

CUTTING EDGE

Technology, Information Capitalism
and Social Revolution



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New Technologies, Neoliberalism, and Social Polarization in Mexico's Agriculture

Gerardo Otero, Steffanie Scott and Chris Gilbreth

Neoliberal reform has been sweeping Mexico since the onset of the debt crisis in the early 1980s. Moving away from protectionist and inward-looking development, the state has embarked on liberalization of trade and foreign investment policies. Consciously or not, this path is leading away from social and environmental protection. By opening the national economy and relying on exports to generate growth, the Mexican state is rendering Mexican workers, peasants and natural resources more accessible to exploitation. Pressure to exploit natural resources under free trade undercuts attempts to promote conservation of the environment. Subsequent structural adjustment policies have cut government spending, thereby reducing environmental, health and safety programs. Neoliberal reforms culminated in the North American Free Trade Agreement (NAFTA) during the administration of Carlos Salinas de Gortari (1988–1994). In agriculture, President Salinas's policy reforms were intended to make Mexico more attractive to foreign investors, and to prepare the country for a more decisive economic integration with the United States and Canada.

It is clear that restructuring and North American integration will exacerbate recent trends toward social polarization and environmental degradation and that this will be further aggravated by the application of biotechnology to agriculture. Government policy and the penetration of international capital in the past several decades have worked to the disadvantage of small producers and have enhanced environmental problems in Mexico, becoming politically explosive in the state of Chiapas, where Mayan peasants decided to take up

arms to contest the sweeping changes being imposed. Despite the efforts of the Mexican state to describe the Zapatista rebellion as a regional conflict, this struggle against 'savage capitalism' has achieved national and international proportions. National and international protests demanding a peaceful solution to the conflict forced the new administration of President Zedillo to offer amnesty and renew peace negotiations. This occurred in February 1995, only a week after Zedillo had sent 60,000 troops to suppress the rebellion.

This essay focuses on the introduction of agricultural technologies that displace small peasants and degrade the environment. The first section discusses the effects of the Green Revolution on Mexico's agricultural sector, as manifested in a decline in food self-sufficiency and the impoverishment of the majority of Mexico's peasant farmers. It also addresses the potential application of biotechnology products in agriculture, exploring their possible roles in Mexican agricultural development. The second section examines the 1994 rebellion by Mayan peasants, led by the Zapatista National Liberation Army (EZLN), as a protest against the government's neoliberal reforms. In the eastern part of Chiapas state, where the uprising originated, social polarization resulted from the rapid introduction of cattle ranching and the environmental assault promoted by policies of modernization. The rebellion is an example of how introducing the socially polarizing modern agricultural paradigm, based on the US model of intensive agriculture, threatens biodiversity and peasant subsistence while intensifying political conflict.

From Green Revolution to Biotechnology

The greatest differences between the agricultural economy of Mexico and that of its partners in NAFTA, Canada and the United States, lie in technology and agricultural policies. Mexico's agricultural sector produces only 7 percent of the country's GNP with 26 percent of the labor force in agriculture, while US agriculture produces about 2 percent of GNP with 2 percent of the labor force. The ever greater exchange of agricultural goods and labor between Mexico and the United States will continue as long as this disparity in real wages and rural productivity remains and the market is permitted to respond to it. Even without NAFTA, the *de facto* integration of US and Mexican agriculture has been increasing. This productivity gap is clear from Mexico's inability to produce its chief food grain, maize, as efficiently as US farmers do, the consequence of a vast technology gap: for example, in Mexico there is 1 tractor for every 50 farmers, compared with 1.5 tractors for every farmer in the United States (Scott 1992).

Despite their free trade rhetoric, US and Canadian agricultural policies are characterized by enormous subsidies for agricultural producers. In 1988, direct

agricultural subsidies in Canada constituted 43 percent of agricultural GDP, compared with 35 percent in the United States, and a mere 2.9 percent in Mexico. Moreover, the US provides many hidden subsidies to its farmers. Some experts have estimated that US agricultural subsidies amount to \$50 billion, while the Department of Agriculture admits to only \$16 billion to \$26 billion in subsidies (Calderón 1992). It remains to be seen whether subsidies in Canada and the United States will be eliminated under NAFTA, or whether Mexico alone will be expected to conform itself to the free trade gospel (Calva 1992).

Another way of comparing US and Mexican agriculture is in output per agricultural worker, which in 1980 was 15.5 times greater in the United States than in Mexico. Output per hectare was six times greater (Johnston et al. 1987). Even this comparison understates the low labor productivity and low incomes resulting from the highly heterogeneous structure of agriculture in Mexico, which is characterized by relatively few large and capital-intensive farms that are highly productive, and many small farms with low productivity and income with hardly any access to modern technology (Barry 1995).

The US model of modern agriculture has, however, exerted a tremendous influence on Mexico, although agricultural modernization in the US took place in a context entirely different from that proposed for Mexico. Whereas the United States experienced a robust process of industrialization that was able to absorb the rural masses displaced from agriculture, Mexico has been plagued by unemployment in cities that are unable to provide enough jobs for those expelled from the modernizing agricultural sector. In the US modern agricultural inputs were adopted across the board, but only a very small minority of rural producers in Mexico could increase productivity and develop commercial and export crops. The greater severity of regional and social polarization in Mexico is due in part to the fact that most farms in Mexico are of a subsistence, peasant type, so that most farmers have been incapable of making the necessary capital investments in the technological package demanded by the Green Revolution, including hybrid or improved seeds, chemical fertilizers and pesticides, mechanization and irrigation (Bartra and Otero 1987).

Of the 50 percent of Mexicans living under the official poverty line, 70 percent live in rural areas (Cornelius 1992, 6). This fact reflects the sad effects of modern agriculture and the state policies that have promoted it (Otero 1989). The recent peasant uprising in Chiapas, which was initiated on the first day that NAFTA formally went into effect, was a reaction to economic restructuring in the Mexican countryside, particularly the declining access to land. Chiapas was one of the first states to feel the effect of policy change that reduced protection for marginalized groups (Harvey 1995), and it was particularly hard-hit by the sharp decline in world coffee prices in 1989 (Hernández Navarro and Célis Callejas 1994).

The introduction of the Green Revolution has not only resulted in regional

and social polarization in Mexico but has also modified patterns of food consumption (Otero 1992). Promoting modern agriculture and a US-style diet has involved a dramatic displacement of subsistence crops like corn and beans, grown for human consumption, by modernized livestock production and associated forage crops such as sorghum, the main crop used to feed poultry and pigs (Barkin et al. 1990). Livestock production grew at an extraordinary rate as beef, pork and poultry displaced other foods in postwar diets. This occurred first in the United States and Europe, but increasingly spread to the diets of the upper and middle classes in less developed countries (Friedmann 1991). Transnational corporations have played a key role (Raynolds 1994), marketing products on the one hand to meet the demands of the middle and upper classes in Mexico but on the other, to shape tastes and create demand for their products by way of large-scale marketing campaigns (Spalding 1984: 13–15).

The livestock/feed complex has become a highly technical industry favoring large-scale, capital-intensive, export-oriented agricultural production, and leaving by the wayside millions of peasant farmers. The monocultural farming associated with the specialized production of feedcrops, combined with the high demand for fertilizers and pesticides, has provoked serious ecological imbalances while depleting the natural fertility of soils (Friedmann 1991). Enormous quantities of grain have been required to feed the livestock, grain that could otherwise have been used for direct human consumption. While livestock production has drastically increased in recent decades, the percentage of the population who can afford to eat meat often remains very low. In fact, by 1988 half the population was estimated to be affected by malnutrition (Goldrich and Carruthers 1992, 104).

Over the past few decades there has been a decline in basic grain production per capita, a rise in production of feed grains, and a growing dependence on food imports. Between 1983 and 1987, while the per capita production of basic grains in general declined by 11 percent, the figures for corn and beans, the most important staples in the Mexican diet, declined by 18.4 and 26.7 percent, respectively. Currently, Mexico is having to import fully one-third of its food (Calderón 1992, 62). In 1988 and 1989, Mexico's food imports consumed more than half of the foreign exchange gained from petroleum exports (Calva 1992, 30). These statistics reflect the degradation in the food supply for large segments of the Mexican population. Studies by the US National Academy of Science have identified many negative health implications of this recent dietary pattern based on high intake of meat and dairy products, linking it to the two most frequent causes of death in the US: heart disease and cancer (National Research Council 1989). Yet while US and Canadian consumers are beginning to demand diets with greater fiber content and less fat and cholesterol, Mexican consumption patterns are still moving in the direction of greater amounts of meat and dairy products, and fewer local grains and cereals.

Pressure to change Mexican agricultural patterns has come not only from domestic consumers, but also from the international market, and particularly the United States. This has involved an increasing demand for cattle, fruits and vegetables from Mexico. The displacement of corn and bean cultivation in Mexico has taken place to the greatest extent in the northwest, where land is most fertile and irrigation most prevalent. This change can be seen as following a clearly capitalist logic, since the production of fruits and vegetables, cattle, and animal fodder such as sorghum all bring in larger profits than do corn and beans. International institutions like the International Monetary Fund and the World Bank have further promoted the transformation of crop composition in Mexico and other developing countries (Bello 1994). Concerned about the declining economy and Mexico's ability to pay back foreign debts, these institutions implemented policies of support for the development of new, nontraditional agricultural products for export. Such a strategy resolves problems only temporarily in that it further emphasizes the historical economic disparities of a stagnant peasant sector alongside a modern export sector. Luis Llambi (1994) explains the development of nontraditional exports as stemming from three causes: deteriorating market conditions of traditional Third World exports, trade barriers to Third World exports by advanced capitalist countries, and structural adjustment policies of the World Bank and the IMF in the 1980s designed to earn foreign exchange required for debt servicing.

To compensate for some of the painful economic adjustments under way in rural areas, and to help boost his popularity, then President Salinas developed a new National Solidarity Program or Pronasol (Cornelius, Craig and Fox 1994). Although state welfare spending has been slashed in recent years, the discretionary powers of the president were increased. The Solidarity budget constituted 35 percent of nondebt government spending in 1991. This populist program was aimed at pacifying social discontent by supporting projects like road building, electricity installation, and sewage and drainage projects in rural areas. However, since the Solidarity budget was funded primarily by money earned from selling off state enterprises, it is not clear how much longer such funds will be available. Of 1050 state enterprises in 1983, only 285 remained in 1990 (Grinspun and Cameron 1993, 33). It seems unlikely that band-aid programs like Pronasol can provide a sustainable development alternative for peasant agriculture (Hernández Navarro and Célis Callejas 1994).

Biotechnology: Cornucopia or Pandora's Box?

In the 1940s, Mexico was the first country in the Third World where Green Revolution technologies were applied (Hewett de Alcántara 1978). And, again, Mexico has become a testing ground for the products of the imminent bio-

revolution. At least two major products of biotechnology have already been introduced in Mexico: bovine growth hormone, a product that set off an intense debate over its approval in the United States; and a transgenic tomato variety. The former was introduced in 1992, well before its approval was even close in the US. Both products were targeted to the most modern – and wealthy – farmers in three regions of Mexico in the north and the northwest. It is still early for a full socioeconomic impact assessment of these technologies, but their bias toward large-scale farmers and the more developed regions has been clear from the outset.

Biotechnology can be defined as a set of new techniques developed in the 1970s and 1980s that have enabled the manipulation of the very foundations of life and the creation of new life forms. Some of these techniques are protoplast fusion, cell tissue culture, and genetic engineering. Because biotechnology can change the genetic structure of life-forms, bypassing the boundaries of sexual compatibility, the potential for creating new plants, animals, and biological inputs for agriculture is virtually unlimited. Biotechnology has potential applications in both extensive and intensive agriculture, and at both large and small scales (Buttel and Kenney 1987). It has the potential to increase yields in crops and livestock, shorten agricultural production cycles and maturation cycles of animals, and develop new plant varieties for use in diverse agricultural conditions including, for example, salty, frost-prone or dry soils, thereby contributing to the expansion of agriculture by incorporating marginal soils into production (Parthasarathi 1990, 1698). In addition, while the Green Revolution required an entire package of inputs to accompany its high-yielding seeds, biotechnology could provide for a potential savings in agricultural inputs by producing plants with their own insecticides and nitrogen-fixing capacity built in, thereby eliminating the need for additional purchases of insecticides and fertilizers (Doyle 1985, 271).

Yet despite its potential to address several key problems in Mexico, not the least of which is the need for increased food production, the international context in which biotechnology is emerging is not favorable for such a positive contribution to agricultural development. Rather, the introduction of biotechnology products will force Mexico into further dependence on advanced capitalist countries with greater technological potential, most notably the United States. A predominantly private enterprise system will not be attentive to the small farmers and rural poor who lack the financial resources to acquire the products of biotechnology (Weigle 1991, 102–3). While many have accused the Green Revolution of benefiting the private sector, it should be noted that it was conceived and implemented within a primarily public institutional context. In the end private corporations were undoubtedly the main beneficiaries from the spread of Green Revolution technologies, but they did not spearhead the changes nor did they determine technology transfer or research agendas

(Buttel et al. 1985). Biotechnology, in contrast, has been driven by the private sector from the outset. Investigations are dominated by private companies, while universities and individual scientists often have contracts with such corporations. Knowledge is no longer freely shared between interested scientists (Kenney and Buttel 1985). That incentives are now predominantly economic is exemplified by the tremendous increase in patenting of the new processes and products of biotechnology: private corporations have every intention of shaping the bio-revolution to their own needs and objectives (Buttel 1990).

As the results of investigations are increasingly becoming the property of private corporations, transnational corporations (TNCs) are trying to establish a uniform system of patent laws worldwide. This is being promoted by the World Intellectual Property Organization (WIPO) and was one of the crucial new components of the finalization of the Uruguay Round of talks of the General Agreement on Tariffs and Trade (GATT) in 1993. Pressure for an international system of patents in developing countries is associated with parallel efforts to eliminate all commercial restrictions and tariffs, especially on basic grains, in order to facilitate the free circulation of grains from large producing countries such as the United States. Another phenomenon accompanying the appearance of new technologies in developed countries is the latter's reduced support for regional, national and international research centers in developing countries (Arias 1990).

By exploiting patents and the monopolization of plant varieties, the marketing strategies of TNCs tend to enhance genetic erosion. In recent years there have been a number of instances of large chemical and pharmaceutical corporations taking over seed companies in order to expand the technological package offered to farmers. The newly acquired seed companies can thus create seeds that improve a plant's resistance to the herbicides and pesticides sold by the parent company (Fowler and Mooney 1990). Corporate scientists have thus been focusing their efforts not on engineering plants that require less use of petrochemicals, but rather on creating plants that will tolerate increased doses (Goldburg et al. 1990). A related concern is that the focus of research on new crop varieties is on developing plants that will not reproduce naturally, so as to force the farmer into the market to buy new seeds each year rather than saving seeds from the previous crop to be planted in the following growing season (Kenney and Buttel 1985, 68–9; Kloppenburg 1988).

From these examples it should be evident that biotechnology's proprietary nature will make access to technology more difficult for small farmers in Mexico. The private nature of biotechnology research is leading away from the development of new technologies, particularly appropriate for small farmers, which minimize dependence on purchased inputs. Private firms, increasingly coming to dominate biotechnological research and development, are clearly operating with market-driven goals: 'the technologies for which there are the

largest potential markets will be given the highest priority, and prospective technologies with less attractive markets will tend to be overlooked' (Buttel and Kenney 1987, 114).

In a drive to make the country a more appealing partner for NAFTA, the Mexican government strengthened the country's laws protecting intellectual property, including patents, copyrights and trademarks. Although in 1987 Mexico had passed the *Ley de Invenciones y Marcas*, which prohibited the patenting of genetically manipulated plants or animals, as of 1991 Mexico changed this law, making such patents legal. This change was likely imposed to facilitate NAFTA negotiations, since countries that fail to introduce patent legislation for products of biotechnology could face commercial retaliation (Rodríguez 1992, 244). However, rather than expand international trade, patents in biotechnology actually constitute trade barriers. Historically, biological processes and products were not eligible for intellectual or industrial property protection. But through WIPO and GATT, the United States and other countries that conduct advanced biotechnology research are now attempting to make the products of biotechnology patentable worldwide. This would permit the vast biological diversity of developing countries to become the intellectual property of private interests. In the context of NAFTA, the privatization of knowledge via seed patents could be used as a tool for negotiation or a mechanism of political control. The seed trade is already a very concentrated industry, and permitting the patenting of seeds thus implies a danger for Mexico in terms of securing its capacity to obtain food.

Thus, biotechnology is likely to further exacerbate the social and environmental problems of Mexico's agriculture: the case of Chiapas illustrates how Mexico's rapid introduction of sweeping reforms to the agricultural sector may bring acute political conflict. Short of democratizing the economic and technological paradigms, in the sense of making them more equitable and accessible to a broad range of producers, similar conflicts are likely to spread in other regions and countries.

The Case of Chiapas

The contradictions from over a decade of broad agricultural transformations came to a head on January 1, 1994, when 3000 Mayan peasants in Chiapas entered and occupied five municipal capitals. The indigenous peasants organized in the Zapatista National Liberation Army declared war against the Mexican state and called for then president Carlos Salinas to step down. Most of their demands for reform centered on Salinas's program of modernization, which had increasingly endangered peasant livelihoods despite the National Solidarity Program to combat rural poverty. Analyses of the rebellion have

often pointed to the region's neglect by the national government and its isolation from the national economy. But Chiapas has always been an integral part of Mexico's development. The key problem instead has been the intense exploitation of Mayan peasants over the centuries by a particularly archaic local ruling class, a situation exacerbated by neoliberal reforms that fundamentally altered the ways the Mayan peasants were able to make a living.

Chiapas should not be a poor state. In several sectors it contributes substantially to the national economy. In 1980, Chiapas accounted for 3 percent of Mexico's population, yet it provided 54 percent of the nation's hydroelectric power, 13 percent of its gas, 4 percent of its oil, 13 percent of its corn (Collier 1994, 16) and 12.4 percent of the country's agricultural crop exports (Burbach 1994, 118). Nevertheless, compared with other Mexican states Chiapas rates near the bottom in healthcare access, literacy levels and living conditions. Most indigenous Chiapanecos live in overcrowded houses with dirt floors, do not have electricity or running water, and do not finish primary school (Hidalgo and Monroy 1994, 21–2). The local ruling class has maintained structures of labor subordination and land concentration since the colonial period, creating extreme social and economic disparities. The region's contradictions in natural wealth and social poverty are thus not due to abandonment by the national government or isolation from the rest of Mexico, but are rather the result of exploitation and a concerted effort to maintain the structures of domination.

The roots of the Chiapas rebellion originated during the period of colonization when the region's skewed land tenure pattern emerged. Indigenous communities persevered alongside the Spanish hacienda until the late nineteenth century. At this point there was a concerted effort by capitalist landowners to modernize Chiapaneco agriculture and integrate it with the national and international economy. This often involved privatizing untitled lands that may have been used by Indian communities for generations. The Mexican Revolution (1910–1920) interrupted this process in certain parts of the nation, but by no means fundamentally altered it. The Revolution did not take hold within Chiapas – it was 'a revolution from without'. The economic elite retained control of state government, using it to direct a program of modernization. The minor rebellions which took place in Chiapas during the Revolution were led by the ruling class, seeking to advance local objectives. One rebellion took place among highland landowners in San Cristóbal who resisted the shift of state power to Tuxtla Gutiérrez. The later Mapache rebellion resisted the occupying revolutionary army and the abolishment of indebted servitude. The Mapaches sought to ensure that peasants would not consider the example of land reform taken by the original Zapatistas in Morelos (Nigh 1994, 9). The regional history of Chiapas is thus best understood as a continuation of the modernizing reforms initiated during the Porfiriato (1876–1910), rather than the product of a profound social, political, or eco-

nomic reorientation (Benjamin 1990, 33).

From 1920 to 1950 landless villagers and agricultural workers began to organize. The land reform spelled out in the 1917 Constitution was implemented under Cárdenas in the 1930s, and by the 1950s the Chiapaneco ruling class was challenged by popular mobilization. To deal with the explosive situation, the Lacandón frontier became a social safety valve to appease the land-hungry peasants. Rather than expropriating the large fertile landholdings of the central highlands and valleys, peasants were sent to the largely unoccupied eastern lowland jungles as agricultural colonists. This managed to diffuse the widespread discontent, at least for a few years. By the 1970s, the region had reached its demographic limits and the agrarian rebellion broke out as peasants throughout Chiapas began demonstrating and taking over private lands in protest against worsening conditions. This was exacerbated by the social polarization that resulted from petroleum development in the 1970s. Some peasants were able to prosper by selling their labor to supplement their farming incomes. With their earnings they were later able to expand and diversify their agricultural production by adopting costly Green Revolution technologies. Peasants who were unable to take part in this process were left worse off than before: they could leave for the eastern lowlands but that region's capacity was stretched to its limits. It is this malaise that led to the uprising in Chiapas (Collier 1994).

The particular form of uneven modernization in Chiapas has been a central instigator in creating the conditions that fueled the Zapatista rebellion. Despite rich lands, changes brought out by the Mexican Revolution and the modernization policies attempted by the state and federal governments, most Chiapanecos remain poor. As historian Thomas Benjamin points out about the local ruling class, 'the *familia chiapaneca* attempted to purchase regional growth and development cheaply, unwilling to forego their de facto monopoly privileges for genuine regional development and widespread prosperity, to say nothing of social justice' (1989, xvii). The following sections look at agricultural colonization in eastern Chiapas and President Salinas's agricultural reforms (1988-94) in detail to show the adverse effects of the neoliberal reform on Mexican farmers and on the agricultural environment.

Colonizing the Lacandón Rainforest

In 1940, Mexico's agrarian reform laws were applied to the eastern tropical lowlands of Chiapas, declaring the rainforest part of the national territory. At the same time, land reform was also applied in Chiapas's central plateaus and valleys, momentarily easing land tensions. By the mid 1950s, however, Mayan peasants from the central highlands began to outgrow their lands and a steady

migration pattern was established as peasants from central Chiapas and other land-poor regions in Mexico came to the eastern lowlands in search of land to colonize and farm. By the 1990s, the Lacandón forest had been reduced to one-third of its original size through deforestation. Land-reform legislation actually encouraged deforestation by giving special exemptions to farmers using land for raising cattle, and if land was left forested ranchers risked having it taken away (Russell 1994, 248).

The colonists and ranchers were not the first to occupy the lowland rainforest region. At the end of the eighteenth century a small group of Mayan Indians, escaping Spanish relocation in the west and disease and disruption in the east established several communities in the jungle (Nations 1994, 29). Through generations of living within the tropical rainforest, the Lacandón Maya developed a practice of sustainable agriculture. Their traditional *milpas* (cultivated fields) are chosen on lands most suitable for food production. While corn dominates *milpa* production, often forty to fifty other plant species are cultivated, using a technique that maintains the structure of the tropical rainforest ecosystem. The *milpa* patch is cleared by slash-and-burn, a technique normally associated with unsustainable practices; the difference is that after several productive seasons the Lacandón Maya leave the land to regenerate for ten to twenty years. Often tree crops such as bananas are planted, enabling the fallow field to continue producing food (McGee 1990, 36).

The recent agricultural colonists have not developed such a sophisticated yet simple system of sustainable agriculture. Generally, they clear the land using slash-and-burn techniques, but once the land's fertility declines, it is not allowed to lie fallow long enough for regeneration to take place. Instead, the cleared land is usually sold to, or taken over by, cattle ranchers who come to the tropical lowlands of Chiapas on the heels of the colonizers, in many cases supported by generous government loans to promote beef production. The rich biodiversity of the rainforest is severely reduced as cleared lands are seeded with grasses for cattle grazing, making the land useless for agriculture unless intensive agricultural techniques such as plowing are applied, which are generally not available to the Lacandón agricultural colonies (McGee 1990, 4). This process has not only brought severe environmental damage through deforestation, but also concentrates and destroys agricultural land. This reflects a broader pattern occurring in Mexican agriculture, referred to earlier, by which food crops are replaced by the high-profit production of agro-exports such as nontraditional fruits and vegetables or beef.

Efforts by the state to protect the diminishing Lacandón rainforest came too little and too late. The Monte Azul bioreserve was established in 1978 to protect some of the remaining tropical lands, yet in a region already at its demographic limits such an effort can only be seen as further restraining peasants' access to land. Furthermore, timber rights have been sold by the La-

candón Maya to logging companies, so the forests are still open to exploitation.

Neoliberalism and the End of Agrarian Reform

Under the previous *sexenio* (1988–94), President Carlos Salinas and his technocratic bloc introduced changes of all types in the economy in an effort to increase efficiency and competitiveness and to prepare the country for international economic integration via NAFTA. These neoliberal reforms have included the privatization of state-owned companies, a cut in duties on most imports, a reduction or elimination of restrictions to foreign ownership of firms, cuts in agricultural subsidies and a revision of agricultural credit programs. Yet for agriculture, the most drastic reforms were made to the *ejido* form of land tenure. Under the 1917 Constitution that emerged during the Mexican Revolution, large land holdings could be confiscated by the state and then redistributed to *ejidatarios* (*ejido* farmers). The *ejido* was intended to distribute resources more fairly and avoid the creation of a landless rural class. *Ejidatarios* were permitted to use the land and pass it on to their children, but not to buy, sell, rent, or use it for collateral (Otero 1989). Today more than 50 percent of Mexican farm, forestry and livestock land is held in *ejidos* (Scott 1992). The figure for the state of Chiapas is 41.4 percent (Harvey 1996).

The motivation behind the *ejido* reform is an attempt to eliminate what is considered one of the greatest impediments to private investment in agriculture, namely, the insecurity in the land tenure system. The prohibition on ownership of *ejido* land combined with various controls on the size of privately owned plots created a fear among investors of confiscation of landholdings. Moreover, investors were unwilling to make major improvements on land that they risked losing. The 1992 revisions to Article 27 of the 1917 Constitution and the new agrarian law are designed to satisfy three primary goals: '(1) the establishment of legal mechanisms by which *ejidatarios* may rent or sell their land; (2) the definitive end of the Mexican government's constitutional obligation to redistribute land among the rural poor; and (3) the promotion of expanded commercial linkages between *ejidos* and private sector agriculture' (Zahniser 1992, 6). In addition, the new legislation permits *ejidatarios* to use their land to obtain credit. By permitting *ejidos* to be rented and sold, the law essentially legalizes what has been going on for years, but will accelerate these processes (Cornelius 1992, 5). Moreover, this particular reform will promote some efficiency gains, since previously the uncertainty surrounding the illegal sale and rental of *ejido* parcels tended to depress the price of land and discourage capital investment in agriculture.

Nevertheless, in Chiapas these changes have undercut the agrarianist orientation of many independent peasant organizations, limiting the opportunity

for change through peaceful means. More important, the new agricultural policy represents a reversal in the traditional role played by the state. Under Cárdenas in the 1930s, peasants were co-opted into mass organizations and persuaded that the state was their ally and would advance their interests. The changes to Article 27 broke the last vestiges of this belief, in many cases radicalizing the rural population.

In the maize sector, trade liberalization spells death for small producers in Chiapas. US farmers are capable of producing maize far more efficiently and inexpensively than Mexican peasants. The data on average productivity from 1984 to 1989 show that Mexico produces 1.7 tons per hectare compared with 7 tons per hectare in the United States. Similarly, to produce 1 ton of corn in Mexico requires 17.8 labor-days compared with 1.2 hours in the United States (Calva 1992). Facing such a monumental disparity in productivity, Chiapaneco maize producers do not have a chance under conditions of free trade. Procampo, a government system of subsidies, was set up in 1993 to ease the transition to reduced tariffs and import quotas. Nevertheless, the program is designed to be phased out after 15 years and the per-hectare subsidy given each year fails to cover more than a negligible amount of what it costs to shift production to a more profitable crop (Burbach and Rosset 1994; Gates 1996). As the Mexican government drastically reduces its spending in the agricultural sector, peasants face limited opportunities in the countryside.

With regard to coffee, Chiapas is Mexico's principle growing state with 91 percent of the state's producers operating with less than 5 hectares of land, while at the other end of the scale 116 private owners own 12 percent of the area under cultivation (Harvey 1996). Many of the largest plantations are in the Soconusco region of Chiapas's southwest. Commercial agriculture is most developed in this region, where the best lands are dominated by agro-export production such as coffee and cattle grazing. One study shows that 109 producers in this region control private holdings in excess of 1000 hectares (cited in Burbach and Rosset 1994). In contrast, coffee production in the eastern lowlands of Chiapas is dominated by small producers. Coffee producers have relied on state commercialization support since the establishment of the Mexican Coffee Institute (IMECAFE) in 1973. However, in the 1980s the role of the institute declined as a result of the economic crisis. Under Salinas the state dismantled the IMECAFE, privatizing part of its functions. At the same time small producers faced another setback. In 1989 the International Coffee Institute failed to establish worldwide production quotas and already declining coffee prices dropped another 50 percent. According to Neil Harvey, between 1989 and 1993 coffee production dropped by 35 percent and small producers suffered on average a 70 percent decline in real income. Thus, the rebellion by the new Zapatistas in 1994 is largely an extension of the frustration of peasants who had been demanding land and support for over twenty years and who in

turn received only violence, repression and unequitable access to land and technology.

Mexico's broader policies of restructuring have interacted with the regional particularities in eastern Chiapas to create the conditions for rebellion. The charismatic leader of the Zapatistas, Subcomandante Marcos, has made clear that the movement existed in eastern Chiapas for at least a decade prior to the rebellion. The movement arose shortly after the debt crisis of 1982 when 'structural adjustments' by the Mexican government began taking their toll on Chiapaneco workers and peasants. The changes to Article 27 and other measures designed to reorient the Mexican economy for trade liberalization were the final straw. In an interview in San Cristobal, on January 1, 1994, Marcos stated:

Today the North American Free Trade Agreement begins, which is nothing more than a death sentence to the indigenous ethnicities of Mexico, who are perfectly dispensable in the modernization program of Salinas de Gortari. The *compañeros* decided to rise up on that same day to respond to the decree of death that the Free Trade agreement gives them, with the decree of life that is given by rising up in arms to demand liberty and democracy, which will take them to the solution to their problems. This is the reason we have risen up today. (Marcos 1994)

The social consequences of Mexico's neoliberal reforms stand to be multiplied with the introduction of the new technologies that bear the mark of the US model of agriculture. This is especially true for the southern and southeastern regions of Mexico, which are already highly polarized in social terms and are also the most densely populated. The recurrent agricultural and economic crises of the past two decades have left most farmers in an impoverished and vulnerable position with few employment opportunities within or outside agriculture. In contrast, a few large farmers have the capital to buy new agricultural technologies, thus exacerbating social polarization and political conflict. Only a major social, political and economic reform with an egalitarian and democratic content will be able to change these trends.

Conclusions

Neoliberal reform in Mexico will further enhance the technological bias toward large-scale, capital- and input-intensive agricultural production, as this will be the only viable paradigm in the world economy. Large masses of the rural population will continue to be displaced from agriculture without finding sufficient or adequately paid jobs in other sectors of the economy. As the rebellion in Chiapas shows, wholesale liberalization and free market policies,

which consider peasant production to be redundant, risk creating social polarization that can erupt into rebellion. The application of biotechnology products generated by the pure logic of profit-making, which is currently the dominant trend, can only exacerbate the social conditions that led to the Chiapas revolt. Moreover, the oligopolistic TNCs directing the trajectory of biotechnology research are leading farmers into a greater dependency on chemicals, often toxic and carcinogenic, further entrenching the chemical and pesticide era of agriculture and threatening biodiversity.

The internationalization of Mexico's economy will deepen with current economic restructuring, further compromising the country's capacity to feed itself with the national staples of corn and beans. The imposition of fruit, vegetable, and livestock production by international lending institutions and by agribusiness corporations, while providing foreign exchange for paying off Mexico's debts and luxury foods for North American markets, does little for the country's millions of small farmers.

We do not argue that economic integration per se should be avoided, but rather that the present North American Free Trade Agreement, based on neoliberal ideology and practices, will provoke tremendous social and environmental disturbances. Current trends indicate that short- and mid-term pain will far outweigh potential long-term gains. The integration of North America could alternatively be managed in a way that would promote more equitable social and economic development, and a healthier environment for all. But this would require the democratization not only of political structures, but also of basic economic decision-making. Furthermore, production and access to technologies would also have to be democratized so that the human and environmental needs of the majority are taken into account. Based on this principal, one key question for future development of new agricultural technologies should be the extent to which they can be widely accessible to relevant users. Even Green Revolution technologies, which emerged within public institutions, contained a large-scale bias and caused environmental problems. Thus, in the future, the question should be not only whether new technologies are accessible; their very development should respond to society's democratic decisions about what is best for an equitable application within an environmentally sustainable trajectory.

References

- Arias Pefiate, Salvador. 1990. *Biotechnología: Amenazas y perspectivas para el desarrollo de América Central*. San José, Costa Rica: Departamento Ecueménico de Investigaciones.
- Barkin, David, Rosemary L. Batt and Billie R. DeWalt. 1990. *Food Crops vs. Feed Crops: Global Substitution of Grains in Production*. Boulder, Colo.: Lynne Rienner.

- Barry, Tom. 1995. *Zapata's Revenge: Free Trade and the Farm Crisis in Mexico*. Boston: South End Press.
- Bartra, Roger. 1993. *Agrarian Structure and Political Power in Mexico*. Baltimore: Johns Hopkins University Press.
- Bartra, Roger, and Gerardo Otero. 1987. 'Agrarian Crisis and Social Differentiation in Mexico.' *Journal of Peasant Studies* 14 (3): 334-62.
- Bello, Walden. 1994. *Dark Victory: The United States, Structural Adjustment and Global Poverty*. London: Pluto Press.
- Benjamin, Thomas. 1989. *A Rich Land a Poor People: Politics and Society in Modern Chiapas*. Albuquerque: University of New Mexico Press.
- Burbach, Roger. 1994. 'Roots of the Postmodern Rebellion in Chiapas.' *New Left Review* No. 205 (May/June): 113-24.
- Burbach, Roger, and Peter Rosset. 1994. Policy Brief No. 1: 'Chiapas and the Crisis of Mexican Agriculture.' San Francisco: Institute for Food and Development Policy.
- Buttel, Frederick H. 1990. 'Biotechnology and Agricultural Development in the Third World.' In Henry Bernstein et al., eds, *The Food Question: Profits vs. People*. London: Earthscan.
- Buttel, Frederick H., and Martin Kenney. 1987. 'Biotechnology and International Development: Prospects for Overcoming Dependency in the Information Age.' In Don F. Hadwiger and William P. Browne, eds, *Public Policy and Agricultural Technology*. London: Macmillan.
- Buttel, Frederick H., Martin Kenney and Jack Kloppenburg, Jr. 1985. 'From Green Revolution to Biorevolution: Some Observations on the Changing Technological Bases of Economic Transformation in the Third World.' *Economic Development and Cultural Change* 34 (1): 31-56.
- Calderón, Jorge A. 1992. *El TLC y el desarrollo rural*. Mexico, D.F.: Ediciones CEMOS Memoria.
- Calva Tellez, José Luis. 1992. 'Efectos de un tratado de libre comercio en el sector agropecuario mexicano.' In José Luis Calva Tellez and Gerardo Gómez González, eds, *La agricultura mexicana frente al tratado trilateral de libre comercio*. Mexico, D.F.: Juan Pablos Editor.
- Collier, George A. 1994. *Bastard Land and the Zapatista Rebellion in Chiapas*. Oakland, Calif.: Institute for Food and Development Policy.
- Cornelius, Wayne A. 1992. 'The Politics and Economics of Reforming the Ejido Sector in Mexico.' *LASA Forum* 23 (3): 3-10.
- Cornelius, Wayne A., Ann L. Craig and Jonathan Fox, eds. 1994. *Transforming State-Society Relations in Mexico: The National Solidarity Strategy*. Paper No. 6, U.S.-Mexico Contemporary Perspectives Series. La Jolla, Calif.: Center for U.S.-Mexican Studies, University of California, San Diego.
- Downing, Theodore E. 1988. 'A Macro-Organizational Analysis of the Mexican Coffee Industry, 1988-1977.' In Philip Quarles van Ufford, Dirk Kruijt and Theodore Downing, eds, *The Hidden Crisis in Development: Development Bureaucracies*. Tokyo and Amsterdam: United Nations University and Free University Press.
- Doyle, Jack. 1985. *Altered Harvest: Agriculture, Genetics, and the Fate of the World's Food Supply*. New York: Viking.
- Fowler, Cary, and Pat Mooney. 1990. *Shattering: Food, Politics and the Loss of Genetic Diversity*. Tucson: University of Arizona Press.
- Friedmann, Harriet. 1993. 'The Political Economy of Food: A Global Crisis.' *New Left Review* 197 (Jan./Feb.): 29-57.
- Friedmann, Harriet. 1991. 'Changes in the International Division of Labor: Agri-food

- Complexes and Export Agriculture.' In William H. Friedland, Lawrence Busch, Frederick H. Buttel and Alan P. Rudy, eds, *Towards a New Political Economy of Agriculture*. Boulder, Colo.: Westview.
- Gates, Marilyn. 1993. In *Default: Peasants, the Debt Crisis, and the Agricultural Challenge in Mexico*. Latin American Perspectives Series, No. 12. Boulder, Colo.: Westview.
- . 1996. 'Debt Crisis and Economic Restructuring in Mexican Peasant Agriculture.' In Gerardo Otero, ed., *Neoliberalism Revisited: Economic Restructuring and Mexico's Political Future*. Boulder, Colo.: Westview.
- Goldburg, Rebecca, Jane Rissler, Hope Shand and Chuck Hassebrook. 1990. *Biotechnology's Bitter Harvest: Herbicide-Tolerant Crops and the Threat to Sustainable Agriculture*. Report of the Biotechnology Working Group (U.S.).
- Goldrich, Daniel, and David V. Carruthers. 1992. 'Sustainable Development in Mexico?: The International Politics of Crisis or Opportunity.' *Latin American Perspectives* 19 (1): 97-122.
- Grinspun, Ricardo, and Maxwell Cameron. 1993. 'Mexico: The Wages of Trade.' *Report on the Americas* 26 (4): 32-7.
- Harvey, Neil. 1996. 'Rural Reforms and the Zapatista Rebellion: Chiapas 1988-94.' In Gerardo Otero, ed., *Neoliberalism Revisited: Economic Restructuring and Mexico's Political Future*. Boulder, Colo.: Westview.
- Hernández Navarro, Luis, and Fernando Célis Callejas. 1994. 'Solidarity and the New Campesino Movements: The Case of Coffee Production.' In Cornelius, Craig and Fox. *Transforming State-Society Relations in Mexico*.
- Hewitt de Alcántara, Cynthia. 1978. *Modernización de la agricultura mexicana*. Mexico, D.F.: Siglo XXI Editores.
- Hidalgo, Onecimo and Mario B. Monroy. 1994. 'El Estado de Chiapas en Cifras.' In Mario B. Monroy, ed., *Pensar Chiapas repensar Mexico: Reflexiones de las ONG's Mexicanas sobre el conflicto*. Mexico, D.F.: Convergencia de Organismos Civiles por la Democracia.
- Johnston, Bruce F., Cassio Luiselli, Clark W. Reynolds. 1987. 'An Overview: Asymmetry and Interdependence.' In Bruce F. Johnston et al., eds, *U.S.-Mexico Relations: Agriculture and Rural Development*. Stanford, Calif.: Stanford University Press.
- Kenny, Martin. 1986. *Biotechnology and the University-Industrial Complex*. New Haven, Conn.: Yale University Press.
- Kenney, Martin, and Frederick Buttel. 1985. 'Biotechnology: Prospects and Dilemmas for Third World Development.' *Development and Change* 16: 61-91.
- Kloppenburg, Jack R., Jr. 1988. *First the Seed: The Political Economy of Plant Biotechnology, 1492-2000*. New York: Cambridge University Press.
- Llambí, Luis. 1994. 'Comparative Advantages and Disadvantages in Latin American Nontraditional Fruit and Vegetable Exports.' In Philip McMichael, ed., *The Global Restructuring of Agro-Food Systems*. Ithaca, N.Y.: Cornell University Press.
- Marcos, Subcomandante. 1994. 'Testimonies of the First Day.' In *Zapatistas! Documents of the New Mexican Revolution*. New York: Autonomedia.
- McGee, R. Jon. 1990. *Life, Ritual, and Religion Among the Lacandon Maya*. Belmont, Calif.: Wadsworth.
- McMichael, Philip. 1991. 'Food, the State, and the World Economy.' *International Journal of Sociology of Agriculture and Food* 1: 71-85.
- National Research Council. 1989. *Diet and Health: Implications for Reducing Chronic Disease Risk*. Washington, D.C.: National Academy Press.
- Nations, James D. 1984. 'The Lacandones, Gertrude Blom, and the Selva Lacandona.' In Alex Harris and Margaret Sartor, eds, *Gertrude Blom Bearing Witness*. Durham, N.C.

- University of North Carolina Press.
- Newman, Gray. 1993. *Business International's Guide to Doing Business in Mexico*. Chicago: R.R. Donnelly.
- Nigh, Ronald. 1994. 'Zapata Rose in 1994: The Indian Rebellion in Chiapas.' *Cultural Survival Quarter 1* (Spring).
- Otero, Gerardo, ed. 1996. *Neoliberalism Revisited: Economic Restructuring and Mexico's Political Future*. Boulder, Colo.: Westview Press.
- . 1992. 'Latin American Agriculture and Biotechnology in a Globalizing World Economy.' In Jacques Zylberberg and Francois Demers, eds, *America and the Americas*. Sainte-Foy, Québec: Les Presses de l'Université Laval.
- . 1989. 'Agrarian Reform in Mexico: Capitalism and the State.' In William Thiesenhusen, ed., *Searching for Agrarian Reform in Latin America*. Boston: Unwin Hyman.
- Parthasarathi, Ashok. 1990. 'Science and Technology in India's Search for a Sustainable and Equitable Future.' *World Development* 18 (12): 1693–1701.
- Randall Ireson, W. 1987. 'Landholding, Agricultural Modernization and Income Concentration: A Mexican Example.' *Economic Development and Cultural Change* 35 (Jan.): 351–66.
- Raynolds, Laura T. 1994. 'Institutionalizing Flexibility: A Comparative Analysis of Fordist and Post-Fordist Models of Third World Agro-Export Production.' In Gary Gereffi and Miguel Korzeniewicz, eds, *Commodity Chains and Global Capitalism*. Westport, Conn.: Praeger.
- Rodríguez Chaurnet, Dinah. 1992. 'La Brecha biotecnológica entre México y Estados Unidos-Canadá.' In Calva Tellez and Gómez González, eds, *La agricultura mexicana frente*.
- Russell, Philip L. 1994. *Mexico Under Salinas*. Austin, Texas: Mexico Resource Center.
- Scott, David Clark. 1992. 'Mexico's Reforms Transform Agrarian Sector.' *Christian Science Monitor World Edition*, Nov. 13–19.
- Spalding, Rose J. 1984. *The Mexican Food Crisis: An Analysis of the SAM*. La Jolla, Calif.: Center for U.S.–Mexican Studies, University of California, San Diego.
- Weigle, Thomas C. 1991. *Biotechnology and International Relations: The Political Dimensions*. Gainesville, Fl.: University of Florida Press.
- Zahniser, Steven S. 1992. 'Ejido Today, Gone Tomorrow? An Evaluation of Salinas de Gortari's Ejidal Reforms and Their Implications for Rural Mexico.' Unpublished paper, Department of Political Science, University of Colorado at Boulder.

15

The New Technological Imperative in Africa: Class Struggle on the Edge of Third-Wave Revolution

Abdul Alkalimat

The twentieth century is ending as a global drama full of conflict and change, with humanity torn between hope and despair. For a few the new century offers the wonder of a high-tech future, with wealth amid the birth of a new civilization; but for the majority there is fear of war, starvation, homelessness, poverty and plagues that lead to certain death. Almost all Africans share the fate of the majority, with their countries falling rapidly into various levels of social disintegration. This article proposes a framework for understanding this tragedy in class terms, in the hope of reorienting our thinking from one of hopelessness to a vision of a new epoch of revolutionary class struggle. Specifically, I examine the development of a new class as a result of the technological revolution taking place in the advanced industrial world and its impacts on Africa. Such an analysis is essential to understanding the new poverty in Africa and the accompanying political revolt of the dispossessed (Peery 1993). These notes are organized around ten propositions that together constitute this framework for understanding the African crisis, the new class and this new stage of revolutionary struggle.

Background: Classes and Class Struggle

1. Africa has been a source of great wealth for the world, but has little to show for its enormous contributions, and today it is the poorest continent with the lowest quality of