
Science and Education in Mexico: Lessons for Africa from the Transition from National Capitalism to the Crisis of Globalisation

Hugo Aboites*

Abstract

Almost two decades have passed since governments in Latin American, African and Asian countries were lured by capitalism in crisis to take their populations through the new course of modernisation and globalisation. The case of Mexico represents a good example of why and how this transition took place, why it is not working and what alternative perspectives are emerging. Seen from a point of view of knowledge in society, as is the intention here, this history is even more revealing. This paper shows how science and education, including research and schools, were first called on to play an important role in the nation-building experiment of national capitalism and how, when deprived of any clear social mandate, they have been left to float aimlessly in the market streams, independent social subjects that emerged from the contradictions of a globalising model of capitalist development. At the same time I argue that some recent developments, notably the Zapatista uprising in the southern state of Chiapas and the impetus this has given for the creation of new responses to globalisation and new organizations of academics, students and worker, are creating spaces of autonomy which were once inconceivable. I conclude that the resistance to neo-liberal policies can be decisively supported by social forces arising from science and education.

Résumé

Presque deux décennies se sont écoulées depuis que les gouvernements des pays latino-américains, africains et asiatiques ont été dupés par le capitalisme, en cherchant à conduire leurs populations vers la modernisation et la mondialisation. Le cas du Mexique est illustrateur de la façon et de la manière dont cette transition a eu lieu, des raisons de son échec et des perspectives alternatives émergentes. Cet article

* Metropolitan Autonomous University, Campus Xochimilco, Mexico City, Mexico.

décrit la façon dont la science et l'éducation, y compris la recherche et les écoles, ont été mises à contribution, afin de jouer leur partition dans l'expérience du capitalisme national ; il décrit également la façon dont, lorsqu'elles ne comportent plus de mandant social clair, la science et l'éducation se mettent à flotter sans but sur les flots du marché, tels des sujets sociaux indépendants résultant des contradictions d'un modèle globalisant du développement capitaliste. J'ajoute plus loin que de récentes évolutions telles que le soulèvement zapatiste, dans l'état du Chiapas, au Sud, et ses implications, la création de nouvelles réponses à la mondialisation et la naissance de nouvelles organisations d'universitaires, d'étudiants et de travailleurs, contribuent à créer des espaces d'autonomie autrefois inconcevables. Je conclus en affirmant que la résistance aux forces néolibérales peut être soutenue de façon décisive par les forces sociales issues de la science et de l'éducation.

Introduction

Mexico more than any other case symbolises this extreme situation. Geographically linked to the United States of America by a long, porous border and by the North American Free Trade Agreement (NAFTA), it clearly faces north and feels the pressure to enter the capitalist experiment of globalisation. Science and education clearly show this. But Mexico also faces south; the Zapatista rebellion of peasant and indigenous communities in the state of Chiapas, which started the same day as NAFTA came into effect, has become a pole that brings together Mexican and international social actors. It links present-day social subjects to the history and framework of rights created by the Zapatista and Villista rebellions of 70 years ago, as well as to labour, human, women's and political rights gained elsewhere in the world. Science and education are starting to become sites of this confluence and process of knowledge.

What are the perspectives? What will be the impact of this process on the possibility of strengthening social actors? How could this be translated into social pacts or revolutionary changes? What national/international forms will these new conformations of social and political knowledge assume? The Mexican experience cannot provide all the answers, and in any case the intent of this article is more modest. It presents the situation and hopes that different readers (and the readings from different contexts) can see through the words and images to gain more than is explicitly given.

The Building of a Social Arrangement

Class and Nation in Mexico: 1930–1982

In December 1982 a group of 'technocrats', or to use the more recent term 'neo-liberals', gained the Mexican presidency. Although they were members of the political families of the 70-year-old Partido Revolucionario Institucional

(PRI), the new arrivals clearly distinguished themselves from their predecessors in power. They aimed to radically alter the route of the country in every respect – the economy, social security and education, as well as science.

Since then the changes (especially since 1988 under President Salinas) have been in clear contrast to the strategy for nation-building centred on the peculiar model of capitalist development that was followed until the 1980s. That strategy found its clearest expression in President Lazaro Cardenas (1934–1940), who organised the nationwide pact of all social classes that the conclusion of the 1910–1917 revolution made indispensable. A rebellion with a price tag of one million deaths clearly showed the political winners that in order to avoid constant conflicts and peasant/worker rebellions in the future, any national project of capitalist development needs to be based on a clear and fair agreement between the classes. Such agreement must offer peasants clear assurances of land and the resources to cultivate it, and offer to workers (and the whole population) employment, labour rights, education, health, social security and general well-being. Instead of class struggle workers and peasants were incorporated into the struggle to create a nation. Stability for economic growth was the main objective of the pact.

In order to provide such political and social stability the state created large class organisations – from workers and peasants to professionals, bankers and industrialists. In different ways social forces would not only join the pact but also become part of the state which promoted it. For this purpose the official party, the PRI, was the key political and social instrument. It integrated all organisations and was capable of mobilising, for electoral purposes and for the provision of tangible material benefits, the vast masses of organised labour, poor urban dwellers and peasant organisations, as well as small business entrepreneurs and professionals of all categories.

On the economic side the pact was based on the concept of the ‘mixed economy’ which includes substitution of imports. ‘Mixed’ meant the coexistence of both a private and a public sector within the concept of a ‘state-ruled economy’. On the one hand it meant a strong and profitable private property regime for land, commerce, industry and the banking system. Sheltered by tax privileges industry also enjoyed a protected market (by means of the substitution of imports paired with strict restrictions on imports) and was supported by the state infrastructure, which provided cheap oil, electricity and irrigation systems. On the other hand, it meant a large industrial, commercial and financial sector administered by the state (including PEMEX, the gigantic state oil company). The state also removed or expropriated from the market large portions of land and gave it to communities in the form of *ejidos* – land granted to communities of peasants for production and not subject to sale. The concept of

the nation as the owner of all land and natural resources underlay the model of the mixed economy.

In the social arena Mexico became a nation built on large organisations as a way of ensuring political control. On the one hand the state required that bankers, employers, industrialists, ranchers and farmers each had at least one single and national organisation. Industrial and state workers all belonged to national federations made up of thousands of company unions. Primary and secondary school teachers belonged to one single national union, *Sindicato Nacional de Trabajadores de la Educación* (SNTE), which with more than one million members became the largest in Latin America. Several million peasants from all the *ejidos* were also organised in national federations. The creation of these 'blocs' of classes, together with the state domination of the economy, enormously facilitated control by the state of the day-to-day negotiation between classes. It also centralised the economic, political and social life of the country.

For millions of workers and peasants, this bureaucratic and centralised structure made it very difficult to develop ideologies and organisations independent of the state. The leaders of unions and federations, for example, comprised an important part of the PRI and the state; they had ready access to political and government positions at local and federal levels and to a well-organised system of patronage and corruption that offered extensive privileges. The authoritarian and repressive nature of this leadership made it possible to ensure control within the organisations and deep within the political life of the country. Not surprisingly, for 70 years, the PRI never lost an election for state governor or president or lost control of congress.

Nevertheless, protests and movements that attempted to recreate autonomous forums and organisations started to appear. During the 1950s and 1960s, a succession of independent movements of coal miners, railroad workers, health workers, peasants, teachers and students became part of the life of the country. These social (and political) movements expressed at least two specific contradictions within the nationalist model for capitalist development. One was the fact that soon after the deal had been completed (at the beginning of the 1940s) the state began to use it against peasants and workers. Agrarian reform drastically slowed down and the salaries of teachers, workers and other groups dropped by half in real value around 1942, while by the 1950s the emerging bourgeoisie and the political class were obtaining high profits. Technical rural schools were closed, and the article of the constitution that made 'socialist education' mandatory in all public schools in the 1930s was changed to 'education for the harmonious development of the person' in the 1940s. The second contradiction was that large organisations deeply committed

to the survival of the state could not embrace and channel popular unrest. The leadership reacted to independent movements by further centralising the system and repressing dissent within organisations. The resort to more overt police and military force became more frequent. Both the protectionist policies for the development of national capitalism and the centralised bureaucratic climate emanating from the state control apparatus worked together to limit and suffocate many strategic spaces for capitalist development itself, including, among others, the development of knowledge. Science and education were key elements of this complex social arrangement for development, but at the same time they showed its structural limitations.

Science and the Private Sector

Implicit in the national pact was the understanding that the private productive sector was not required to develop its own research infrastructure. This was a result of the emphasis placed on guaranteeing a market favourable to private manufacture and thus promoting jobs for a fast-growing population (averaging 3.5 per cent annually). The policies went as far as favouring the creation of a network of semi-monopolies where each segment of the market was dominated for decades by one or two firms. Large companies prospered from the abundance of public contracts, many obtained through close relationships between businessmen and politicians. Business in general benefited from the advantages of a state that had a strong share in the economy and was able to offer inexpensive energy (from state electricity and oil industries). Business also benefited from a cheap, disciplined work force as well as from agricultural products at very low cost, both resulting from tight control over the unions and peasant organisations and the drain of the surplus from subsistence agriculture communities. Political stability and strong barriers to imports completed an environment built for the development of national capital but which provided little incentive for private development of science and technology.

More specifically, the policy of import substitution allowed many industries and workshops to use the same technology for decades. Table 1 clearly shows that of more than 2,000 centres or research units existing by 1984, only 55 had been created by private industry in the previous sixty years. Organised mostly around the state, the research infrastructure closely reflected, even geographically, the strong political tendencies towards centralisation that were part of the basis of the general arrangement. As can be seen in Table 1, the individual states have practically no research infrastructure – only 23 centres (less than one per cent of the total). Moreover 236 of the 388 research units belonging to the federal government – more than half – are located in the capital (Mexico City), while the rest serve 31 states.

Table 1: Distribution of research units in Mexico (1984)

Public higher education institutions	900
State enterprises	732
Federal government	388
Private higher education institutions	97
Private manufacturing firms	55
State governments	23
Non profit-making private organisations	2,206

Source: compiled by the author with data from *Directorio Nacional: 1988*. 'Research unit' is a general term for research centre.

Higher Education and the National Experiment

In the educational arena the state sought to establish a continuous flow of cadres for industry ('human capital'), but this concept alone does not reflect how intrinsically the purpose was laced with national, social and ideological goals and how important this was as part of the overall arrangement. The need to offer a clear path of social mobility and to strengthen ideological support for the deal coincided with the requirements of a growing economy. In 1937 the National Polytechnic Institute (IPN – initials in Spanish) was created in Mexico City because, among other reasons, the old national university, Universidad Nacional Autonoma de Mexico (UNAM), was not technically orientated, and its liberal-aristocratic culture had led to tense relations with the new post-revolutionary state.

Directly administered by the state, the IPN underscored the strategic importance of a new education system and strong higher education. This was further made clear by the nationalisation of foreign oil companies (Dutch, British and American) a year later. This immediately required hundreds of technicians who were capable and eager to explore and manage technologies that were not their own. The new professionals coming from higher education institutions, resourceful and nationalistic, were drawn from the families of workers, peasants and other similar social segments. They were specifically recruited and given free room and board at the IPN, at some universities and at agricultural and teacher training schools. Although not a very large sector (total enrolment in higher education in those years was no higher than 100,000), higher education thus became a clearly open road to social mobility.

The purpose of creating a new breed of technical but nationalistic institutions to provide the necessary manpower and a wider educational opportunity for the working class was advanced in the 1940s with a whole system of technological institutions that began to be established in every corner of the country (Institutos Tecnológicos Regionales). The qualified professionals and high-level technicians they trained were in high demand, not only by the nationalised oil and electricity industries, but also by the thousands of state plants and centres and by the growing private industrial and commercial sectors. The new shape and orientation of higher education resulted in the creation of a small but very influential segment of the population that went on to fill positions in the universities, government agencies and private firms. Its popular origins and nationalistic but generally progressive ideology fitted well into the structure of a state that had to integrate the masses, follow an independent position in foreign policy and repress the excesses of the right while maintaining the general order needed for investment and profits.

Given that the state had emerged from a violent social revolution caused mostly by peasants seeking land, it needed at the same time to use education and the generation of science to integrate peasants into the new post-revolutionary national identity and into an allegiance to the state. It also needed to support the productive aspect of the land reform process. For this purpose tens of thousands of rural basic schools were created in a centralised and vertical structure headed by the federal Ministry of Education. In addition the Chapingo National School of Agriculture (later to become a university) and other similar institutions around the country were converted from their previous orientation towards 'hacienda' production and overhauled to provide cadres for the creation of the public structure for research and technical support for the ejido land distributed by the millions of acres.

All these institutions, and above all the Autonomous National University (UNAM), were well endowed for research and for the diffusion of knowledge. They bore the seeds of what would become an important if not a large system of state-supported research centres in the country. So the state effort in science and technology was developed in close contact with the formation of technicians and professionals in public institutions. Moreover a wide range of research centres and technical programmes within the state, public firms and government offices offered abundant opportunities to graduates for permanent employment at middle and higher level positions. Clearly science and education played an important part in the state project of nation building.

Ironically it was precisely in the area of higher education that the experiment of national capitalism showed what was perhaps its most definitive sign of a crisis in the culture of subordination and control. Dramatically in 1968

this involved the killing of hundreds of demonstrating students from the IPN and the National University in Tlaltelolco by the army in Mexico City. Three years later, in 1971, the state responded again to a massive peaceful student demonstration with a bloody attack by armed paramilitary forces, again in Mexico City. Not surprisingly, around the same period, scores of students and peasants joined some of the urban and rural guerrilla groups that made their appearance in these years. At the same time a movement of rebellion against the state-supporting leadership of the electrical workers union erupted, while strikes were declared in other key industries (something rare within the rigid framework of state control of unions). The period also witnessed the creation of new and independent unions, especially of highly militant faculty and clerical workers in every public university in the country.

This political crisis in the experiment of national capitalism neatly expressed the growing distance between a nationalistic and authoritarian state on the one hand and the universities and an important sector of the working class on the other. Lessons were being learned from a deal that had not been fulfilled and from decades of subordination which were reflected in the universities. Furthermore students saw that the state – which had generated its own nationalistic proposal for knowledge and ideology and had even borrowed other ideologies (like Marxism) to create a platform that would sustain its popular commitment and appeal – would not allow workers, students, employees and the progressive middle class to take autonomous class initiatives. Universities such as Nicolaita in the state of Michoacan, and even the national university, became examples of institutions that during the 1960s opened themselves to wider populations, generated social visions and practices that linked them to peasants and workers and in some instances adopted ideological positions highly critical of state control and subordination of the social classes.

The now troubled state could not open up possibilities – as it had done in the 1930s – because the less visible but rapid deterioration of the economy (especially in agricultural production) was increasingly trapping the state within its own set-up. As the economic crisis began to encroach, the private capitalist sector pressed for more privileges within the deal (fiscal reform, money parity, infrastructure, stability). These demands obviously created further tensions with the other social classes. The more profound limitation of the state was that in order to survive it could not allow the growing of circles of autonomy around itself, as this would only make it less and less capable of operating as an umbrella for all classes. The experiment of national development of capital was reaching its limits.

In the 1970s the state attempted to solve the crisis by renewing the original agreement and offering economic stability again. It started a policy of relying

on foreign loans and on massive exports of oil. In the realm of education and science it tried to strengthen the public research infrastructure and to widen the realm of industrial knowledge that was not subject to patenting. At the same time, and as a social element of the renewal attempt, it offered the restless youth a dramatic expansion of the opportunities for access to higher education institutions. Not surprisingly it did so following the old tracks of centralisation. In 1970 the federal government created the National Council for Science and Technology (CONACYT— initials in Spanish) which further concentrated science and technology in the hands of the state. CONACYT started as an exceptionally well-subsidised programme for financing research projects in public and private centres and as a way to revamp the aging research plant in the technological institutes and universities. It also sent hundreds of young Mexican students abroad to be trained as scientists, professors and high level professionals, but more importantly it was in this period that the real bulk of the research infrastructure of the country was created by the state. Of the previously mentioned total of more than 2,000 centres that had been created by 1984 (Table 1), 50 per cent were first created in the 1970s.⁷ In the same vein important changes were introduced in the laws regulating foreign investment (1973) and intellectual property (1976) in an effort to create the basis for the national development of science.

According to the new law foreign investment should not displace Mexican firms but should create jobs, employ Mexican technicians and further qualify them, at the same time using national supplies and parts for its products. Foreign investment should also contribute to the development of certain regions and provide technology and research for the development of technology in the country. Intellectual property on the other hand was strictly limited. The new laws defined wide areas of knowledge which could not be subject to patenting or commercialisation: animal and vegetable varieties, alloys, food and drink for human consumption, bio-technological processes and products (including medicines, fertilisers, food for animal consumption, herbicides) as well as genetic processes for animal and vegetable varieties that were considered of strategic importance to promote national development (Aboites and Soria 1992).

In order to promote access to higher education and thus regain some leadership among the increasingly politically aware Mexican youth, the federal government substantially raised the proportion of federal subsidy in the state universities from less than 10 per cent to more than 50 per cent and created many new universities and technological institutes. As a result national enrolment in higher education went from less than 300,000 to nearly a million from 1970 to 1980. Also the federal government organised centres for scientific research and development inside and outside the universities and created or

strengthened programmes to link higher education with rural and poor urban areas. It also came to accept the existence of unions in public universities.

However, these and other efforts were unsuccessful in renewing the vigour of the national deal. Apart from inside factors, the growing pressures arising during this period from the effects of world capitalism were devastating. The effects were felt in Mexico as prices of raw materials fell and signs of a looming debt crisis appeared. The country's huge oil reserves and large markets had attracted American and European banks, whose officials literally waited in the reception areas of the treasury offices to offer loans, but by the beginning of the 1980s the situation had become critical. The federal government began to have problems covering the interest on the national debt and in 1982 had no choice but to declare a moratorium on the debt and suspend all payments to foreign banks.

Dismantling the Arrangement

The Entrance of Globalisation

When the neo-liberal group within the PRI obtained the presidency of the country in 1982, it rejected the proposal of Brazil and Venezuela to create a debtors' cartel and collectively renegotiate the loans. Instead it chose to comply fully with the structural adjustment plan required by the International Monetary Fund (IMF) as a condition for financial support. In effect it used the debt crisis to declare the end of the Mexican experiment of seventy years and to create the political conditions for deep changes.

In the early 1990s a change in the constitution ended land reform and opened the ejidos to commercialisation. Social security was reformed to bring the resources of workers' pensions previously held by the state onto the investment market. The number of state firms dropped from more than 4,000 to less than 300, the majority being sold or simply closed down. The banks, the last bastion of nationalisation, were all sold back into private hands. Investment areas which had been restricted or forbidden to foreign capital (including private education at all levels) were opened up and conditions on investment were abandoned. Intellectual property norms also changed drastically to adhere to US proposals. Meanwhile state education was decentralised to individual states and local governments, a move that made education accessible to private investment. In higher education the expansion of enrolment stalled, tuition fees were imposed or raised substantially, corporations began to establish links with universities and faculty unions' bargaining powers were severely restricted. Salaries in higher education institutions (as well as for most workers) fell by half in real value.

However the main change was the substitution of a national paradigm for development by a globalisation paradigm based on participation in the North American economic bloc. This meant signing the 1992 North American Free Trade Agreement (NAFTA), an instrument that came into effect in 1994. This trade agreement became the new charter for the creation of a completely different social pact in Mexico that, as elsewhere in the world, followed the basic proposition that economic growth and welfare for all would follow from the opening of as many spaces as possible (including science and technology) to the market and to the flow of international capital. This implied a new role for the state in the economy and also in the social sphere (education, land reform, unions, social security, etc).

The new deal meant a change in social actors. Large organisations of peasants and workers, together with the PRI itself, could no longer be decisive. The role of old actors was transformed, while new actors began to emerge and becoming powerful in the life of the country: a federal government now in the role of an agency paving the way for change and foreign financial and industrial conglomerates (in some cases associated with national firms) and international organisations headed by the most influential world bodies (OECD, IMF, World Bank, APEC, WTO), acting as external regulators of the process. In specific areas such as higher education international coordinating groups have been created to take the important decisions.

There has also been a relentless effort – so far largely unsuccessful – to create a basis of social support for this new state. While there is a trend to create stronger national and international organisation of corporations and governments inside Mexico, there is a trend to dismantle the role of large organisations of workers, peasants and employees or to leave them with only a marginal role and to base the support of the new state on an undifferentiated social mass. Mexico is no longer a nation of organisation but of individuals. The social pact is thus based on the promise of an abundance of well-paid jobs and on the empire of the law to defend an individual now without participation in the running of society. Education, science and technology immediately reflected this change.

Change in Education

Education is no longer considered part of the process of integrating thousands of youngsters into a nation-building project and promoting development and social mobility organised by the state. In most cases it is now conceived as the basic provision (together with some health care) offered to the individual by the state to reach a level of productivity that will enhance the opportunities of

finding a job and providing family welfare. This approach brings about a radical degradation of education for large masses everywhere.

In a country like Mexico it arrives in a context already devastated by the unfulfilled promises of the national experiment and by the new IMF policies on expenditures in education. Only twenty-eight of every one hundred of those who start elementary school now reach middle-higher education (education for those at 15–18 years of age) and only fifteen enter higher education. This trend has been legally encouraged by a change in the constitution (Article 3, modified in 1993), which opened the door to the federal government's interpretation that for all practical matters the right of the individual ends with basic education. The deprivation of knowledge is also clear in the emphasis on education as a tool for productivity emptied of any social project of wider cultural horizons or of links with communities and land. This is having an influence on the basic-level curriculum but notably more on middle-higher education and higher education. In higher education, perhaps the best example is the signing of an agreement between the Ministry of Education and representatives of the private sector which resulted in a completely different breed of institutions of higher education.

The new Universidad Tecnológica is creating an alternative to the old technical institutions which originated in the 1930s and to the model of autonomous universities that flourished in every state during the 1970s. The Universidad Tecnológica is a publicly financed, two-year industrial college that charges relatively high tuition fees and offers students a work and study programme at nearby industrial plants (*estancian industriales*) according to study plans designed by the representatives of those same firms. Although these institutions are established and financed mostly by the Ministry of Education, each is administered by a board composed half of representatives from the local governments and half of executives from the above-mentioned firms. These so-called universities are really training centres for particular industries. They lack any intention or infrastructure for becoming centres for the generation of science and technology while forming well-rounded professionals. The old technological institutes feel the pressure of money going into that other model and are trying to adapt, for example, by issuing two-year certificates, reducing the student population and establishing closer relations with industries. The message from the government is clear: 'competitive professionals and technicians (and research) are required to make our industry and our services more internationally competitive' (Poder Ejecutivo 1996).

The change in the general scope of education has been linked with a still small but significant change in terms of who should run higher education. Instead of a national and nationalistic perspective Mexican higher education

now readily adopts the NAFTA platform for higher education. In fact, right after the signing of the NAFTA agreement – and deriving from it – a Higher Education Task Force was established in Wingspread, Wisconsin. Its members are presidents of universities and corporations as well as government officials from the three countries. They discuss and agree on the tri-national agenda for higher education, establishing transnational educational policies to homogenise education and science in the three countries, to increase the efficiency of institutions and to create three tri-national markets of students, faculty and financial resources (Aboites 1997). Under its umbrella, efforts are now underway in fulfillment of what was agreed in NAFTA to create tri-national procedures for certifying professionals. These will create uniform professional profiles and study plans across the borders (without any consideration for the profound differences between the three countries). In practice this task group initiative will take away the running of higher education institutions that in the past was negotiated somehow between the state and self-governing bodies of universities and transfer it to corporations and governments.

Directly related to equalisation of the professions across the borders, the Mexican government is now trying to fill the gap that it assumes exists between Mexico and the other two countries in terms of certification and accreditation procedures through a higher education examination for each profession (Examen General de Calidad Profesional), a test made up of 300 multiple-choice questions. This move is intended to centrally monitor the efficiency of all institutions and, by giving each graduate a precise score with two decimals, to precisely regulate their entrance into the labour market. This exam will create a single and standardised body of knowledge in each profession, something absurd in a pluri-cultural country that is also extremely diverse in geography, social and economical structures. For example students of civil engineering who live and will most likely work in the arid plains of central to north Mexico will be forced to study maritime port construction to pass the exam because corporations that indirectly and directly participate in the selection of themes are interested in this type of topic instead of those related to the needs of small towns and communities, such as solid waste disposal, water recovery or rural roads.

In middle-higher education there are also modifications in the study plans (with the emphasis on computing, math, science and English as a second language), but change is most visible in the effort to de-emphasise general or university-leading education. In substitution for the so-called traditional education that leads to college, professional or specialised technical studies, the federal government now actively promotes the option of a bare technical or vocational education. The call for this type of technical study is not based on

the Mexican educational situation and labour market. Many more university graduates are needed in a country of 95 million where only a little more than two million have four years of higher education (that is, less than 2 per cent, while in the US it is about 22 per cent). On the other hand employers clearly prefer general education graduates over those existing schools that are known for their lack of academic resources, anaemic curriculum and concentration on only a few competences. The new system is a far cry from the concept and practice of technical education of the 1930s. They now charge tuition, they do not have the necessary infrastructure nor full-time teachers and their pedagogical scope is extremely rigid and limited.

Since few youngsters prefer this education, recruiters use not only massive persuasion (school counselling and TV ads) but also plain coercion. For example the *Examen Unico* is a 128-question multiple-choice test that is applied every year in one day to a quarter of a million students seeking to enter public post-secondary education. First implemented in Mexico City in 1996 it does little to measure the academic merit of the student but has become a handy instrument to channel youngsters demanding general education into vocational studies. As technical education is practically terminal this one-day exam pretty much defines the future of many students in an irreversible manner. A few public and private schools and universities of 'excellence' offer a general education track to a small number of students, but thanks to the tests, joining these schools is increasingly being determined by family income, gender and social class. The educational pauperisation of large numbers of children of workers and peasants closely reflects what is happening in the productive arena. As small businesses and workshops disappear and modern firms provide little employment, the dominant education perspective is to prepare personnel for a country whose industrial plant increasingly consists of *maquiladoras*, foreign-owned assembly plants (mostly near the US border) making products mainly for the US market and paying very low wages (as little as five dollars per day). Meanwhile, the informal market employs at least 32 per cent of the work force.

Change in Science and Technology

The general approach to science and technology has also suffered an important transformation during these years with a radical change in the general purpose of research. This is the result not only of the changes in the goals of the higher education institutions and research centres described earlier but also of the void that is being created by a number of factors: the selling or closing of state industry, the end of land reform and of free education, the growth of privatisation of many areas of social welfare, and the disappearance of most of the orienting poles and recipients for state-promoted science and technology.

Therefore ‘to serve the needs of the society’ (a common expression in the founding charters of Mexican public universities) is coming to mean something achieved through the alliance of universities and corporations.

In a Mexican public university, after signing an agreement that grants an American manufacturer (and producer of military technology) the free use of institutional buildings and academic resources for research, its president summed things up by saying that both the university and the Parker Hanniffin Corporation ‘share the idea that the quality of life of our people depends in our ability to educate and to generate knowledge’ (Organo Informativo UAM 1993). The statement clearly reflects the change: public science no longer is promoted and sustained by the state; instead the responsibility now rests on the association between the public infrastructure of research and the private sector. However, in the case of Mexico, this association means little commitment from the free market and lots of state subsidy, since industry has practically no research infrastructure of its own (see Table 1). Even foreign firms such as Parker Hanniffin do not pay the university a penny. Resistol, a large Mexican chemical corporation, is one of the few that has always had its own research centre. It has only twenty full-time researchers, but thanks to a successful ‘mega-research project’ it has now expanded to include the research teams of at least three Mexican public universities. Yet the cost is very modest for the corporation: 40 per cent is financed by CONACYT, the federal agency for science and technology, 35 per cent by the institutions involved and only 25 per cent by the corporation (*Investigacion y Desarrollo* 1994: 6).

This type of association is only accessible to larger firms – those which have the technical capability and vision to define projects and specify demands of knowledge, to propose coherent research programmes and to use the information productively. In Mexico this means only a few hundred manufacturing firms can take advantage of the globalising economy. The rest, about 120,000, are certainly not the prime focus of attention for the new science or the new educational strategy.

Slogans such as ‘frontier of knowledge’, ‘international competitiveness’, ‘globalising’ and so on constitute implicit but powerful parameters. They send a clear message to academics and scientists: the focus should be placed on joining the international circuits of knowledge, not on local, regional and national needs nor based on the traditional regional history of appropriation of technology. The result is that the contribution of science and technology becomes marginal in comparison to the developmental needs of the society as a whole. To put the university to work on generating a new glue for shoe soles, a more efficient cleaner for floor tiles or an ‘ecological’ nail polish (some of the

products generated by the Resistol mega project) make the university a mere workbench for industry (Organo Informativo UAM 1994).

In contrast other university research that is more important is neglected or its value diminished by its incorporation into the commercialisation circuit: a detailed map of the seismic areas of the Valley of Mexico, the development of fertilisers that can be easily produced and applied by peasants on their small plots, a vaccine against cysticercosis in hogs, against diarrhoea or against the virus linked to cervical cancer, a detailed analysis of the national budget from alternative social perspectives a test on the contamination present in milk and other food products, etc. This type of research that focuses on the public interest now has a harder time prospering because public networks formerly used to transfer knowledge to social needs have been dismantled or relegated to the fringes of the scientific mainstream. For example researchers who mapped block by block the entire metropolitan area of Mexico City, where 18 million people live, had to witness how insurance companies used their efforts. They now have a way to establish with accurate precision a quotation for seismic risk for practically every house or building in the area. Commercialisation of knowledge is now actively pursued in universities through the creation of foundations, small high-tech firms or by advertising their innovations in magazines devoted to that purpose. The legal changes imposed on intellectual property in 1991, which turned previously restricted areas into patent-ready knowledge, have contributed to this process. The legal competence of the state to defend the public interest in this area also shrunk with the change in the law. As a result most of the work done in public research centres is now subject to commercialisation. Bonuses offered to faculty for each patent further encourage this trend.

In summary the practice of science in Mexico is quickly redefining its social scope. Once conceived together with education as an instrument of class agreement, science is now one more of the elements that contribute to polarising society. Beside the elements of globalisation at play and the general failure of the national experiment, the drastic change in science and education in Mexico has been made possible thanks to the authoritarian structures and culture of the post-revolutionary state. The new culture of globalisation has been superimposed on the authoritarian political structure of the past that still survives and makes the country run. At a nod from the president and his team laws and even constitutional articles have been changed, financing for universities and research centres redefined and the budget for education and science restructured. Another factor of change has been the fact that privatisation has been taken up by groups of academics who were tired of the bureaucratic atmosphere of the old regime, as a way to regain personal and group initiatives, to provide more active meaning for

research and development and to reshape the professions and educational work in general. Because of the persistence of old authoritarian practices, not even in this respect have the promises of the new order come true.

The Renewal of Class Conflicts

As the process of undoing the social pact progressively advances from one of the main areas it previously included to another, crisis explodes in a myriad of social conflicts. Without any deliberate and comprehensive attempt to establish a new agreement among classes, the possibilities of a new experiment in capitalist development rapidly diminish. Conflicts have erupted around union leadership and are slowly changing the previously passive role of labour. Increasing pressures from the US provoke strong nationalistic reactions. At the same time the PRI is not only losing elections, but its process of disintegration is dotted with political murders between the inner factions (including the assassination of the PRI presidential candidate and of the general secretary of the party, both in 1994) and denunciation of drug money financing their political campaigns and of the involvement of important figures in drug trafficking.

In this situation of political crisis the state becomes just one more of the factions rather than an arena for mediation. It is losing authority and control among criticisms of its handling of the economy, obscure and substantial subsidies to large companies and banks, the passing of overtly partial judicial resolutions and the mishandling of social and guerrilla conflicts. New actors have appeared in this complex context, the centre left – the Party of the Democratic Revolution (PRD), with Cuauhtemoc Cardenas as the informal leader, the right through the National Action Party (PAN) and the Church. The latter in particular is gaining strength as the process of political instability, which started with the end of the previous deal, is followed by a social disintegration that is making many Mexican cities insecure and violent.

The absence of a deal between classes tends to create pressure for rupture in every area, to make solutions difficult and thus to weaken the leadership of the state. Neither the new state nor NAFTA show can be a firm base for a new proposition of class arrangement. So far the globalising economy's promises of jobs, justice and the stability of free and democratic elections are not being fulfilled. From 1960 to 1982 jobs increased at a rate of 4.9 per cent a year, but in the past seventeen years jobs increased at only 0.2 per cent a year, and wages are still far from regaining their 1982 level in real value (Labra 1998). Conflict, insecurity, the recourse to old political practices and public and private corruption directly contradict the promise of a state based on the individual's trust of a protective, expeditious and fair justice system. Although fraudulent elections seem to be a thing of the past, the economic and social crisis is forcing

political parties to mobilise large social groups and to enter directly into the daily dispute about how to run the country, thus further weakening the role of the state. The environment created by NAFTA in the economy, as well as in education and science, does not show a betterment of conditions for the majority of the population. On the contrary, peasants, workers, students, and indigenous groups, whose situation changed little in the seventy years of the previous model, are now losing any hope that the new order will ever bring a clear improvement.

New Perspectives

Zapatista Movement

In this context the Chiapas-based Zapatista movement in the south is the main political perspective open to the large masses of disenchanted Mexicans. It has been able to embody this sense of national crisis deriving from the unfulfilled promises of the past and the rejection of a new deal that falls even shorter than the old. An armed rebellion of indigenous people that started the same day (1 January 1994) as NAFTA came into effect certainly does not assume the perspective of starting a revolutionary period and overthrowing the government. Its value lies rather in dramatising the willingness of many indigenous communities to literally die rather than to accept the terms of the new deal. They clearly understand that it is time for defending and widening the terms already obtained through the other armed rebellions (1910–1917) without returning to the marginalisation and subordination of the previous seventy years. All this is implicit in their willingness to negotiate with the federal government and in their basic demands for respect for their culture and self-determination, and for access to education, health, housing, land, work and food for indigenous communities and for everybody in the country. It is a way of saying that any new deal, to be accepted and to work, must comply with the new references provided by struggles all over the planet for human, women's and labour rights, ecological protections, democracy and justice against dictators. By actively surviving the state strategy of military encircling and by maintaining their demands since 1994, the movement has introduced a new element into the process of seeking a new deal. Without this movement as a point of reference of what should be demanded it would have been much easier to pressure the peasants and working classes into passively accepting the new terms. The presence of a rebellion, armed, defiant and active despite being surrounded by the army, has a historical significance which explains the government's outright campaign to end this defiance quickly. The recent 1996 emergence of at least two more guerrilla movements (the Popular Revolutionary Army, EPR, and

the Popular Revolutionary Indigenous Army, EPRI) with influence in three more states of the republic simply underscores the point.

Perspectives Arising from the Realm of Science and Education

Science and education, like many other areas where the future of the country is being decided, are affected by the Zapatistas and by the specific contradictions of the globalisation project in different ways. Perhaps the most important is that again, with their mere presence, the Zapatistas have begun to offer the possibility of creating a new frame of reference for knowledge and education. There are at least two main reasons for this.

First, the Zapatistas and other social actors in Mexico have succeeded in creating an alternative pole to NAFTA's interpretation of which direction the new social arrangement should follow, including the possibility of discussing a different approach to science and education. The implicit Zapatista proposal seems to be: preserve what was gained in the 1910 revolution by peasants and workers, expand it for everybody and for every village and region in Mexico and enrich it with the lessons of other struggles around the world. This is in fact an agenda for education and science – for redefining the country in the crisis of globalisation. In fulfilling this agenda some concepts begin to appear as fundamental, for example, autonomy, class, community and region, nation, democracy in education and access to knowledge. Autonomy from the state and corporations not only for universities and schools but also for teachers and university unions. Class as the basic pole of reference for identity and interaction in the regional, national and international context and as the basis for the participation in organisations, community and region as the reference points for systematically recovering local knowledge and technology and returning it to social groups in the form of research, diffusion, professionals and educated youngsters. Community and region in the form of educating for strong participation in local democratic processes and also as the pole of reference for establishing relations with other regions and the nation, as well as with other social groups in other countries. Nation as the understanding of the need to establish wide national class agreements beneficial to everybody based on a particular history and culture identity. Democracy in education as a way to create an educational process that provides rich experience in participation, in collectively determining the knowledge needs of the community and region, establishing them in the curriculum and creating the educational experience. Access to knowledge as a way of emphasising the right to education and the need to have the required resources for everyone to have access to all possible forms of knowledge in the most advanced forms. These interpretations of the role of

education can offer something that is most valuable: The contribution to the setting of new and higher levels of demands by the working classes, peasants and indigenous groups everywhere in the world, standards of a world civilisation that only these classes can offer.

Second, the Zapatista movement has converged with movements that are creating new social subjects or actors in science and education and are strengthening others which already exist. They help to generate the social basis for making possible a new approach to education and science. For example, a few days after paramilitary forces executed forty-five children, women and men, members of the Zapatista Acteal community, 2,000 scientists and academics, most of them members of the presidential National System of Researchers, organised themselves for the first time to 'pressure the government ... to avoid new killings' (*La Fornada* 1998a). Then this one-third of the elite membership of the 'president's men and women of science' also undertook to find ways by which they could put science at the service of these communities. This public stance was not spontaneous; it had been preceded by years of intense involvement by university students, faculty and unions in support of the Zapatistas and even in direct work in the besieged communities. The novelty of the initiative consisted of who they were and the impact of their action. For the first time they drew the whole national higher education apparatus into the debate on Chiapas. Shortly after they spoke, the Colegio Academico of the Autonomous Metropolitan University, the foremost public university of Mexico City, issued a defiant statement urging the federal government to comply with its signed commitment in the San Andres agreements, the disbanding of the paramilitary and 'the withdrawal of the Mexican Army from the ejidos and indigenous communities' (*La Fornada* 1998b: 48).

The National Association of Universities and Higher Education Institutions (ANUIES) issued a statement praising the government's handling of Acteal in prosecuting the suspects, but it also remembered the old social mandate given to the Mexican universities and stated that 'our institutions are ready to contribute to the solution of the old problems of indigenous communities of Mexico' (*La Fornada* 1998c: 13). Finally the National University itself also went public and vowed to put "its resources of intelligence, culture and science to the service of Mexican society, to contribute to solving the dramatic situation that ... [people] live in, in that region of our country' (*La Fornada* 1998d: 43).

Only a fine line perhaps, but a distinct crack can be seen now across the territory of science and higher education, and thus contrasts are beginning to appear. While a group of those scientists were visiting the communities besieged by the Mexican Army in Chiapas, in Mexico City the authorities of the

National University were celebrating the newest initiative to link academic resources to the logic of corporate earnings: training programmes for middle-level executives of corporations in the premises of the firm. For example, Glaxo Wellcome, the first beneficiary of this programme, sees this training as indispensable in order to rise 'to a position of leadership in Mexico, from its present number seven... and to achieve the goal of \$200 million a year of sales in Mexico above the present \$134m and in the Latin American market to move from \$605 to \$1,200m a year in sales' (*Investigacion y Desarrollo* 1998).

Groups of scientists who were recruited and educated in the context of a state that stressed the sensitivity of science and education to poverty and exploitation now witness how this state and the university administrators hardly consider themselves responsible for addressing basic social demands. They now have no other alternative but to act autonomously from the government. This tendency is reinforced by the interaction between the perspectives created by the Zapatistas and the bureaucratic and authoritarian policies of the government in science and education. In order to change the scientific and higher education system, the federal government has practically taken over the institutions in the last fifteen years of 'modernising'. Financing, evaluation, institutional goals, faculty and scientific training and academic reform have become direct governmental instruments for making research centres and universities market and industry-friendly. This has marginalised collegiate structures (the above-mentioned Colegios or Consejos Universitarios), unions, faculty and student organisations, as well as the intermediate decision-making forums, and has even turned the national association of university presidents (the ANUIES) into a structure subordinate to the government.

However, this tendency contradicts the drive for decentralisation and the process of political democratisation – part of the promises of the new era. While higher education becomes more and more centralised, almost an appendix to the federal government, the country has clearly started on the state-promoted decentralisation (health, basic education, etc., having already been transferred to the individual states), and this coincides with a trend towards political plurality. This puts the running of higher education and research in sharp contradiction with the cultural and political changes that are taking place in the country. Government actions such as promoting higher tuition fees, cutting enrolment, lowering faculty salaries (or tying them and research money to 'productivity'), creating sharp differences in resource availability among institutions and research centres, trashing university autonomy and linking laboratories with corporations, all now interconnect with disgruntled faculty, unions, students and scientists. All these now have to protest against authoritarianism

in their universities as well as repression in Chiapas. More importantly they do not start from zero but link with a history of resistance and organisation in the educational sector.

That history includes the first strike started in 1979 by the massive National Coordination of Educational Workers (Coordinadora Nacional de Trabajadores de la Education, CNTE) for the democratisation of the state-controlled and gigantic National Union of Educational Workers, SNTE. Its strong presence contributed decisively to the creation of a context favourable to the organisation of thousands of strikes by workers, teachers and university unions against the IMF policies in 1983. This story then continued with a long and successful student strike in 1987 at the National University which halted the attempt to start a process of 'modernising', which included a proposed rise in tuition fees.² Other successful movements against tuition hikes followed, like the one at the Autonomous Metropolitan University in 1992. In 1994 university unions struck unsuccessfully for salaries and against merit pay in a long fight which gained special significance in the powerful context created by the beginning of the Zapatista movement and by the massive urban protests against the government's military offensive of those days. Finally, in 1996 and 1998, a new kind of social movement erupted; parents, youngsters seeking school places, students, faculty and university and middle education unions organised themselves against coercive national multiple choice exams applied by the private agency, CENEVAL. New, wider forms of organisation are emerging with these new actors.

The new period has also brought about attempts to create a different type of union organisation in the educational sector. The Trinational Coalition in Defense of Public Education (1993), for example, involves large sections of teachers and faculty unions from Canada and Mexico as well as some representation from the US. This has helped to change the perspective of unions. They are now involved more in resisting and organising from a wider angle, regarding the impact of globalisation on education in the continent (like national exams in Mexico and loss of teachers' control over schools in Canada). A recent project to create similar initiatives throughout Latin America has the same sort of scope. This succession of movements, together with many other similar histories, also contributed to electorate results which were highly favourable to the left-centre party PRD in the 1997 elections. This party not only gained the City of Mexico Government but also one-third of the seats in the National Congress. It remains to be seen how this party and the city government will interact with the process of struggles and conformation of subjects in education, but in 1998 the local representatives and the city government supported without any hesitation the protests by parents and students against the

CENEVAL exams applied by the Federal Ministry of Education. They are now considering the introduction of a change in the constitution that will create autonomous and democratic running of education at all levels. If approved the proposed education system will be in the hands of communities, unions, students, parents and other social groups, and the right to education will be clearly re-established at all levels.

Conclusion

In Mexico the social sectors that sustained the now-dead experiment of national capitalism are now generating new social forces. They are creating spaces of autonomy which were once inconceivable. It is also evident that steps in this direction can be decisively supported by social forces arising from science and education. Their role is important to further clarify objectives beyond the false dilemma between national capitalism or global capitalism and to strengthen independent social actors but also to stress the value that national history plays in the formation of new social subjects. As local communities, regional forces and histories emerge from the oppressive traits of centralisation and subordination, education and knowledge can explore new roles. Perhaps the Mexican experience can help by providing an example.

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