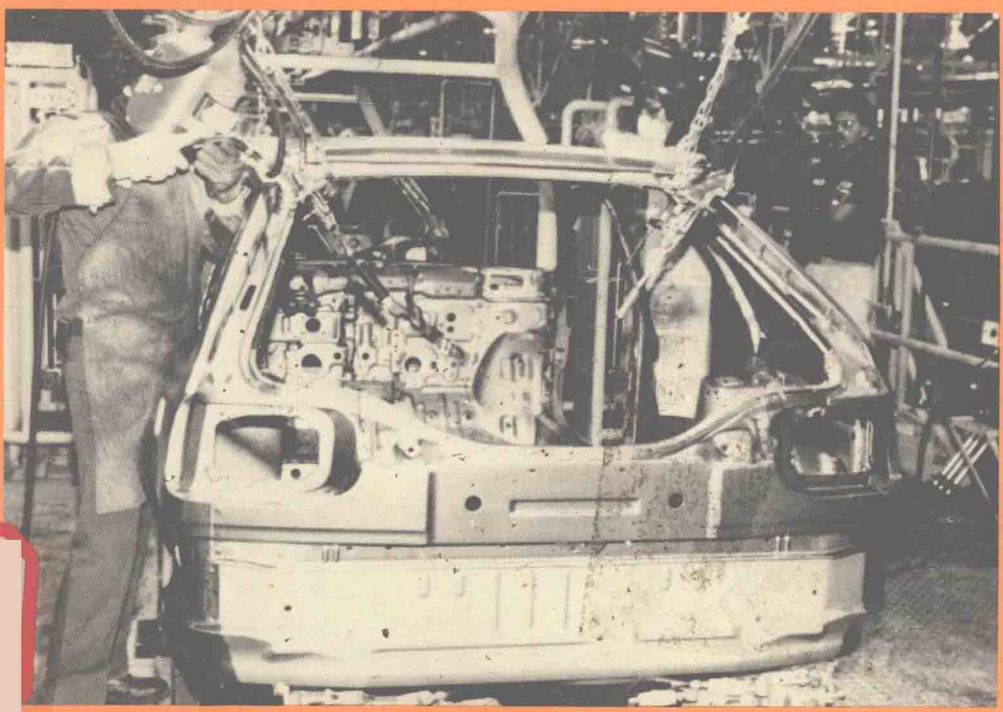
Monograph Series, 33

MEXICO IN THE GLOBAL ECONOMY

HIGH TECHNOLOGY AND WORK ORGANIZATION IN EXPORT INDUSTRIES

Harley Shaiken



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Mexico in the Global Economy

Preface

The theme of this research—the role of high technology in a new global division of labor—was first suggested by issues raised in a previous study, published as *Automation and Global Production: Automobile Engine Production in Mexico, the United States, and Canada.* In this earlier work I sought to explore the trade-offs involved in locating high technology in industrial and industrializing economies, focusing on the automobile industry. A continuing interest in the uses of high technology in a broader range of Mexican industries, including the rapidly growing border assembly plants, led me to undertake the present study. I soon found that the organization of work was central to understanding the technological questions involved and therefore decided to emphasize these organizational issues. A study in progress addresses more fully the response of workers to new technological and organizational questions.

Many individuals and institutions were extremely helpful throughout the course of this study. Isaac Mankita, a student at the University of California, San Diego (UCSD), was an exceptional research assistant, who displayed a real talent for both interviewing in the field and gathering background data. He contributed original insights throughout. In Mexico, Luis Núñez Noriega, a university student, did an excellent job of interviewing workers at the auto assembly and stamping plant. Miguel Angel Vázquez Ruiz and Sergio Sandoval Godoy also contributed useful help. Harry Browne and Larry Messerman, graduate students at the School of International Relations and Pacific Studies at UCSD, and Dan Wolf, a graduate student in Political Science at UCSD, made valued contributions at various phases of the research. Stephen Herzenberg spent many hours providing extremely valuable verbal and written comments and aided in working through central ideas in the study. My wife, Beatriz Manz, a professor at UC-Berkeley, contributed key ideas on how to conduct the fieldwork and helped shape core themes. Gabriel Székely and Greg Schoepfle assisted with useful comments on the manuscript. Sandra del Castillo thoughtfully edited the final manuscript and pulled the many loose ends together. Funding for the study was provided by the Bureau of International Labor Affairs of the U.S. Department of Labor and

supplemented through Committee on Research grants from the University of California, San Diego. Finally, I would like to thank the companies that provided access and the managers, workers, and union officials who generously contributed their time and insights.

Executive Summary

This study addresses a critical question for the 1990s: Will high-technology manufacturing take place in newly industrializing countries (NICs), or will it draw production back to the United States and other industrial economies?

A number of analysts argue that microelectronics and other flexible forms of automation will retard or even reverse the movement of manufacturing to low-wage countries. Proponents of this view stress that the skills and infrastructure necessary to achieve high levels of productivity, quality, and adaptability with new technologies are more readily available in industrialized economies. Moreover, since automation can dramatically reduce labor content, the lure of low wages diminishes.

Other analysts dispute the claim that high tech is inextricably linked to industrial economies and argue that the more sophisticated industrializing countries such as Mexico are capable of successfully operating advanced production processes. These observers contend that while automation may make wages less important in siting decisions, they are hardly irrelevant. As developing economies narrow or even eliminate the productivity and quality gap with industrial economies, low wages translate into low unit costs and make high-tech investment increasingly attractive.

Mexico has become an increasingly important place to explore the geographical implications of high-technology manufacturing. Despite domestic economic crisis, Mexico is now the third largest trading partner with the United States, after Canada and Japan. Mexico's rapid export growth in the 1980s was fueled by two sectors: *maquiladoras* and automobiles. *Maquiladoras* are assembly plants which import parts and supplies duty free into Mexico from around the world and export their production largely to the United States. Exports from maquiladoras soared from almost $2.5 billion in 1980 to over $10 billion in 1988. By mid-1989 exports for that year already exceeded $7.2 billion and the industry employed close to 450,000 workers. Despite strong growth, maquilas have developed few backward linkages to Mexican suppliers for parts and materials, drawing most of their inputs from the United States and the Far East.

Export growth in the auto industry has been equally impressive, climbing from $366 million in 1980 to over $3 billion in the first nine months of 1989, with much of the increase coming from new capital-intensive plants. Although multinational automakers have operated in Mexico since the 1920s, the industry primarily used low-volume, antiquated methods to produce for a relatively small local market. The cars that rolled off the assembly lines were widely criticized for high price and poor quality. The 1980s, however, has seen a surge of exports from a new generation of advanced plants whose construction was spurred by Mexican local content decrees, mandating that automakers domestically manufacture a percentage of every vehicle sold. The success of early export plants led major auto companies to view expansion in Mexico as an increasingly important component of their overall competitive strategy.

To better understand the prospects for high-tech manufacturing in Mexico (or other newly industrializing countries), this study examines the use of advanced automation in five Mexican plants in three industries: automobiles, computers, and consumer electronics. The plants were selected because they employ some of the most sophisticated manufacturing technologies in Mexico, and their experience therefore offers insight into future technological directions in that country's export-oriented industry. All five plants are owned by subsidiaries of large transnational corporations—three based in the United States and two in Japan—and all utilize advanced manufacturing techniques.

The auto plant, owned by a Big Three U.S. automaker referred to as Universal Motors, utilized the most advanced technology and represented the highest level of investment. This assembly and stamping facility accounted for an initial investment of $500 million, much of it in the latest production technologies. In addition, the plant employs new forms of work organization which are often associated with Japanese companies. The computer plant, also a subsidiary of a large U.S.-based company, "Zeta," assembles a product virtually synonymous with high technology but with a more labor-intensive production process. The three consumer electronics firms—Alpha, Beta, and Gamma—assemble color televisions, as well as related electronic components, and are maquilas. While most maquilas are labor intensive and low tech, these plants are part of a "second wave" of higher-tech maquiladora investments. Alpha and Beta are subsidiaries of two Japanese-owned transnationals, while Gamma is a division of a U.S.-based corporation. The Gamma and Universal plants are unionized, the others are not.

All five plants studied had comparable or better productivity and quality than similar U.S. plants operated by the same parent company.

The Universal Motors assembly and stamping plant, for example, produced the highest quality car Universal manufactured in North America. The vehicle is virtually tied for first place as the highest quality subcompact sold in the United States, surpassing many better-known Japanese rivals. The plant's novel work organization, which partially integrates skilled and production work, could prove to be a prototype for changes throughout the company's global operations.

Some other factors also stood out:

- A key factor in the strong performance of these high-tech plants was a well-educated and highly motivated work force. Given access to effective training and a cadre of experienced managers, this work force was able to acquire needed skills rapidly. In some cases, such as the auto assembly plant, the training time for skilled workers was considerably shorter than in the United States.
- Firms complained about the Mexican industrial infrastructure and border-related delays. While these problems were often serious, they did not appear to interfere with production in a decisive way.
- The Mexican plants followed a longer learning curve when first set up relative to comparable U.S. plants, largely due to work force inexperience and infrastructure problems. Once in operation, however, the plants proved to be adept at implementing new production processes and introducing new products.
- The three electronics maquilas had low inputs from domestic suppliers—less than 2 percent—indicating that the ability to operate sophisticated production systems did not automatically lead to broader industrial linkages.
- The auto and computer firms, propelled by government local content agreements, developed more extensive and sophisticated supplier networks, demonstrating Mexico's potential in this area.

PART ONE

OVERVIEW

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1

Issues and Findings

The 1980s have seen a surge of manufacturing exports from newly industrializing countries (NICs).[1] Not only has the dollar value of these exports soared, but the mix has changed as well, with high-technology goods such as computers and automobiles increasingly joining traditional labor-intensive products such as textiles. While many transnational firms are moving sophisticated production processes offshore, others reportedly are relocating labor-intensive operations from developing economies to newly automated factories in the United States. These competing trends raise a critical question for the 1990s: Will high-technology manufacturing take place in newly industrializing countries, or will it draw production back to the United States and other industrial economies?

Mexico has become an increasingly important place to explore this issue. Despite domestic economic turmoil, the Mexican economy has had a very strong export performance since 1982. "Domestic sales and imports fell dramatically after the external debt and internal inflation crises manifested themselves," according to Kurt Unger, "but surprisingly, this downturn was accompanied by an unexpected rally in

[1]The share of Third World countries in global manufactured exports rose from 7 percent in 1965 to over 16 percent in 1985. See John W. Sewell, "The Metamorphosis of the Third World: U.S. Interests in the 1990s," in *The Global Economy: America's Role in the Decade Ahead*, edited by William Brock and Robert Hormats (New York: Norton, 1990), 123.

exports."[2] As a result, Mexico is now the third largest trading partner with the United States, after Canada and Japan.[3]

Mexico's rapid export growth during the 1980s was fueled by two sectors: *maquiladoras* and automobiles. *Maquiladoras* are assembly plants which import parts and supplies duty free from around the world and export their production, mostly to the United States. The industry is diverse, ranging from high-tech electronics plants to labor-intensive textile facilities, and from ten-employee operations to 3,000-person complexes. Exports from these plants soared from just below $2.5 billion in 1980 to over $10 billion in 1988. By the middle of 1989, exports for that year already exceeded $7.2 billion and the industry employed close to 450,000 workers.[4]

Export growth in the auto industry has been equally impressive. Exports climbed from $366 million in 1980 to over $3 billion in the first nine months of 1989, with much of the increase coming from new capital-intensive plants. As a result, the motor vehicle sector went from a $1.5 billion trade deficit in 1980 to a $1.4 billion trade surplus for Mexico in the first nine months of 1989 alone.[5]

The aggregate economic data alone, however, do not tell the full story of the prospects for high-tech manufacturing in Mexico or other newly industrializing countries. To better understand these prospects and their implications, this study examines the use of advanced automation in five Mexican plants in three industries: automobiles, computers, and consumer electronics. All five plants are owned by subsidiaries of large transnational corporations (three based in the

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[2]Kurt Unger, "Mexican Manufactured Exports and U.S. Transnational Corporations," Working Paper No. 22 (Washington, D.C.: Commission for the Study of International Migration and Cooperative Economic Development, March 1990), 3.

[3]International Monetary Fund, *Direction of Trade Statistics: 1989 Yearbook* (Washington D.C.: IMF, 1989), 402–404. See also Peter Truell, "United States and Mexico Agree to Seek Free-Trade Pact," *Wall Street Journal*, March 27, 1990. In 1989, U.S. exports to Mexico were valued at $24.97 billion, and U.S. imports from Mexico totaled $27.19 billion. For a thoughtful overview of export issues in Mexico, see Gabriel Székely, "Dilemmas of Export Diversification in a Developing Economy: Mexican Oil in the 1980s," *World Development* 17:11 (1989): 1777–1797.

[4]Preliminary estimates indicate that maquila exports will exceed $13 billion for 1989. Mexican value added in the maquilas rose from $764 million in 1980 to more than $2.3 billion in 1988 and reached $1.7 billion from January through July 1989 (based on data from the Instituto Nacional de Estadística, Geografía e Informática [INEGI]).

[5]1980 data calculated from Asociación Mexicana de la Industria Automotriz (AMIA), *La industria automotriz de México en cifras, Edición 1988* (Mexico City: AMIA, 1989), 205–210. 1989 data from Banco Nacional de Comercio Exterior, *Comercio Exterior* 40:2 (February 1990):188.

United States and two in Japan) and all utilize advanced manufacturing techniques.[6]

The auto plant, owned by a Big Three U.S. automaker referred to here as Universal Motors, utilized the most advanced technology and represented the highest level of investment. This assembly and stamping facility accounted for an initial investment of $500 million, much of it in the latest production technologies.[7] In addition, the plant employs new forms of work organization—such as grouping workers into teams—which are most often associated with Japanese companies. The computer plant is a subsidiary of a large U.S.-based company which will be called Zeta. The plant assembles a product virtually synonymous with high technology but with a more labor-intensive production process. The three consumer electronics firms—"Alpha," "Beta," and "Gamma"—assemble color televisions as well as related electronic components. All three are maquiladoras. While most maquiladoras are labor intensive and low tech, these electronics plants are part of a "second wave" of assembly plants that increasingly employ high-tech processes. Alpha and Beta are subsidiaries of two Japanese-owned transnationals, while Gamma is a division of a U.S.-based corporation. The Gamma and Universal plants are unionized, the others are not (see table 1).

I selected these five plants because they employ some of the most sophisticated manufacturing technologies in Mexico, not because they are representative of their respective industries. Since they are advanced plants, however, their experience promises insights into future technological directions in export-oriented industry in Mexico. In analyzing this experience, I address a number of questions about transferring programmable automation to newly industrializing countries: How do skill levels and industrial infrastructure influence performance? What is the length of the learning curve? How do productivity and quality compare to these factors in the United States? Will the Mexican plant be able to respond quickly to market changes? And, primarily in the case of Universal Motors, can "late-developing" NICs successfully implement new forms of work organization considered critical to matching high-performance plants in advanced economies?

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[6]Transnational firms now generate about two-thirds of private-sector exports and an even larger portion of manufacturing exports. See Unger, "Mexican Manufactured Exports," 12.

[7]The plant has many of the characteristics of a maquila—it imports most of its inputs duty free and exports all its production to the United States—but it operates under different Mexican regulations.

TABLE 1

Overview of Research Sites

Company	Principal Products	Annual Output	Hourly Employment	Ownership	Union Affiliation	Location
Universal Motors	Automobiles	135,000 vehicles[a]	1,665	U.S.	C.T.M.[b]	Northwest
Zeta	Personal and Mini Computers	100,000 PC's 4-5000 Mini Computers[c]	193	U.S.	none	Central
Alpha	Color Televisions	N.A.[d]	1,000	Japanese	none	Northwestern Border
Beta	Color Televisions, Television Chasis	1,000,000 TV sets 1,200,000 Chasis	1,500	Japanese	none	Northwestern Border
Gamma	Color Televisions, PC Boards	1,000,000 TV sets, 24,000,000 PC Boards	2,500	U.S.	C.T.M.	Northeastern Border

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[a] Plant Capacity

[b] Confederacion Mexicana de Trabajadores (Mexican Confederation of Workers)

[c] Projected Output, 1988

[d] Alpha's principal U.S. plant and its Mexican plant together assemble 1,700,000 TV sets a year

The answers to these questions define the technical possibilities and limits to production transfer, that is, whether the technological underpinnings exist for a new global division of labor. A word of caution, however, is in order: The technological ability to locate high-tech production processes in a newly industrializing country does not necessarily determine whether manufacturing will move offshore. The siting of production—whether automated or labor intensive—also depends on a broader range of political and economic factors which are largely beyond the scope of this study.

AUTOMATION: IN THE UNITED STATES OR OFFSHORE?

A number of analysts have argued that microelectronics and other flexible forms of automation will largely halt, or even reverse, the movement of manufacturing to low-wage NICs. Castells and Tyson have dubbed this approach "comparative advantage reversal" because "the traditional comparative advantage of developing countries in labor-intensive activities becomes a comparative advantage of the developed countries as a result of labor-saving automation."[8] Proponents of this view stress that the skills and infrastructure to operate new technologies are more readily available in advanced industrialized countries than in newly industrializing countries. Moreover, since automation can dramatically reduce labor content, the lure of low wages diminishes. Juan Rada, for example, argues that "in a number of industrial sectors, labour cost is losing importance in the total cost, while, in other sectors, the complexity of production does not necessarily justify investment in developing countries."[9] Rada contends that some export-oriented companies are already returning from developing countries to advanced economies. Moreover,

> Areas of production that were potential candidates to move to developing countries are remaining in advanced countries because of automation of production and change in products (e.g. automobiles) or because the products are being designed for automatic production (e.g. VCRs and compact disks).[10]

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[8]Manuel Castells and Laura D'Andrea Tyson, "High-Technology Choices Ahead: Restructuring Interdependence," in *Growth, Exports, and Jobs in a Changing World Economy, Agenda 1988*, edited by John W. Sewell and Stuart K. Tucker (New Brunswick: Transaction Books, 1988), 58.

[9]Juan F. Rada, "Development, Telecommunications and the Emerging Service Economy," mimeographed (Geneva, Switzerland: International Management Institute, n.d.), 136.

[10]Ibid.