting consumption trends began to appear between 7 and 10 years ago, and they are reversing some very important traditional patterns. Up until the 1970s, the composition of the U.S. diet emphasized animal proteins, fats, and processed and refined foods, while its dependence on flours, cereal grains, corn, and starches progressively declined. Meat consumption, which had grown steadily and rapidly since the first part of the century, assumed a slower growth rate during the 1970s. Moreover, the meats favored are also changing, as red meat gives way to poultry (the most dynamic and sustained alternative, accounting for 40% of meat consumption) and pork. Fish, both fresh and frozen, has also become more popular with the U.S. consumer since the 1970s. Furthermore, vegetable oils are gradually displacing animal fat in the U.S. diet.

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[37] There are, however, some instances of vitamin B6, magnesium, and iron deficiencies.

TABLE 5
ENERGY SOURCES IN THE U.S. DIET
(percentages)

	1909-1913	1949	1980
Proteins	12	12	11
Fats	32	39	43
Carbohydrates	56	49	46

Source: Leticia Brewsten and Michael F. Jacobson, *The Changing American Diet* (Washington, D.C.: Center for Science in the Public Interest, 1982).

In contrast, the consumption of eggs, milk, and butter has fallen. Decreasing egg consumption is paradoxical on two counts: first, eggs constitute an optimal protein source;[38] secondly, the drastic reduction in egg consumption which began in the 1940s coincides with an increasing demand for chicken. Whole milk, with its high fat content, has also lost ground, and only two dairy products have enjoyed increased popularity: cheese and yogurt.

The consumption of fruits and vegetables, which had been stable and even declined slightly in recent decades, is now accelerating, largely through demand for fresh produce. At the end of the 19th century, consumers abruptly turned away from flours and cereals; this change, along with increasing demand for animal protein, constituted the central modification in the dietary habits of the 20th century. However, current trends indicate that as vegetable proteins gain favor, this dietary pattern is once again reversing.[39] The shift toward grains, the increasing popularity of fresh fruits and vegetables, and the decline in meat and animal protein consumption portend a move toward a new

[38] The most commonly cited explanations for the decreasing popularity of this excellent protein source are the tendency away from complete breakfasts as increasing numbers of women enter the labor force, leaving them with less time for preparing breakfasts, and the avoidance of foods with high cholesterol content. The first argument does not explain why egg consumption began tapering off in the 1940s; and the assertion that eggs are harmful because of high cholesterol levels has yet to be proved conclusively.

[39] While vegetables contain lower concentrations of amino acids than do meats, a varied vegetable diet can be completely adequate in terms of protein supply.

type of diet, a more natural and varied one. This type of diet, although now more popular in the U.S., is very similar to the traditional diet of countries such as Mexico. Paradoxically, these countries began abandoning their traditional diets with the dawning of the "age of meat," at the cost of equity, natural resources, and energy efficiency.

Sugar consumption has continued to rise, now with renewed intensity but with some changes in its composition. Corn syrup is rapidly replacing cane and beet sugar, especially in the very popular processed and frozen foods. Along with the extensive use of artificial sweeteners in soft drinks and other products, the shift to corn syrup foreshadows a decreasing demand for cane sugar, which will negatively affect Mexico's sugar exports to the U.S.

Similarly, Mexico's coffee exports will feel the impact of a decreasing market for coffee. U.S. consumers are becoming convinced of the negative effects of caffeine and are replacing coffee with soft drinks, influenced no doubt by the overwhelming advertising of the soft drink industry. In 1981, sales of soda pop totalled 20 billion dollars, or 412 soft drinks for each member of the U.S. population.

Lastly, a discussion of the U.S. diet should not fail to consider, albeit briefly, special government programs supporting good nutrition among children, the poor, etc. Among these are food stamps, school lunch programs, and the 1940-1975 campaigns to fortify foods with iron and vitamins. In general, these programs have reached their goals in terms of correcting nutritional problems. For all of its bureaucratic inefficiency, the U.S. food stamp program may provide a model for Mexico to emulate, since the current economic crisis has created an urgent need to support groups suffering from inadequate nutrition. Such a program could address malnutrition while simultaneously lessening the financial burden which subsidies impose on the Mexican government.

While this essay will not compare the U.S. and Mexican diets,[40] the persistence of widespread malnutrition in Mexico bears repeating. Not only is the Mexican diet less ample than that of the U.S., but it is also more affected by differences in income, age, and region. Worse still, certain sectors of Mexico's population have attempted to adopt a North American-style diet without having the resources necessary to adopt it fully. Unable to affort a diet rich in energy, animal protein, and processed foods, these individuals adopt only a part of the diet, and the

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[40] For information on this topic, see the nutritional surveys conducted by the SAM and Mexico's National Nutrition Institute in 1979 and 1980. These reports describe Mexico's nutritional situation in detail by region, age group, and income level.

foods they choose are generally determined by advertising or the distribution capability of the large food-processing companies. As a result, inexpensive foods rich in fiber and vegetable proteins are replaced by an incomplete and costly diet. Not surprisingly, the diet of many marginal urban dwellers actually decreases in quality with improvements in family income.

This North Americanization of the Mexican diet does not follow a uniform and generalized pattern, nor are its impacts consistently predictable. Despite its frequently counterproductive consequences, this trend continues, supported by modern food producers with extensive technological capabilities, often transnationals. The mass media provide these corporations with the advertising power to create a market for the output of their modern productive processes. This phenomenon became notorious in the 1960s, as animal protein began displacing vegetable protein in the Mexican diet, especially in the upper socioeconomic levels. Meat consumption rose an average of 3.9% annually from 1960 to 1970 and 4.6% from 1970 to 1980 — that is, from 9 to 13 kilos per inhabitant. Although perhaps of little note by the standards of richer nations, this change is highly significant in Mexico. Another indicator of dietary change in Mexico is bread consumption, which has increased 400% in the last 10 years; 75% of Mexico's population now eats bread regularly, compared with 45% in 1940. Nevertheless, corn tortillas have not decreased in popularity as much as might have been expected, given increased bread consumption and the characterization of the tortilla as an inferior product. Although high-income groups disdain the tortilla in favor of bread, corn tortillas retain their traditional popularity among other socioeconomic groups.[41]

Other evidence of U.S. influence on the Mexican diet includes excessive consumption of refined sugars, often in products manufactured by transnational processing firms. Most of these products have little nutritional value at best, and at worst they may pose a health threat. A key element to this consumption pattern is the enormous demand for soft drinks and "junk food." According to one SAM report, 16 processed foods[42] have substituted for the traditional diet among high- and middle-

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[41] Mexico should avoid substituting white bread for the traditional tortilla, since wheat production cannot expand at as high a rate (or as low a cost) as can corn production. Maintaining the tortilla's popularity can be achieved by favoring it through relative pricing.

[42] These are: cocoa, breakfast cereals, broth concentrate, bread, teething crackers, instant coffee, refined flours, gelatine, mayonnaise, yogurt, powdered drinks, bottled soft drinks, snack foods, canned tomatoes, chile peppers, and sauces. "Fase de consumo en base a las ENIG de 1968 y 1977," mimeographed (México, D.F.: SAM, 1982).

income groups and are making inroads into the diet of the remaining social groups, with devastating results.

The strategy for food self-sufficiency intends to correct these nutritional deficiencies through a return to the traditional Mexican diet. The uncritical and mechanical adoption of the U.S. diet must halt, and the traditional diet must be improved by selective additions from other diets. To be avoided at all costs is the emphasis on meat; dependence on animal protein implies social inequity and precipitates related problems when livestock-raising becomes an overly strong competitor in the food-producing system. Possible improvements on the traditional diet include increased consumption of fish, fruits, natural beverages, and a variety of vegetable proteins, among others. These parallel the changes observed in the North American diet during recent years.

V

TRADE AND TECHNOLOGY TRANSFER BETWEEN THE U.S. AND MEXICAN FOOD SYSTEMS

The U.S. and Mexican food systems continue to interact in very clear ways and may do so even more dynamically in the future. A strategy for self-sufficiency requires that Mexico optimize its benefits from this interaction. In assessing its options, Mexico must recognize the fundamental asymmetry of the two systems and strive to define reciprocity and equity based on that recognition and on the potential of Mexico's food-producing sector and its redistributive capability. Also, Mexico should avoid certain elements in the U.S. food system, such as its concentration of resources, its extensive utilization of energy resources, and its capital intensity; these characteristics are ill-suited to countries such as Mexico, with a large unemployed labor force and limited economic resources.

The U.S. food system can nonetheless benefit Mexico in certain respects: one involves the tremendous size of its market, which can absorb many more Mexican exports than it now receives. Another is its advanced technology, much of which, if carefully selected, can be readily adapted to Mexico. Overall, in fact, Mexico's food-producing efforts should concentrate primarily on making the interaction between these two food systems much more selective, as well as on increasing and diversifying exports, reducing imports to Mexico, and focusing import expenditures on key U.S. technologies appropriate to Mexico.

These recommendations are obviously made from the Mexican perspective and grounded in the need to reinvigorate the fishing, natural-resource, and food-producing sectors endogenously. The suggestion that Mexico develop these areas may serve to stimulate research efforts and lead to other recommendations in the future.

These considerations touch on two different areas — trade and technology. In the area of bilateral trade, agricultural and food exchanges over the last 30 years have undergone profound modifications. The amount of goods exchanged has increased tremendously, and their composition has changed radically. This relationship will undoubtedly continue to evolve just as rapidly in the future. Reciprocal supply and demand between Mexico and the U.S. will remain in flux, and the international economy will, as always, undergo shifts. These will affect financial markets,

which influence exchange rates, interest rates, and other variables, and countries will respond by adjusting tariffs and other incentives and deterrents to the exchange of goods.

The emergence of the U.S. as a major agricultural exporter in recent years has also had an impact on Mexico's agricultural situation. In 1982, Mexico was the third most important trading partner of the U.S., surpassed only by Canada and Japan. In terms of agricultural trade, Mexico was again third, behind Brazil and Canada, with 1.4 billion dollars of exports to the U.S. However, this total represented only 7.2% of total U.S. agricultural imports. In the same year, Mexico consumed 3.3% of U.S. exports, making it the seventh most important importer of U.S. products. Contrasted with the heftiness of the U.S. in total and agricultural trade (70% of Mexico's imports in 1981), Mexico's relative insignificance in the U.S. export-import economy points up the asymmetry in the interaction of the two food systems.[43]

This asymmetry has been reinforced over time. Commercial linkages between the two countries have evolved within a framework of growing influence of the U.S. food system over the Mexican, and a decreasing influence of the latter on the former. The U.S. has increased its food self-sufficiency, diversified the points of origin of its agricultural imports, and — most notably — expanded its activities in the world market, all of which have reduced Mexico's role as a supplier of foodstuffs to the United States. Mexico's situation is precisely the reverse: its dependency on foreign food supplies has increased, especially during the last decade, while its sources of food imports, especially of grains, have narrowed to the point that the U.S. is virtually its sole supplier; meanwhile, its agricultural exports sector has contracted under the impact of internal demands, disadvantageous pricing, and U.S. protectionism.

Even under such adverse conditions, Mexico achieved some diversification in its food exports. Between 1950 and 1981, the proportion of total Mexican food exports purchased by the United States fell from 91% to 65%. This effort to diversify trading partners is highlighted in the area of animal feed: in 1950 all Mexican feed exports were sent to the U.S.; by 1981 the U.S. share had declined to 63%.

On the other hand, suppliers of food imports to Mexico have decreased in number since the 1950s: in 1955, 42% of food imports to Mexico were of U.S. origin, while in 1980 this figure rose to 75%. Mexico's dependency on the U.S. is particularly acute in the area of vegetable fats and oils (including cereal and oilseed derivatives).[44]

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[43] However, the relative weight of Mexico's agricultural exports decreases as manufactured and petroleum exports gain importance.

[44] Banco de Comercio Exterior, *Anuario de Comercio Exterior de México,* 1950 to the present.

An examination of the situation over time reveals a reversal in the U.S.-Mexico agricultural trade balance; Mexico, rather than realizing a surplus, has become a net food importer (see tables 6 and 7). This situation has resulted directly from Mexico's growing dependency on the U.S. grain market and the reduced vitality of its agricultural exports in the face of increasing internal demand, U.S. protectionist barriers, and an overvalued peso, especially from 1978 to early 1982. Although food exports to the U.S. did grow slightly over time, the expansion of U.S. food exports to Mexico far outstripped their increase.

Following World War II, Mexican food exports surged, then held steady until the mid-1950s, when they rose even higher, stimulated by the Korean War, improved yields, and increases in the cultivated land area, especially that dedicated to crops such as sugarcane and coffee. Mexico's cultivated food exports grew more gradually from 1959 to 1964, when prices for basic goods in the international market fell, but increases in Mexican exports of meat and livestock picked up some of this slack, increasing notably in the 1960s. However, by 1970 meat exports had entered an extended period of erratic behavior. Meanwhile, food exports rose generally, though slowly, until the 1974 peso devaluation. In 1979, the stimulus provided by a recovering U.S. economy ended abruptly, due to the combined impact of an overvalued peso, increasing internal demand, and climatic factors.[45]

Conversely, U.S. agricultural exports to Mexico, which had been virtually stagnant, grew rapidly after 1970. Their expansion was favored by many factors: an undervalued dollar;[46] credits, subsidies, and technological advantages; the progressively overvalued Mexican peso; burgeoning internal demand in Mexico; and Mexico's food crisis.

Mexico's guaranteed prices for basic crops were at this time too low to persuade Mexican farmers to plant crops for human consumption, so these individuals redirected their cultivation toward agroindustrial and forrage crops. Coincident with this redirection, economic crisis began to take its toll among peasant agriculturalists, the main producers of corn, beans, and wheat. The combination of the two accounts for the insufficiency of Mexico's agricultural supply in the face of rapidly expanding internal demand.

The most dynamic categories of U.S. food exports to Mexico include animal fat, beans, wheat, oilseeds, and corn, all

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[45] See Proyecto de Cooperación SARH-ONU/CEPAL, *El comercio exterior de productos agropecuarios. El desarrollo agropecuario de México,* vol. 4 (México, D.F.: CESPA-SARH, 1982).

[46] See Eduard G. Schuh, "U.S. Agriculture and Trade Policies" (Paper presented at the Conferencia Cocoyoc sobre Relaciones Estados Unidos-México, Sept. 1982, Mexico City).

TABLE 6
MEXICO'S FOOD IMPORTS
(thousands of current dollars)

Import Category	1950	1960	1965	1970	1975	1980
Total imports	74,100	50,133	75,430	168,224	799,679	3,246,277
Total imports from U.S.[a]	42,640	36,672	39,080	106,026	509,532	2,183,006
Animal products	[b]	12,073	15,681	33,817	53,133	274,916
Animal products from U.S.[a]	2,520	10,651	10,437	19,724	40,123	151,029
Vegetable products	[b]	18,123	28,321	83,842	666,178	2,054,092
Vegetable products from U.S.[a]	35,354	15,316	18,625	64,131	414,360	1,884,773
Fats and oils (animal and vegetable)	[b]	6,356	10,655	10,271	42,978	157,084
Fats and oils from U.S.[a]	3,044	2,367	6,916	7,829	37,004	101,462
Processed foods and beverages	[b]	13,581	20,773	40,294	37,390	760,215
Processed foods and beverages from U.S.[a]	1,772	8,038	3,102	14,342	18,045	45,742

[a]F.O.B. United States.

[b]Not available.

Sources: Asesoría de la Dirección General de Estudios, *Sistema Alimentario Mexicano* (México, D.F., 1982); Banco Nacional de Comercio Exterior, S.A., *Anuario de Comercio Exterior de México, Report, Calendar Year 1979-1980;* Secretaría de Programación y Presupuesto, *Comercio Exterior de México,* Feb. 1982.

TABLE 7
MEXICO'S FOOD EXPORTS
(thousands of current dollars FOB Mexico)

Export Category	1950	1960	1965	1970	1975	1980
Total exports	109,983	305,106	357,355	596,812	847,296	1,867,600
Total exports to U.S.	100,153	265,983	304,546	543,985	694,076	1,207,554
Animal products	47,596	85,298	97,694	198,076	209,058	534,560
Animal products to U.S.	47,053	80,364	90,683	191,304	177,270	307,644
Vegetable products	52,874	141,789	151,164	253,739	423,523	1,073,085
Vegetable products to U.S.	45,959	115,467	114,299	223,124	330,391	757,998
Fats and oils (animal and vegetable)	11	[a]	1,897	[a]	2,400	N/A
Fats and oils to U.S.	9	[a]	[a]	[a]	[a]	2,758
Processed foods and beverages	9,502	78,019	106,600	144,997	214,715	259,955
Processed food and beverages to U.S.	7,132	70,152	99,564	129,557	186,415	139,154

[a]Zero or insignificant.

Sources: Asesoría de la Dirección General de Estudios, *Sistema Alimentario Mexicano* (México, D.F., 1982); Banco Nacional de Comercio Exterior, S.A., *Anuario de Comercio Exterior de México, 1951-1978;* U.S.D.A., *U.S. Foreign Agricultural Trade Statistical Report, Calendar Year 1979-1980;* Secretaría de Programación y Presupuesto, *Comercio Exterior de México,* Feb. 1982.

with annual growth rates above the average level of food imports from the U.S. (see table 8). Data from 1981 and, to an even greater extent, those from the first half of 1982 indicate a decline in Mexico's grain and oilseed imports, a decrease which resulted directly from increased production stimulated by the economic policies implemented under the SAM. These measures were primarily directed at reaching food self-sufficiency in basic food products, such as corn, beans, wheat, and rice. Despite the reduction of grain and oilseed imports, however, the amount of processed food imports from the U.S. quadrupled from 1978 to 1981, reaching a total value of 1,124 million dollars. In 1981, imports of such luxuries cancelled out the favorable balance of trade resulting from the dramatic reduction in grain and oilseed imports.

Data from the first half of 1982 show a marked reduction in Mexico's food imports. This observation holds not only when compared with the same period in the previous year, during which food imports had also fallen in value (42%), but also when compared with the historical pattern established during the 1960s and 1970s (see tables 6 and 8).

Based on the anticipated harvest and projected food stocks, the Ministry of Agriculture and Water Resources and the SAM predicted in 1982 that the country would attain self-sufficiency in rice, beans, and wheat in 1983. It would continue to import corn (to maintain its strategic reserves) as well as sorghum and oilseeds. Unfortunately, severe drought reduced the size of the harvest, and purchases of sorghum fell behind schedule in late 1982 and early 1983, causing large quantities of corn and wheat to be redirected toward animal consumption. These two factors increased Mexico's corn and wheat import requirements for 1983.

The volume of Mexico's food exports remained stable in 1982-83, but their value rose notably due to favorable prices. Meanwhile, the value of Mexico's food imports remained virtually constant. These figures reveal that the terms of agricultural trade favored Mexico, especially in the livestock sector.

The tables presented above which pertain to Mexico's balance of trade indicate a deficit in vegetable products, especially basic grains and oilseeds. However, dynamic sales of fruit and vegetable exports compensate for grain import deficits. Mexico's high levels of powdered milk imports, moreover, are offset by its trade surplus in animal products, that is, Mexican exports of cattle, meat, fish, and shellfish. Given this trade situation and today's undervalued peso, Mexico must return to a favorable world trade balance. To achieve this, Mexico must halt grain, oilseed, and processed-food imports, while simultaneously mov-

ing aggressively to increase traditional and non-traditional exports.[47]

The strategy for dramatically decreasing imports must address nearly all import categories. Such reductions will be neither easy nor attainable in the short term; demand will continue its rapid growth, especially for products such as oilseeds, sorghum, soybeans, and milk, products for which demand is characterized by high income elasticities. Mexico will be unable to reach self-sufficiency in these products within the next five years, but it can at least realize a drastic reduction in their importation. Future imports of basic grains, including corn, beans, and rice, will depend on the strategy adopted. If Mexico makes a strong commitment to the production of basic foodstuffs, it could attain self-sufficiency in these product areas within five years. The same is true for wheat, although Mexico's ecology is less suited to wheat cultivation than to the production of other basic grains.

Mexico's technology imports from the U.S., meanwhile, will certainly continue at significant levels along the entire food-production chain. In this area Mexico should attempt to substitute technology when possible and to refine the mechanisms for technology evaluation and acquisition.

The current recovery in the U.S. economy, if combined with a favorable peso exchange rate, could facilitate a rapid increment in the level of Mexican exports to the U.S. Mexico has a definite comparative advantage in producing agricultural goods which in the U.S. are becoming increasingly costly to produce. There is no fundamental contradiction between exports capability and food self-sufficiency, since production for domestic consumption often does not compete directly with export production for land and capital resources. The state should encourage the growth of agricultural exports, but this sector, in turn, should develop in response to the needs of the external market, without relying on public support or jeopardizing basic grain production by peasant farmers. For example, U.S. demand for certain traditional export products such as coffee and sugar is falling off rapidly. Mexico should therefore seek other markets for these goods, perhaps in Europe or the Socialist countries, and anticipate that this demand will taper off even further over the medium term.

In the area of livestock, Mexico's exports of cattle for fattening are beginning to be important in the U.S. market. This opportunity should be pursued and broadenend to include fresh

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[47] Mexico could reduce its dependence on oilseed imports by increasing sunflower and African palm cultivation. Similarly, it could decrease sorghum and soybean imports by producing alternative animal feeds internally.

TABLE 8
PRINCIPAL FOOD
IMPORTS AND EXPORTS IN MEXICO
(thousands of current dollars)

	Jan.-July 1981	Jan.-July 1982	% change 1981-1982
Total exports	*1,135,992*	*949,705*	*-16.4*
Unroasted coffee beans	180,308	197,364	9.5
Tomatoes	240,276	136,168	-24.5
Fresh vegetables	153,860	129,337	-15.9
Cantaloupe and watermelon	62,817	42,147	-32.9
Fresh fruits	9,449	18,411	94.8
Almonds and sesame seeds	13,218	11,854	-10.3
Chickpeas	37,594	5,859	-84.4
Sheep	63,543	53,969	-15.1
Honey	21,385	18,404	-13.9
Fresh and refrigerated shrimp	136	562	313.2
Fresh fish and shellfish	1,039	248	-76.1
Other primary products	17,852	13,602	-23.8
Frozen shrimp	176,361	161,314	-8.5
Processed fruits and vegetables	33,315	40,706	22.2
Frozen strawberries	28,862	20,844	-27.8
Orange juice	6,183	16,872	172.9
Roasted coffee	6,589	12,889	95.6
Tomato juice and paste	2,339	7,935	239.2
Canned abalone	7,792	6,575	-15.6
Other processed food products	73,074	54,645	-25.2

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	Jan.-July 1981	Jan.-July 1982	% change 1981-1982
Total imports	*1,862,577*	*933,520*	*-49.9*
Oilseeds	83,785	148,095	76.8
Beans	105,227	97,621	-7.2
Wheat	159,824	75,180	-53.0
Soybeans	232,428	62,736	-73.0
Sorghum	330,286	49,372	-85.1
Corn	359,386	36,674	-89.5
Fresh and dried fruits	13,390	8,559	-36.1
Fresh vegetables	11,372	7,469	-34.3
Sheep	21,483	34,780	61.9
Hunting and fishing	2,996	2,772	-7.
Other primary food products	91,846	57,802	-37.1
Powdered milk	56,145	68,522	22.0
Sugar	127,995	45,895	-64.1
Fresh and refrigerated meat	31,892	36,650	14.9
Evaporated and condensed milk	58,032	31,914	-45.0
Butter	30,823	27,687	-10.2
Animal and vegetable oils and fats	10,597	14,811	45.0
Pork rind	10,214	13,485	32.0
Animal feed	28,033	10,851	-61.3
Other processed food products	96,823	102,645	6.0
Trade Balance in Food Products	*-726,585*	*16,185*	

Source: Sistema Alimentario Mexicano (SAM), Dirección General de Estudios, México, 1982, y Secretaría de Programación y Presupuesto (SPP), Coordinación General de los Servicios Nacionales de Estadística, Geografía e Informática.

and processed meat. The limitations on water, land, and fodder in the United States should indicate to Mexico the potential in this arena. The creation of binational, vertically integrated agroindustrial cattle complexes in certain transborder regions would permit the sharing of risks, technology, and investment and for Mexico would have the additional advantage of assured access to the U.S. market.[48]

Similarly, the rapidly increasing U.S. demand for fish and shellfish, which has already stimulated Mexican shrimp exports, could be tapped further if Mexico were to push its other seafood exports aggressively in the U.S. market. Again, joint participation could be considered in activities such as distribution. Recent problems in tuna fishing, however, sound a pessimistic note, highlighting the need to counter U.S. protectionism.

In spite of the recurring "tomato wars" against Mexican fruit and vegetable exports to the U.S., Mexico's competitive advantage in these products will inevitably become stronger in the immediate future.[49] Increasing production costs north of the border and the steady growth of U.S. demand for fresh fruits and vegetables assure Mexico's competitive position, which is threatened only by U.S. protectionism. Mexico could improve its potential in fresh-produce exports by adding products such as garlic, celery, and chili peppers, and even tropical fruits such as mangoes, coconuts, guavas, and custard apples, which have recently caught the fancy of the U.S. consumer. The adaptation of certain areas in Veracruz, Tamaulipas, and the Yucatán peninsula for the cultivation of these fruits could compensate for the loss of citrus exports. Mexican honey, a product of very high quality, also has export potential which should be encouraged.

Cacao, vanilla, pepper, and other species also have high export potential; with assertive marketing among food-processing companies and U.S. distributors, these products could easily compete with widely-used artificial flavorings. In light of the sophisticated U.S. consumer's marked preference for the higher quality, natural products, this fact should be self-evident. Just as with meat and tomatoes, joint endeavors with U.S. business partners could help Mexican producers avoid discrimination and protectionism in the U.S. market for natural flavorings.

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[48] The most promising transborder regions for such developments include northern Tamaulipas, Chihuahua, Sonora, and Baja California. See IMCE, *Mexican Exports of Cattle and Beef* (México, D.F.: Instituto Mexicano de Comercio Exteriro, 1973); and Dirección de Producción Pecuaria, "Sistema carne," mimeographed (México, D.F.: SAM, 1981).

[49] Ruth Rama and Raúl Vigorito, *El complejo de frutas y legumbres en México* (México, D.F.: Ed. Nueva Imagen, 1979).

Processed ethnic foods, now popular far beyond the limits of the Latino and Mexican-American communities, constitute an export product with high potential and with a good measure of added value built in. Such is the case for alcoholic beverages as well. Despite recent encounters with protectionism, the success in the U.S. market of Mexican beers is a fine example of the U.S. population's growing acceptance of quality products from other countries. The U.S. market for Mexican beer and other alcoholic products is, moreover, still largely unexplored.

After successfully substituting internally produced fertilizers and agrochemicals for goods now imported from the U.S., Mexico could also enter the international market for petrochemical products. Mexico's comparative advantage in this area could transform it into a supplier for U.S. agriculture, which will undoubtedly continue to depend heavily on inputs of energy and agrochemicals.

Clearly, to realize this vision of expanded exports and reduced imports will require time, imagination, and political will. It will also require a detailed examination of several elements in trade policy between the two countries. The first is the narrow conception of reciprocity that has tended to characterize trade norms between the U.S. and Mexico, often producing results which discriminate against Mexico and benefit neither country. Supporting increased trade flows, especially of Mexican exports, encourages Mexico's strength and development, which in turn benefit the United States over the long run. However, these matters cannot be negotiated bilaterally because Mexico still receives some special concessions (the number decreases with time) under the U.S. Generalized System of Preferences (GSP). Furthermore, if all goes according to U.S. plans, Mexico will soon become a signatory to the Generalized Agreement on Tariffs and Trade (GATT).

If exports are to contribute to the strategy proposed in this essay, Mexico should defend its products from foreign import barriers, especially non-tariff ones, and continue to market its exports within the structure of the GSP. Mexico's leaders, knowing that the country's food imports are significant and will remain so for several years because of the needs of their food system, can use this knowledge in negotiations with the U.S. Mexico can emphasize the benefits to its neighbor country of maintaining a high level of bilateral trade, especially since the relative prices of Mexican exports will offer greater and greater savings in the future.

Perhaps the most effective negotiating strategy under current circumstances would be to expand the market for Mexican exports by setting up trading companies within the

United States to participate directly in the U.S. market.[50] Although not fully exploited in the past, this strategy represents a magnificent opportunity (assuming the U.S. system is amenable) to gain technological benefit, market savvy, and overall know-how. These companies could range from trading companies to storage and processing firms. Ownership parameters could vary from case to case and include co-ownership with the state, between the state and individuals from the U.S. and Mexico, between the governments of interested Mexican states, or between individuals, cooperatives, etc.

If the United States were to develop a more flexible trade policy, one which takes mutual advantages into account, it would cease acting as a negative influence on the consolidation and development of a flourishing food system in Mexico. Rather than pressing surplus grains on Mexico, the U.S. could provide technology or products essential to modernization and employment in rural Mexico. Moreover, the U.S. should refrain from supporting producers who can no longer compete in products which Mexico can supply more economically. The entire system of market regulations, plant quarantines, antidumping restrictions, and import duties, as well as "voluntary" restrictions, amounts to a high degree of protectionism, which does not square with its government's pious platitudes in support of free trade. In light of the tremendously asymmetrical trade relations with Mexico, this inconsistence seems almost predatory. With luck, the present crisis, felt strongly in the U.S. market, may serve to open the U.S. economy to competitive products from Mexico.

Another key area of interaction between these two food systems is that of foreign investment and, by extension, of technology transfer. Before attempting to design a functional, nationalistic, and integrated policy to govern foreign investments and technology, Mexico must gain an understanding of its current internal scientific and technological capabilities. A policy formulated without such an understanding would likely produce effects contrary to its objectives rather than responding to the country's endogenous capacity. Although no country's food-producing system incorporates highly advanced technology, the U.S. tends to predominate in technological advances for agriculture; this predominance represents an area of opportunity for Mexico. The issue here is not the presence (which is more strategic than extensive) of transnationals in Mexico,[51] but rather how to

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[50] An example of this type of endeavor is Ocean Garden Products, a Mexican government company which successfully markets shrimp and other Mexican products in San Diego, California. The efforts of Sinaloan tomato growers in Nogales, Arizona provide another interesting example.

[51] See Rosa Elena Montes de Oca and Gerardo Escudero, "Las empresas transnacionales en la industria alimentaria mexicana," *Comercio Exterior* 31:9 (Sept. 1981).

develop a policy to regulate investments and technology so as to complement an ambitious national effort in the field of science and technology in food production.

In very broad terms, Mexico's food system offers a highly optimistic landscape for scientific and technological advances in all stages of production. Indeed, based on national capabilities, it could achieve parity with the U.S. system. To do so, however, Mexico will require a clear vision of which technological areas should be given priority and which products should be imported from the U.S. or other countries. This effort should avoid extremes: autarchy on the one hand, and the indiscriminate acceptance of imports inconsistent with Mexico's needs, resources, and possibilities on the other. It should shy away from the capital intensity and high utilization of energy and agrochemicals which characterize the U.S. technological complex in favor of agroecological and bioengineering techniques. The latter require less capital and are less dependent for success on economies of scale, characteristics which render these techniques better suited to Mexico's small-scale agricultural and agroindustrial operations and to its variety of flora, which is much more extensive than that of the U.S.

Mexico already has a growing infrastructure of science and technology addressing production in its basic stages, including problems of strategic inputs in the food-production chain. For example, the National Agricultural Research Institute (INIA) has achieved international recognition in most agricultural sciences. The same is true of the Agricultural University of Chapingo and other research centers. Other notable centers developing new technologies include the National University (UNAM), where researchers are working on nitrogen fixation and bioengineering; the National Polytechnical Institute (IPN), with its excellent work in biochemistry; and the National Institute of Biotic Resource Research (INIREB), which explores the areas of fermentation and ecology. However, many more systematic studies are needed: on tropical and arid ecosystems, tropical vegetables, and oilseeds, to name but a few. The Salvador Zubirán National Institute for Nutritional Studies (INNSZ) is known around the world for its work on nutrition and pathology.

Thus, although Mexico's technological infrastructure is inadequate, it is a solid foundation from which to begin. Moving ahead in the food-production chain to the periods after harvesting, we find inadequate scientific and technological support; not only is it limited in quantity, it is also poorly articulated with the productive apparatus. Probably because of the lamentable lag in developing the field of machine tooling, capital goods and agricultural machinery are not designed to meet the specific needs of Mexico's agriculturalists and food processors. Post-harvest or, in the case of fisheries, post-catch technological innovations are badly needed, both at the company and research-center

levels. Important areas, such as food preservation, dehydration, refrigeration, storage and handling, quality control, and packing have been ignored by Mexican science and technology.

The nebulous landscape of Mexican agricultural technology thus includes a poorly developed short- and long-term plan, a scarcity of trained personnel, an appalling lack of incentives for research and development, and, above all, feeble links between research centers and actors directly involved in the productive process.

As stated above, Mexico must understand its position and its needs before attempting to formulate a policy on foreign technology and investment. Remedying the situation would likely involve two key elements: first, a vigorous government effort to coordinate and define the dispersed scientific and technological findings applicable to food production; and second, the development of a more complete institutional framework for organizing and overseeing the approval, adoption, and implementation of foreign technologies.

As an initial step, Mexico must define in terms of urgency and priority the elements of what we might call the "national food arena." The strategy proposed throughout this essay would include three elements in that arena. The first is strategic national interest, which comprises developments in basic and applied genetics, all aspects of bioengineering, and packing and packaging.[52] This area should receive the highest priority for development and incorporation into the productive sector. The state would regulate the foreign trade of products and technologies introduced in the fields of genetics and bioengineering to assure that they truly promote Mexico's overall national interests and not only those of one specific transnational group, however important. For the same reason, these two fields should be off-limits to any investment offers from abroad.

The second area to be defined is that of priority support — equipment, capital goods, and strategic inputs. Both the public and the private sector would work toward the development of this area, which will shape the future of Mexico's food-producing sector just as much as strategic national interests would. In the area of priority support, Mexico must focus on the modernization of farming equipment and new techniques in fishing and food-processing, which might well impede agricultural progress if left unaddressed. By discouraging certain foreign investments, Mexico might stimulate an active Mexicanization of this area, assuring that majority ownership would be held by national public and private interests.

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[52] Although packing and packaging would seem to require little in the way of scientific and technological innovation, such inputs are essential to advance a self-sufficient and redistributive food strategy.

The final area falling within the national food arena is the development of priority food-producing systems dedicated to grains, oilseeds, animal feed, meat, dairy products, eggs, fruits and vegetables, fishing, and aquaculture. Foreign investment should be disallowed in the first two — grains and oilseeds — and it should be restricted to minority ownership in the remainder. Viewing these productive processes as systems is essential to their development and integration into an overall strategy of food self-sufficiency. To encourage this perspective, each phase — required inputs, basic production, processing, and distribution — should be evaluated in terms of the subsystems which support it, including research, technological developments, engineering requirements, economic inputs, and methods for disseminating and incorporating the technologies deemed most appropriate. Together these elements constitute a "development portfolio" for each product or system, which can serve as a mechanism for integrated planning and, more importantly, as a practical and concrete means for identifying needs to be satisfied by nationally developed or imported technologies. Addressing considerations such as project design, costs, and marketing will encourage applied research and the active participation of the private sector, linking research centers with producers. Viewing food production as a complex of integrated productive systems, or development portfolios, also permits the design of a policy for "technological extension," which to date has been precarious and restricted, at best. Such a policy would involve the state not only as the agency overseeing technology transfers and encouraging cooperation between academics and the private sector, but also as an active participant with substantial capacity and demand.

Once the national food arena is defined, the design of a national framework to organize scientific and technological research and to direct foreign investment and technology could follow. As a first step, Mexico could establish a National Institute for Food Technology (INTAL),[53] charged with research and development in the post-harvest stages of the food-production chain for all productive system. The most important of these stages are storage, food preservation, refrigeration, dehydration, handling, and packaging. A food technology institute could be financially self-sustaining through sales of project design and internally developed technologies; it could also include input

[53] Restrictions imposed by the current economic crisis will hinder the immediate creation of research institutions. However, a temporary method for partially overcoming the inadequacy of the existing fragmented and incomplete research structure would involve a concerted effort to coordinate ongoing research among institutions working in the same areas. Such cooperative efforts could eventually lead to the establishment of small institutes.

from the private sector. To facilitate and coordinate certain kinds of technological development, Mexico should create a bioengineering company, a "BIOMEX," which would combine government participation (via PEMEX, FERTIMEX, etc.) with that of private national capital and universities such as the UNAM and the IPN. Such a company would link the development of technologies with their production and sale; consult on contracts of purchase and sales regarding bioengineering and related technologies; and supply risk capital for productive projects in this field. A high-level institute for research in the areas of fishing and aquaculture would also fit within the proposed strategy. The creation of these entities should not restrict the establishment of other companies, especially in the private sector, but it should shut the door to foreign investment.

Lastly, Mexico needs to reorganize the state mechanisms for approving, regulating, and purchasing foreign technology. In addition to enacting the legal reforms which would follow from the definition of a "national food arena," Mexico should strengthen the National Commission for Foreign Investment and the Registry of Technology Transfers. In particular, this commission should, without exception, consider the recommendations of research institutions[54] on matters pertaining to the national food strategy prior to approving any transfer of technology to be employed in the food-production chain.

Conclusion

This essay represents an ambitious but realistic strategy applicable to Mexico's entire food system and based on goals which are consistent with Mexico's resources. This strategy recognizes that Mexico's ailing economy is one of many obstacles to be overcome in the process of resolving the country's structural problems. Food relations between Mexico and the United States can be constructive, wide-ranging, and mutually beneficial, but only with the explicit recognition on both sides of the asymmetry and essential differences between the two countries. To repeat, selectivity and imagination, rather than autarchy or indiscriminate adoption of outside elements, must form the bases from which to reorient this inescapable relationship.

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[54] These research institutions would be INTAL, BIOMEX, and the Institute for Fishery and Agricultural Research recommended above. Each would provide guidance in matters pertaining to its respective area of expertise.

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