

**The London School of Economics  
and Political Science**

*Computer Bargaining in México and Brazil 1970-1990:  
Dynamic Interplay of Industry and Politics*

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Degree of Doctor of Philosophy.  
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## **DECLARATION**

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

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## **ABSTRACT**

Theories of host country – TNC bargaining seek to explain dependency shifts based on positional assets and relative capabilities. This analysis of the efforts of México and Brazil to promote and direct the development of a national computer industry from 1977 to 1990 reveals a bargaining landscape that is more dynamic than the traditional bargaining model anticipates. This thesis explains the variable nature of bargaining gains and losses by analysing the on-going, complex interplay of political, industry and market forces.

Despite industry characteristics that favoured foreign capital, both México and Brazil achieved bargaining gains in the computer industry. Brazilian state actors enticed national finance and industrial groups to invest in the industry, prompted the development of indigenous technological capacity, and limited the market influence of computer transnationals for more than a decade. With more limited policy ambition, support and duration, México had initial success prompting TNC minority joint ventures in microcomputers and extracting concessions from the TNCs for exports.

In both cases, however, bargaining gains were not secure; shifts in dependency were not progressive and one-directional. In fact, the study exposes a reverse trend toward greater dependency on foreign capital in both countries. For this reason one may not employ either case to support the obsolescing bargain in high technology industries.

This thesis highlights three factors neglected by the traditional bargaining construct: the dynamism of the global computer industry which opened and closed

windows of opportunity to re-strike the bargain, and presented enormous challenges for the states to adapt policy to the rapidly evolving industry realities; host country situational factors and the states' ability to forge and maintain coalitions of support for the policy; and the importance of firm level strategy and capability to explain the enduring success of a few national players amidst the commercial failure of so many others.

## ACKNOWLEDGEMENTS

When I embarked on the fieldwork for this thesis, little had been published on the Mexican and Brazilian experience with the international computer industry. It was clear that my research in both countries would depend on the generosity and patience of a great many very busy people in industry, government and the academy. I must therefore first acknowledge my debt to all those I interviewed. In México, I am especially grateful for José Warman and Ricardo Zermeño – the two who were in the proverbial eye of the storm in the 1980s. They not only gave generously of their time; they trusted me enough to speak openly about issues of political sensitivity and – at times – personal frustration. In Brazil, I would like to specially recognise Vivian Morgan-Mendez who lent her network and influence to open doors for me in industry, finance and government. Her generosity accelerated my work there.

Naturally, I am indebted to my supervisor, Professor George Philip. He gave important direction and guidance in the early stages of this project; his insights into the Mexican politics that constrained the policy choices I studied were especially helpful. He provided decisive encouragement to complete and submit the thesis following an extraordinary hiatus, expressing confidence in the work I had done. I am truly grateful for his patience and support.

Doug and Marilyn Stewart extended friendship and hospitality in México City, treating us as part of their family during our six months there. I am grateful for their friendship, encouragement and formative influence on our lives to this day.

I have been blessed with extraordinary parents who encouraged my intellectual curiosity and analytical tenacity, modelled integrity, industry and civic

engagement, and gave me the freedom and the confidence to follow my own insights, wherever they led. Their deep influence on me is evident in this work in so many ways.

I want to acknowledge our three daughters, Susanna, Lindsay and Amy. They have inspired and encouraged me in the home stretch and continually remind me what is truly significant.

Finally, I would like to thank my wife Dot, to whom I dedicate this thesis. She has been my faithful, loving companion for more than 27 years; that alone is enough to warrant the dedication and more! Yet she personally invested in this project from the beginning, and shared the many adventures, ups and downs of the year in México and Brazil. She has encouraged and enabled me to devote time and energy to finally complete the thesis. I am grateful for the steadfast love and grace she has shown me throughout.

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## PREFACE

Every doctoral student's experience must be common in many ways and doubtless unique in some. While the particulars of my own experience are not relevant *per se* to the academic merits of this thesis, some aspects of my academic journey to this point require explanation. This doctoral dissertation is late. Most of the concerted work for it was done from 1985 to 1988 – a quarter of a century ago. The purpose of this Preface therefore is to explain the long hiatus, clearly delineate the timeframe that the work addresses and affirm the relevance of the research today.

### **The Hiatus**

I enrolled as a graduate research student in the Department of Government at the LSE in 1985. By the end of 1986 I had refined and agreed the focus of my doctoral research and planned a year of fieldwork, self-funded from savings. My wife and I then spent two months in the United States, six months in México and nearly four months in Brazil where I conducted and documented structured interviews with a wide range of stakeholders and observers in each of these countries: directors of transnational and domestic computer firms, government ministers and officials responsible for policy implementation, trade association leaders, academics, journalists, industry analysts, and major commercial and industrial users of computer equipment and services. I returned to London at the end of 1987 and began writing my thesis. I completed a first draft in the spring of 1988.

In April of 1988, the first of our three daughters was born. That same month we exhausted our savings and I needed to find paid employment. I returned to the strategy consultancy where I had worked previously, and tried, for another year or so, to combine working full time with revising and refining my doctoral thesis. Whilst I

made some progress, the professional demands of client deadlines and constant international travel, coupled with the personal obligations of a growing family, squeezed out the quality time required to complete and submit the thesis.

In the ensuing years, my consulting career took off while my doctoral research and draft thesis languished in boxes. Nevertheless, I maintained a keen interest in developing economies and what constituted effective development policies and action. In 2002, I had an opportunity to give more direct expression to these interests. I left consulting to help start up and then lead a firm (Geneva Global Inc. – [www.genevaglobal.com](http://www.genevaglobal.com)) that researched, managed and evaluated grants to indigenous relief and development programs in the global south. Six years and \$85 million of grants later, I left to start a social investment fund providing venture capital to businesses in East Africa whose products and services generate significant benefits to low-income households (e.g., fuel-efficient cook stoves, public health information via SMS text, etc.). This social venture capital fund – SpringHill Equity Partners ([www.springhillequity.com](http://www.springhillequity.com)) – engages with live case studies of entrepreneurs, firms, industry development and government policy in developing economies every quarter. Our investment activities and approach have also generated an increasing number of opportunities to engage with academics and students about what works and what doesn't in development and frontier market investing.

This current focus of my activity led me back to the doctoral research that I did in the late 1980s on business, politics and development. The geographic focus of my current work is now in Africa, not Latin America. Nevertheless, many of the issues we encounter as investors in and partners of firms in developing economies are the same as those I studied in México and Brazil: navigating the complexities and changing

priorities of government policy, identifying sources of competitive advantage, accessing markets at home and abroad, anticipating changes in industry structure, and supporting the efforts of local entrepreneurs. I am enjoying this convergence of academic and professional interests and hope to continue in both of these active/reflective spheres in the years ahead.

In the autumn of 2010 I enquired about the possibility of reviving and submitting my thesis in order to complete my Ph.D. I was delighted (and somewhat surprised) to learn that this was allowed under the rules and determined to seize this second chance.

### **The Context**

As explained above and reflected in the title of this work, my thesis is based mainly on the world as it was in the 1970s and 1980s. The research reviews the experience of México and Brazil with the international computer industry in those two decades and identifies implications for TNC-host country bargaining in this dynamic, high technology industry. I have not initiated comprehensive new research to explore in detail the development of government policy and the informatics industry from 1990 until today.

Nevertheless, I am first submitting the thesis in 2011 with the potential benefit of more than two decades of hindsight and considerably more practical experience. It is important to understand the main policy and industry developments since 1990 to ascertain whether any of them alter (or even invalidate) the conclusions I have drawn from the cases. Therefore, in the early part of 2011 I reviewed literature that has been published on the Mexican and Brazilian cases since 1990. I have summarized these developments and their implications for each case in an *Afterword* that immediately

follows the discussion of each case (Chapters 5 and 9). My conclusions in the final chapter have incorporated these perspectives.

In each of the two cases, policy and industry developments since 1990 confirmed the key conclusions in my thesis. This is not because I was unusually prescient; the direction of travel in each case was already discernible in the late 1980s. The benefit of such a long hindsight is a clearer picture of the hyper-dynamism of the globalizing informatics industry and the difficulties such rapid, continuous change presents to policy makers and implementers. An industry was forming with global technology standards controlled by a few international companies like IBM, Microsoft and Intel. It is easier now to see the global industry structure that was emerging in the 1980s and appreciate how it placed unbearable pressure on protectionist policies, particularly as information technology became the critical lynchpin to overall economic growth and competitiveness. I am more convinced of the importance of firm level strategy and management to eventual success and failure of industry participants. And the explanatory shortcomings of static models that credit structural advantages at a point in time with bargaining victories have come into sharper relief.

### **Relevance**

Twenty-three years have passed since the first draft of this thesis was written. Is the original research still relevant today? I submit that it is, for three primary reasons.

First, the documentation of the two cases based on original empirical research enriches our understanding of host country – high technology TNC bargaining in developing economies. The Brazilian case has received more attention since I did my

fieldwork.<sup>1</sup> However, my analysis of policy impact and emphasis on the dynamic interplay between market and political forces is distinctive. By contrast, the Mexican case has continued to be relatively neglected, especially with respect to the host country politics surrounding policy development and implementation.<sup>2</sup> The case material alone on México therefore adds to the body of knowledge about the 4+ years' market reserve experiment in that country.

Secondly, this thesis adds to the body of literature that *compares* the experiences of developing economies with the international informatics industry.<sup>3</sup> The cases of México and Brazil have not been compared with a view to drawing lessons for TNC – host country bargaining. In fact, the two cases are rarely discussed together.<sup>4</sup>

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<sup>1</sup> Evans, Peter B. *Embedded Autonomy: States and Industrial Transformation*. (Princeton, NJ: Princeton University Press, 1995); Evans, Peter B., Claudio Frischtak, and Paulo Bastos Tigre. *High Technology and Third World Industrialization: Brazilian Computer Policy in Comparative Perspective*. (Berkeley, CA: International and Area Studies, University of California at Berkeley, 1992); Schoonmaker, Sara. "High-Tech Development Politics." *The Sociological Quarterly* 36.2 (Spring, 1995): 369-395; Schoonmaker, Sara. *High-Tech Trade Wars: U.S. – Brazilian Conflicts in the Global Economy*. (Pittsburgh, PA: University of Pittsburgh Press, 2002).

<sup>2</sup> Alberto Montoya Martín del Campo wrote his doctoral dissertation on the 1981 Computer Development Policy with an emphasis on investment in education and training, focusing on the development of professional technical competence in the country. Montoya completed his research in 1986, just after the policy was decisively tested by IBM and the U.S. State Department. Montoya Martín Del Campo, Alberto. *Mexican State Informatization Policies [Unpublished PhD Thesis]*. (Stanford, CA: Stanford University Department of Education, 1986). See also the book Montoya edited, Montoya Martín Del Campo, Alberto, ed., *México ante la revolución tecnológica*. (México, D.F.: AMIC, Editorial Diana, 1992); and Borja, Arturo. *El estado y el desarrollo industrial*. (México D.F.: Centro de Investigación y Docencia Económicas, 1995). In his book, Borja offers useful comparisons of different policy instruments adopted by México, South Korea and Brazil.

<sup>3</sup> Brazil's experience with the international informatics industry has been compared at some level to India and Korea in the mid- and late-1990s in Evans, *Op. Cit.*, 1995; and Evans, Frischtak and Tigre, *Op. Cit.*, 1992.

<sup>4</sup> A summary comparison of the impact of liberalization on the computer industries in México and Brazil can be found in Dedrick, Jason, Kenneth L. Kraemer, Juan J. Palacios and Paulo Bastos Tigre. "Economic Liberalization and the Computer Industry: Comparing Outcomes in Brazil and México." *World Development* 29.7 (2001): 1199-1214, though there is very little discussion of host country politics or host country – TNC bargaining in the article.

Yet the two cases are interesting, not just because they offer a test and potential refinement of bargaining theory in high technology industries. Both cases developed in a period of national history characterized by growing democratization and transition to free market economies – economic policies that have largely endured to this day.

Thirdly and finally, I submit that the long hiatus offers an advantageous possibility that didn't exist when the thesis was originally drafted in the late 1980s. It is possible now to view the Mexican and Brazilian cases with hindsight that is long enough to see them all the way through the liberal market reforms of the early 1990s. Conclusions and implications drawn from the analysis of the cases can be offered with more certainty. In the late 1980s I could assert that bargaining gains were not secure. Today I can more confidently distinguish transient from longer lasting gains and identify the relative importance of policy, industry structure and dynamics, and country-specific assets such as the size and geographic location of the domestic market.



## CHAPTER 1

### INTRODUCTION

#### **Overview**

This thesis charts the attempts of Brazilian and Mexican state actors to promote and direct the development of a national computer industry from 1977 to 1990. The primary aim of this research project is to explain the policy initiatives followed and the factors that explain different policy outcomes in the two cases, thereby enriching our understanding of host country – TNC bargaining, emphasising country-specific factors.

The bargaining construct rests on four basic assumptions: (i) relations between host countries and TNCs are characterised both by divergent and mutual interests; (ii) there is the possibility of shared, non-zero-sum gains; (iii) the actual distribution of benefits depends on the relative bargaining power of each; and (iv) there is a shift over time in relative bargaining power in favour of the host country. This fourth assumption is commonly known as “the obsolescing bargain”. From the standpoint of the host country, the state’s effective bargaining power – and therefore the expected distribution of benefits – is thought to depend on six factors:

- (i) Host country ability to monitor investor and industry behaviour;
- (ii) The cost of duplicating or forgoing what the investor offers;
- (iii) Competition within the industry;
- (iv) The vulnerability of the foreign assets and earnings to adverse treatment by the host country;
- (v) The ability of the host country to discount the international political tension caused by investment disputes;
- (vi) The degree of uncertainty with regard to the investment project.<sup>5</sup>

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<sup>5</sup> C. Fred Bergsten, Thomas Horst, and Theodore Moran, American Multinationals and American Interests, (Washington, D.C.: Brookings Institute, 1978), pp 369-370.

Theories of host country – TNC bargaining thus seek to explain dependency shifts based largely on positional assets and relative capabilities. While these six factors are each important in their own right, this analysis of the efforts of México and Brazil to promote and direct the development of a national computer industry reveals a bargaining landscape that is far more dynamic than the traditional bargaining model anticipates. This thesis explains the variable nature of bargaining gains and losses by analysing the on-going, complex interplay of political, industry and market forces.

Despite industry characteristics that favoured foreign capital, both México and Brazil achieved bargaining gains in the computer industry. Brazilian state actors enticed national finance and industrial groups to invest in the industry, prompted the development of indigenous technological capacity, and limited the market influence of computer transnationals for more than a decade. With more limited policy ambition, support and duration, México had initial success prompting TNC minority joint ventures in microcomputers and extracting concessions from the TNCs for exports.

In both cases, however, bargaining gains were not secure; shifts in dependency were not progressive and one-directional. In fact, the study exposes a reverse trend toward greater dependency on foreign capital in both countries. For this reason one may not employ either case to support the obsolescing bargain in high technology industries.

In addition to calling bargain theory's fourth assumption (the obsolescing bargain) into question, this thesis highlights three fundamental and critically important factors neglected by the traditional bargaining construct: the dynamism of the global computer industry which opened and closed windows of opportunity to re-strike the bargain, and presented enormous challenges for the states to adapt policy to the rapidly evolving industry realities; host country situational factors and the states' ability to forge and maintain coalitions of support for the policy (referred to in this thesis as a bargaining "game-within-the-game"); and the importance of firm level strategy and capability to explain the enduring success of a few national players amidst the commercial failure of so many others. A comprehensive understanding of

the experience of México and Brazil with the international computer industry must take good account of these three factors.

## Introduction

In the early 1970s Brazil began isolated efforts to foster the development of an indigenous capability in electronic data processing. These efforts culminated in the government's decision in 1977 to reserve the domestic minicomputer and microcomputer markets to Brazilian-owned firms. An indigenous computer industry developed thereafter.

Brazil's policy of market reserve in computers has been widely acclaimed.<sup>6</sup> To many, the Brazilian experience with the international computer industry is an unexpected success in need of explanation. The successes of the Brazilian policy include: the increase in employment in the sector (doubling from 21,000 in 1981 to 42,021 in 1986);<sup>7</sup> the development of a critical mass of scientists and technicians in computers; the emergence of a national capability in minicomputer, microcomputer, and peripherals manufacturing; and the resultant reduction of foreign dominance of the industry, illustrated by the increase in market share of locally-owned companies from 23% in 1979 to 55% in 1986.<sup>8</sup>

Emphasising the importance of shared developmental ideology among strategic elites in Brazil, Adler argues that

"the Brazilian computer case strengthens the claims by advocates of bargaining theory—as reformulated to include high-technology

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<sup>6</sup> See for example Paulo Tigre, Technology and Competition in the Brazilian Computer Industry. (New York: St. Martins Press, 1983); Emanuel Adler, The Power of Ideology: The Quest for Technological Autonomy in Argentina and Brazil, (Berkeley, CA: University of California Press, 1987); and Peter Evans, "State, Capital, and the Transformation of Dependence: The Brazilian Computer Case", in World Development, v. 14, n. 7, (1986) pp. 791–808. I am greatly indebted to these early studies of the Brazilian computer case, which laid the groundwork for my own investigations, moving me more rapidly along the 'learning curve'.

<sup>7</sup> Secretaria Especial de Informática, "Panorama do Setor de Informática", Boletim Informativo v. 7, n. 16 (August 1987), p. 14.

<sup>8</sup> Ibid., p. 8.

sectors—that developing countries that skilfully mobilise their resources vis-à-vis MNCs can reduce industrial and technological dependence. It also strikes a blow to theorists of structural dependency..."<sup>9</sup>

Peter Evans<sup>10</sup> admitted that the existence of an indigenous computer industry in Brazil would seem to contradict his earlier assertions<sup>11</sup> that transnational corporations would dominate industries where proprietary technology and marketing expertise were the key sources of competitive advantage, especially if those industries were highly oligopolistic. Upon reviewing the Brazilian computer case, Evans appended his earlier argument, explaining that technological change offers "moments of transition" and opportunity when host countries may be able to reduce dependency and shift the position of local industry in the international division of labour.<sup>12</sup>

Moreover, Brazil is not alone in its surprising computer success. India also followed a policy aiming at greater technological independence and was successful in transforming its ties with the international computer industry in such a way as to increase its share of the benefits resulting from interactions between the country and the international computer industry. In his study of the Indian computer case, Joseph Grieco admits that lessons from the case may not be applied generally to developing countries; but he does propose that Brazil and México could duplicate India's 'success':<sup>13</sup>

"India's industrial structure is similar to those of Brazil and México... Hence, India's bargaining success with multinationals might be achieved as well by Brazil and México at present."

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<sup>9</sup> Emanuel Adler, "Ideological Guerrillas and the Quest for Technological Autonomy", International Organization v. 40, n. 3, Summer 1986, p. 704.

<sup>10</sup> Evans, Op. Cit., (1986), p. 791.

<sup>11</sup> Peter Evans, Dependent Development: The Alliance of Multinational, State and Local Capital in Brazil. (Princeton, NJ: Princeton University Press, 1979).

<sup>12</sup> Evans remained rather more sceptical than Adler about Brazil's longer-term prospects for technological autonomy, however.

<sup>13</sup> Joseph Grieco, Between Dependency and Autonomy: India's Experience with the International Computer Industry. (Berkeley, CA: University of California Press, 1984), p. 7.

When Grieco published his study of India, Brazil had already achieved a good measure of 'success' as noted above, while México had just begun to try. What happened there?

In stark contrast to Brazil, México has not had the same attention lavished on its efforts to alter its relationship with the international computer industry and develop indigenous capabilities at the low end of the market. México's policy efforts in this area began much later and were less ambitious than Brazil's. In 1981 the Mexican government formulated an industrial development policy for computers which sought to reserve the market for microcomputers and their peripherals to Mexican-owned companies. México's policy initiative seemed to crumble just four years later when IBM gained entry into the Mexican microcomputer market with a wholly-owned subsidiary based in México, thereby contradicting the 1981 guidelines which restricted foreign ownership in microcomputer ventures to 49%.

Thus, while Brazil's experience seemed to validate the argument that developing countries can overcome dependency on foreign capital even in high-technology industries, México's seemed to contradict it. Yet these two countries are comparable in their level of economic development; this is not a comparison of Brazil and Bangladesh. Each has experienced periods of very rapid economic growth and transformation: Brazil's 'economic miracle', 1968–73; and México in the 1950s and 1960s. And each experienced fundamental political stability from 1970 to 1990. So several questions are in need of examination: Did Brazilian policy in fact achieve the success claimed for it? Were México's policy efforts comprehensively thwarted by the computer transnationals led by IBM? What factors explain the different policy courses followed in México and Brazil, and what factors explain the different policy results? These are questions to be addressed in this dissertation.

### **Research Questions and Thesis Objectives**

The central objective of this research project is to explain the policy initiatives followed and the factors that explain different policy outcomes in the two cases,

thereby deepening our understanding of host country – TNC bargaining, emphasising country-specific factors. The thesis thus addresses itself to four tasks in order: (i) to describe the Mexican and Brazilian experience with the international computer industry during the 1970s and 1980s; (ii) to evaluate the results of Mexican and Brazilian government policy in this sector in light of the policies' objectives; (iii) to explain the relative success or failure of the policy initiatives; and (iv) to draw relevant implications for theories of host country–TNC bargaining, emphasising country-specific factors.

In describing the experiences of the two countries with the industry this dissertation focuses on the development of government policy: what are the forces that shaped policy and its objectives? The thesis also examines the objectives and strategies of the computer transnationals with respect to the two countries, the role of local capital, and the development of the local industry. Given the vital nature of the computer electronics industry to the future of industrialising countries, the descriptive material on the development of the computer policies and industries in México and Brazil is important in its own right. This is particularly true of the material on México which, to date, has been neglected in favour of studies on the computer industries of Brazil, India, Argentina and South Korea.<sup>14</sup>

Having described the development of the computer policy and industry, there follows a detailed examination of the local industry in order to ascertain to what extent government policy has achieved (or is moving toward) its explicit and implicit objectives. Having examined policy successes and failures, the thesis then explores the reasons behind them.

Finally, the dissertation examines the differences between México and Brazil in government policy, the behaviour of local and foreign capital, and the resultant impact on the local computer industries of these countries. This exploration will have implications for theories of dependency and bargaining; however, it is not the aim of

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<sup>14</sup> See for example, Adler, *Op. Cit.* (1987) and Peter Evans, *Op. Cit.*, (1995).

this research project to prove or disprove one or other of these hypotheses. This study is not intended as a rigorous testing of theoretical models, which are too often presented as caricatures and then easily refuted in case study literature of this kind. The researcher shares Cardoso's consternation at this approach:<sup>15</sup>

"The most general and formal of Gunder Frank's works are received as though they were his best, the formal definition of dependency furnished by Theotonio dos Santos is appended, the problematic of 'subimperialism' and 'marginality' is sometimes inserted, one or another of my works or of Sunkel is footnoted, and the result is a 'theory of dependency'—a straw man easy to destroy."

Nor is this study proposed as a basis for a new theoretical structure by which to think about foreign investment and development. Rather it is intended to add to the existing body of case study literature in this area, enriching the understanding of relations between transnational corporations and host governments of developing countries. By presenting a comparative case study of the experiences of two countries with a particular industry, the researcher seeks to enhance appreciation of historical country-specific factors, which have too often been neglected in a rush to validate or invalidate (or even formulate new) theoretical principles based on the author's prior ideological commitments. What follows, therefore, is a contribution to the empirical studies of host country-TNC relations, which David Becker sees as the groundwork for a more objective political theory:<sup>16</sup>

"Needed today is a political theory of transnational corporate action in the developing countries whose progressive value commitments do not stand in the way of comprehending late-capitalist phenomena that have surfaced since the Marxian classics were written... It will not be deduced from philosophical or ideological first principles but will be built up inductively on a groundwork of empirical studies."

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<sup>15</sup> Fernando Henrique Cardoso, "The Consumption of Dependency Theory in the U.S.," III Scandinavian Research Conference on Latin America, (Bergen, 1976), p. 13.

<sup>16</sup> David G. Becker, The New Bourgeoisie and the Limits of Dependency: Mining, Class, and Power in "Revolutionary" Peru, (Princeton, N.J.: Princeton University Press, 1983), pp. 323–324.

## Methodology

This Methodology section describes the rationale for – and limitations of – the chosen research design and cases studied, and the process by which the researcher collected and analysed the data. This section concludes with an outline of research scope and definitional notes on sub-segments of the computer industry in the 1970s and 1980s. As computing power has grown exponentially in a very short time, this brief historical outline will be a useful guide to the 21<sup>st</sup> Century reader.

### Research Design<sup>17</sup>

The aim of this research project is to explain the relative success of policy initiatives adopted by Mexican and Brazilian state actors toward the computer industry, and thereby enrich our understanding of host country – TNC bargaining emphasising country-specific factors. A comparative case study approach is well suited to this purpose. Of necessity, this approach entails a dialog between the researcher’s ideas, competing theories of host country – TNC bargaining, and the empirical data. The researcher has examined each case as a whole and compared the cases as “wholes”, making few simplifying assumptions so as not to restrict or constrain the examination of the evidence from the cases. The result is a basis for examining how conditions and actors combined in different ways and in different contexts to produce different outcomes. Following Lijphart, the approach employed in this research project is “a method of discovering empirical relationships among variables, not a method of measurement.”<sup>18</sup>

By focusing the research on (a) actual policymaking in historical context, (b) empirically observable relationships between TNCs, state actors, local capital and local and international markets, and (c) identifiable results, the thesis provides a rich data set that informs existing theories of host country – TNC relations. In this comparative

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<sup>17</sup> In this general discussion of the comparative case study approach, the researcher benefits from Charles Ragin, The Comparative Method, University of California Press, 1987 and Arend Lijphard, “Comparative Politics and the Comparative Method”, The American Political Science Review, Volume 65, Issue 3 (September 1971), 682-693.

<sup>18</sup> Lijphard, Op. Cit., p. 683.



case study approach, the state is not treated as an exogenous “black box” – essential for economic growth but unable to play more than a general contextual governance role. As Evans advocates,

“Looking at state agencies involved in particular industrial sectors is one way of putting more empirical meat on the idea that it is scarcity rather than surfeit of bureaucracy that impedes development. The key is to identify differences in the way states are organised and then connect these differences to variations in developmental outcomes.”<sup>19</sup>

The case approach pays equal attention to the information technology sector and the firms operating in it; it is not sufficient to analyse the competence and politics associated with the host-country states in question. Indeed, Susan Strange’s later works recognised the declining role of the state vis-à-vis the market in the study of what she termed “who-gets-what” questions. She advocated more granular study of state interaction with particular firms and industries to advance the discipline:

“If the host-state is not always the most important independent variable, it makes no sense to compare the politics of two host states *in general*... such [international political economy research] work when it deals with sectors like cars, textiles, air transport, oil or banking cannot by its nature ignore the role of firms, nor the technological and market variables affecting them, and their consequent impact and influence on state policies.”<sup>20</sup>

The common critique of the comparative case method is put simply: “too many variables and too few cases.”<sup>21</sup> In other words, the number of cases considered is inevitably too small to allow confident control for identified variables. Therefore, it is not possible to draw hard-and-fast, generalised conclusions from a study of this kind. The researcher accepts this constraint. However, the nature of the subject being studied doesn’t lend itself to this kind of statistical treatment in any case.<sup>22</sup> And the thesis does not seek to offer a definitive rebuttal of particular aspects of bargain theory, nor does it seek to formulate a new theory altogether. Rather, its aim is to examine historical decisions, actions and interactions in order to explain specific policy

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<sup>19</sup> Evans, *Op. Cit.* (1995), p. 40.

<sup>20</sup> Susan Strange, *The Retreat of the State: The Diffusion of Power in the World Economy*. Cambridge: Cambridge University Press, 1996, p. 188.

<sup>21</sup> Lijphart, *Op. Cit.*, p. 685.

<sup>22</sup> At least as a doctoral research project necessarily constrained by time and resource.

outcomes and draw clear but limited implications for existing bargain theory – a purpose that is well served by the comparative case study method.

### Case Selection

“If one does put politics and political systems at the centre of one’s analysis, one has to abandon the idea that all developing countries face essentially the same predicament. Evidently, the fact of plurality need not undermine the insights of theory but it does pose problems of its own. If one still believes in the value of comparison, what is the appropriate unit?”<sup>23</sup>

Professor George Philip goes on to answer his own question, outlining “two kinds of approach to political economy that have proved to be both feasible and useful... The first approach is to study comparatively (and historically) a particular industry, issue or economic sector.”<sup>24</sup> As noted above, this research project employs precisely that approach, examining the experience of México and Brazil with the international computer industry. The remaining methodological questions are then: “Why the computer industry?” and “Why México and Brazil?”

The computer industry was selected for three main reasons. The first of these is the industry’s strategic importance to development in the late 20<sup>th</sup> Century and beyond. When the choice of sector was made, computers – and more broadly, *informatics* – could already be seen as *the* strategic industry for economic development. It is an industry complex whose effect on overall economic growth and competitiveness would grow more profound each year as it permeated the production processes of all sectors. Effective deployment of information technology drives extraordinary efficiency gains – indeed, has changed the terms of competition in an increasing number of industries. If an emerging market state could find ways to shape and harness this industry, it had the potential to drive economic growth and significantly improve its competitive position among nations. As such, the symbolic national salience of high-technology industries transcended its potential as an

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<sup>23</sup> George Philip, “The Political Economy of Development,” Political Studies, 38:3 (September 1990) p. 495.

<sup>24</sup> Ibid., p 496.

economic engine only. In some cases (Brazil among these), indigenous capability in the industry was itself seen as a symbol and milestone of development.

The second reason for choosing the computer industry for examination was the researcher's familiarity with the industry from his background consulting to information technology firms in the Silicon Valley in the early 1980s. As Philip notes, "an immediate if mundane problem for the researcher is the question of expertise... One cannot really write about oil without knowing something of how the industry works."<sup>25</sup> With respect to information technology (if not to oil), the researcher was able to bring some prior knowledge and expertise to bear.

The third main reason for selecting the computer industry was access to information. In the late 1980s, the industry was increasingly well documented by independent research and consulting firms. Thus, information gleaned from interviews could be tested against a growing array of independently documented industry phenomena. Information access was further enabled by the researcher's prior contacts in some of the leading transnational firms in the industry.

Once the industry was identified, the choice of countries to study was relatively straightforward. In order to be able to compare policy outcomes meaningfully, the states needed to be comparable in that they shared a large number of important characteristics. Apart from being in the same hemisphere, México and Brazil were comparable in their economic development during the period under study; each having enjoyed prolonged periods of economic growth spurred by similar industrial development policies. These two states – at the time – were arguably the most 'developmental' in Latin America, where each state sought to proactively shape their country's economic development, employing a variety of policy tools and instruments.<sup>26</sup> Each pursued specific policy initiatives to intentionally develop

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<sup>25</sup> *Ibid.* p. 496.

<sup>26</sup> As will be discussed later, neither México nor Brazil was a great example of the "developmental state". They were what Evans termed "intermediate states" – sharing some of the characteristics of the East Asian developmental archetypes while also infected with a certain amount of clientelism. The point here is only that the two states were

indigenous technological competence and shape the development of the computer industry in their respective country. Each entered into bargaining and negotiating relationships with the transnational information technology industry at a similar point in time. And each shared the interests of the same large computer transnationals and their home state “sponsors.”

Finally, the choice of states to compare was constrained by practicalities. While it would have been equally valid to add India and/or Korea to the caseload, it was not practically possible to spend adequate time (and money) to conduct the needed fieldwork in more than two countries. The result would have been a more superficial treatment of all of the cases, which would in turn violate the in-depth approach decided in the first place.

#### Data Collection and Analysis

Most of the concerted research effort for this thesis took place in London, the United States, México and Brazil from 1985 to 1988. The researcher first established the historical context, studied the existing conceptual frameworks, defined the underlying research questions, and designed the interview guides. The next step was to identify the preliminary list of individuals and organisations to interview in the United States, México and Brazil. This list grew through referrals from interviewees and industry observers in country. The researcher then spent two months in the United States, six months in México and three months in Brazil conducting interviews, accessing original source material and consulting with industry analysts.

It was essential to interview a cross section of all of the policy stakeholders. The field work thus consisted firstly of ninety-six primary field interviews (and many other informal discussions) with directors of transnational and domestic computer manufacturers; government officials representing México, Brazil and the U.S.; trade associations; academics, journalists and analysts interested in the industry; and major commercial and industrial users of computer equipment and services. The perspective

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*relatively* “developmental” among those in the same hemisphere at the time and that they were comparable on this dimension.

of these users is particularly important because they bore the economic cost of restrictive policies in terms of high prices and older, often inferior technology than what was currently available in the international market. Appendix B contains a reference list of interviewees.

The focus interviews generally lasted from one and a half to two hours. The interviews were not recorded; instead the researcher took contemporaneous notes during the interview. For the industry participants the researcher employed an interview guide to ensure completeness, consistency and comparability of data. The guide employed for these interviews in México can be found in Appendix C<sup>27</sup>. In order to facilitate candid discussion, particularly in interviews with civil servants and ministry officials, the researcher offered anonymity to the interviewees. For this reason, some of the interview quotations are ascribed generically rather than specifically and personally.

While in México and Brazil the researcher also spent considerable time reviewing primary source documents such as copies of legislation, government reports, company reports, trade association papers, as well as secondary sources, e.g., current periodical literature.

### Scope

Computer electronics is a large, diverse industrial grouping that includes industries as different as the manufacture of process control equipment and the coding of microcomputer software. It includes every stage of the industry chain from the design and diffusion of silicon chips to the servicing of end user computer equipment. This investigation focuses on the manufacture of electronic data processing equipment (computers), peripherals and software because these are the areas common to the policy initiatives in both México and Brazil. However, in evaluating and explaining the cases individually, the research examines them in light of their respective policy objectives and scope. The 'National Informatics Policy' in Brazil

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<sup>27</sup> The guide used for industry interviews in Brazil is exactly analogous.

was broader in scope than México's 1981 computer industry development programme. Thus, the industry scope of this investigation is necessarily wider in Brazil than in México.

#### Computer Equipment – Historical Glossary

In 1977, Ken Olsen, chairman and founder of Digital Equipment Corporation (DEC), was famously quoted as saying, “There is no reason to believe that anyone will want a computer in their home.” Olsen seemed to have reason to feel secure; DEC was a leader in minicomputers and second only to IBM in the global computer market at the time. 20 years later, with minicomputers squeezed from below by much cheaper networks of ever-more-powerful personal computers, DEC was sold to Compaq – a leader in the *home computer* market at the time. This little vignette is a good reminder of how rapidly the industry has changed.<sup>28</sup>

This research project focuses on the computer industry in the period from 1977 to 1990. Since that time, the astoundingly rapid development of integrated circuits (chips) and the Internet has rendered whole sub-segments of the computer industry obsolete. But these sub-segments were very relevant in the period under study. The definitions below are offered as an historical aid to understanding the industry as it was then.

Four basic sub-segments of computer hardware were relevant during the period under study:

(1) Mainframes: Powerful, large centrally-managed computers used primarily by large corporate and governmental organizations for bulk data processing, enterprise resource planning and management, and high volume transaction processing. Several manufacturers produced mainframe computers from the late 1950s through the 1970s. The group of manufacturers was first known as "IBM and the Seven Dwarfs": IBM, Burroughs, UNIVAC, NCR, Control Data, Honeywell, General Electric and RCA. These large machines were typically leased to customers; not sold.

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<sup>28</sup> Compaq was then itself acquired by Hewlett-Packard in 2002.

And it was typical for manufacturers to create high barriers to switching, through extended contracts and proprietary systems that were incompatible with other machines.

(2) Superminicomputers: A minicomputer with high performance compared to ordinary minicomputers. This term was applied from the mid-1970s onward to the more powerful 32-bit machines introduced around that time. The term and its delineation are now obsolete.

(3) Minicomputers: The term evolved in the 1960s to describe smaller (than mainframe) computers that became possible with the use of integrated circuit and core memory technologies. They typically occupied one or more cabinets the size of a large refrigerator, compared with mainframes that normally would fill a room. The first successful minicomputer was Digital Equipment Corporation's 12-bit PDP-8, though the minicomputer standard was a 16-bit machine. Minicomputers were gradually replaced in the late 1980s and 1990s by lower cost microprocessor-based hardware (microcomputers) and the advent of network technologies. With these, end users were much less reliant on IT department data centers.

(4) Microcomputers: Computers with a microprocessor as the central processing unit. During the period under study, microcomputers were typically defined as having a word length (number of different computations the processor can perform) of 4 to 16 bits, and central memory of not more than 64k bits. After the 1981 release of the "IBM PC", microcomputers came to be known more as "personal computers." They have since grown rapidly in their speed and computing power. The memory in today's 4-gigabyte RAM (random access memory – or core processing power) personal computer is 64,000 times larger than the 64k microcomputer of the 1980s. Instead of 4 to 16-bit word length, the modern PC runs a 64-bit processor, and today's PC is some 2,000 times faster than the 60 calculations per second of the old microcomputers.

## Theoretical Context

There is an abundance of theoretical literature concerning the impact of foreign direct investment on development in Latin America. Out of this body of literature, two general conflicting theoretical models emerged in the 1970s and 1980s: the structural dependency model and the bargaining model. It is worth exploring these models here for two reasons: firstly, they provide a theoretical context with which the findings of this study must interact; and secondly, both informed the actions of those formulating computer policy in the two countries. Each of the models is considered in turn below, either side of a discussion of the “developmental state” construct, which serves as a conceptual bridge from the dependent development school to the bargaining school.

### The Dependency Model

The dependency model<sup>29</sup> was articulated largely by Latin American writers and gained widespread popularity in the 1960s in Latin America as an explanation for underdevelopment in these countries. Palma<sup>30</sup> distinguished three approaches within the dependency school. The first, associated with the works of Frank, dos Santos, Marini, Caputo and Pizarro, posits dependency as a formal theory of Latin American underdevelopment. This approach concludes that development is impossible for Latin America within the world capitalist system. The second, associated with the works of Furtado and Sunkel, stems from an attempt to reformulate the ECLAC analysis of Latin American development. This approach shares the first’s pessimism with regard to the possibilities of capitalist development in Latin America, but concentrates upon generating policy prescriptions that can overcome the obstacles to national development. The ‘father’ of the third approach is Fernando Henrique Cardoso who argues that it is misleading to look at dependency as a formal theory. This approach is

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<sup>29</sup> In this discussion of dependency, the author closely follows two writers in particular: Gabriel Palma, “Dependency: A Formal Theory of Underdevelopment or a Methodology for the Analysis of Concrete Situations of Underdevelopment?”, World Development, vol. 6, (1978) pp. 881-924; and Evans, Op. Cit., (1979).

<sup>30</sup> Ibid., (1978), p. 898.



concerned with the analysis of concrete situations of dependency. It accepts the possibility of capitalist development in Latin America, emphasising the particular subservient forms that it adopts with respect to the advanced countries.

Though there are a number of divergent approaches within the dependency school, each approach shares common roots in Marxist thought on the development of capitalism in so-called 'backward nations', and therefore ultimately draws inspiration from the broader theoretical context of imperialism.

Imperialism is defined as the system of economic expansion and political domination whereby the economically-advanced (or "centre") countries exploit the resources of the poorer (or "peripheral") countries. Although imperialism is no longer politically explicit in Latin America as it was during the colonial period, its fundamental features are said to remain; economic development has not followed political independence. The economies of the poorer countries remain geared to serve the interests of the centre countries at the expense of the indigenous population. "Foreign capital, profit repatriation, adverse changes in the terms of trade all play a role in confining, distorting or halting economic development and industrialisation."<sup>31</sup>

Dependency analysis has concentrated on the forms of articulation between 'external factors' and 'internal factors'; that is, between the general determinants of the capitalist system and the specific determinants of the individual society under analysis. Dependency analysis therefore is corollary and complementary to the theory of imperialism.

Proponents of the first approach within the dependency school see underdevelopment as a global and structural problem with roots in the social relationships formed by imperialism and its post-colonial effects. The only beneficiaries of the system in the periphery are the ruling elite linked in interest, ideology, and culture more closely to the centre than they are to the periphery in which they live. Exclusion of the masses from both mainstream political and economic

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<sup>31</sup> Robert Sutcliffe, quoted in Palma, *Ibid.*, p. 885.

life, and the disarticulation of the economy are central features of underdevelopment, along with the integration of local elites into the international system.

This approach holds, therefore, that the investments of transnational corporations, which are the institutional embodiment of international capital, do not assist development; rather they further the dominance of the developed countries by exploiting the raw materials, agriculture, and/or cheap labour of the periphery for the needs of the centre, while benefiting only a tiny elite in the periphery. Underdevelopment then, is not just a condition but also a process: in the words of Frank,<sup>32</sup> the "development of underdevelopment." In this context, it is held that no Third World country can expect to escape economic dependence and develop an economy that ranks alongside the major capitalist industrial powers. Any surplus generated is expropriated or siphoned off to the centre through profit repatriation or the consumption of luxury imports by domestic elites, for example. Because underdevelopment is thought to be inevitable within the global capitalist system, Frank et al. hold that the only solution is to reduce or break relations with the system through socialist revolution.

The second approach within the dependency school is linked to the United Nations Economic Commission for Latin America and the Caribbean (ECLAC<sup>33</sup>). The ECLAC School attempted to reformulate its analysis of Latin American development in the mid-sixties following the apparent failure of ECLAC-inspired policies of import substituting industrialisation. At this time, balance of payments problems were growing, real wages were not rising to stimulate demand as quickly as expected, income distribution was becoming more concentrated, unemployment was worsening, and industrial production was geared increasingly toward luxury goods. In an effort to retrofit theory to the reality of the day, the ECLAC School focused on strategies to

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<sup>32</sup> Andre Gunder Frank, "The Development of Underdevelopment," *Monthly Review* 18, (September 1966).

<sup>33</sup> Though, at the time this approach was articulated, the UN Commission was known simply as ECLA – minus the C for Caribbean.

remove the internal obstacles to development in order to increase the possibility of industrialisation.

The ECLAC school and the Marxist *dependencistas* described above both postulate essentially static and unhistorical formal theories which agree that the principal obstacle to development is external, and share a fundamental pessimism about the prospects for capitalist development in dependent countries. Both have been widely criticised, not least for failing to take enough account of the cyclical nature of capitalist development.<sup>34</sup>

“The irony was that while both groups were busy writing and publishing different versions of stagnationist theories... international trade was picking up, the terms of trade were changing in favour of Latin American exporters of agricultural and mineral products, and some countries were able to take advantage of the favourable situation and accelerate rapidly the rhythm of their economic development.”

Indeed, traditional dependency theory expounded in these first two approaches was largely discredited by the historical failure of the socialism that most of the early dependency writers advocated in some form or another. Instead, positive engagement with international capital seemed to be ever more common and essential to development. As Strange notes:

“It is no accident that the ‘dependency school’ writers of the 1970s have lost so much of their audience. Not only in Latin America (where most of this writing was focused), we see politicians and professors who were almost unanimous in the 1970s in castigating the multinationals as agents of American imperialism who now acknowledge them as potential allies in earning the foreign exchange badly needed for further development.”<sup>35</sup>

In their dealings with multinational corporations, actual historical experience suggested that governments of third world nations proved to be neither helpless nor

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<sup>34</sup> See Palma, *Op. Cit.*, p. 908.

<sup>35</sup> Susan Strange, “States, Firms and Diplomacy,” in Jeffrey A. Frieden and David A. Lake, *International Political Economy: Perspectives on Global Power and Wealth*, 4<sup>th</sup> edition, Belmont, CA: Wadsworth/Thomson Learning, 2000, p. 62. This is an edited text of an article, which first appeared in *International Affairs*, London, 68.1 (January 1992), pp. 1-15.

fully co-opted by foreign capital, and local capital was not just a static bystander, as the early *dependencistas* would have us believe.

Though later discredited in the international political economy literature, the early dependency writers did influence policy and debate, particularly in the early part of the period addressed by this thesis. Philip summarises well:

“It was perhaps inaccurate to describe dependency as a theory; it was rather a paradigm or just a way of looking at the world... By way of obituary, however, one may at least recognise that the failure of grand dependency theory has been interesting and instructive and has influenced a wide range of differing viewpoints. Dependency was a success as a polemic but a failure as a theory.”<sup>36</sup>

As such, traditional dependency theory is important to reference here because its underlying worldview and broad influence can be seen in the sectorial market reserve policies adopted in both countries studied in this research project. Market reserve proponents in both countries saw foreign involvement in informatics as more of a threat than an aid to national development goals.

The third approach arising from the dependency school is still more relevant for the purposes of this thesis, as it takes greater account of the specific historical relations between individual societies and the international capitalist system. Indeed, this end of the dependency school spectrum agrees with the critique outlined above: to speak of a formal theory of dependency or of Latin American underdevelopment is misleading. Instead, this third approach holds that the notion of dependency is better employed as a methodology to analyse the concrete forms in which dependent relationships develop.

Proponents of this approach agree with the Marxist *dependencistas* and the ECLAC School on the fundamental condition of dependency and its root causes; the particular development of dependent societies is conditioned by the general development of world capitalism. However, this school recognises the need to base its analysis on an understanding of the *contemporary* characteristics of a *dynamic* world capitalist system. Unlike traditional dependency theorists, proponents of this

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<sup>36</sup> Philip, *Op. Cit.*, pp. 487 and 490.

approach recognise that dependency is a dynamic condition. They agree that certain features of dependent social structures persist, but observe changes in the international division of labour. Further,

“As foreign capital has increasingly been directed towards manufacturing industry in the periphery, the struggle for industrialisation, which was previously seen as an anti-imperialist struggle, has become increasingly the goal of foreign capital. Thus dependency and industrialisation cease to be contradictory...”<sup>37</sup>

The economies of several peripheral states have moved from ones solely, or even primarily, reliant upon exports of primary products to semi-industrialised economies whose competitive advantage now rests on their supply of low-wage labour for routinized manufacturing. Thus, a development of sorts is proceeding.

Authors such as Cardoso and Evans<sup>38</sup> termed the experiences of these countries a special instance of dependency and called the process "associated-dependent development" or simply "dependent development". In these countries, development is still externally conditioned but rests also on the ability of the state to redirect the global rationality of the transnational when it conflicts with the necessities of local accumulation. The peripheral state has several tools at hand to help accomplish the goals of self-determination and local capital accumulation, including, but not limited to, threats of nationalisation and withholding of import licenses. If used properly these tools can over time effect substantial (though incremental) change in host country relations with international capital, with a greater share of the benefits of foreign direct investment (FDI) accruing to the host country. Thus, it is the state that has the central role to play in harnessing the benefits of capital accumulation for the development of the country.

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<sup>37</sup> Ibid. p. 909.

<sup>38</sup> See for example Evans *Op. Cit.* (1979); and Fernando Henrique Cardoso and Enzo Faletto, *Dependency and Development in Latin America*, (Berkeley: University of California Press, 1979).

The development process in a dependent country is thus partly – or even significantly – contingent upon the existence of a "developmental state"<sup>39</sup> as opposed to the "soft" or "predatory" state that has been largely co-opted by foreign capital. The developmental state does indeed forge alliances with international capital; however, this model necessarily assumes divergent interests between the state and TNCs. The state is not wholly co-opted by international capital.

The "dependent development" school of thought acknowledged a general shift in bargaining power to the peripheral state. This shift is attributed to the decentralisation of the North (U.S. investors are no longer the dominant supply of foreign capital with the ascendance of the Japanese economy, the re-emergence of Western European investors and more recently, China's foreign business interests), and the development of the institutional capacities of the state in these countries with the concurrent growth of experience in negotiating with international capital.

By admitting the possibility of successful bargaining with foreign capital by developing states (at least those newly industrialised countries such as México and Brazil) Evans, Cardoso, et al. are not far from the bargaining theorists described below. What is different is the relative importance ascribed to structural relationships over against bargaining skills. According to the dependency school, the outcome of host country–TNC bargaining is due more to the structure of the international economic system and the host country's existing place in it, rather than the relative bargaining skills of the negotiators and their understanding of competitive advantage. Thus, one may expect only very slow and limited gains from host country–TNC negotiations; while the bargaining theorists are more optimistic about the host country's chances for success. Still, bargain theorists acknowledge host country difficulties in striking a favourable bargain in certain industries as described below. There is, thus, a degree of

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<sup>39</sup> It is critical to understand the concept of the developmental state. The concept, general features, and its specific applications to this comparative case study are developed more fully just a few paragraphs below.

convergence between the “dependent development” and “bargaining” schools of thought despite the fact that they arise from two different theoretical constructs.

### The Developmental State

Before turning to a detailed consideration of the Bargaining School, it is instructive to look more closely at the “developmental state” and its primary features. The “developmental state” is a core concept in the “dependent development” school of thought, and is largely assumed by the bargaining construct expounded below. As such, it is an important bridge between the two schools of thought about host state – firm relations.

Arising from comparative institutional analysis, the term “developmental state” was used to describe the post-war Japanese state, as well as the states of Korea and Taiwan, individually and together viewed as archetypal developmental states.<sup>40</sup> In each case, the state played an intentional, activist role to promote longer-term development objectives. Japan’s post-war economic miracle could not be explained without recognising the central role played by the Ministry of International Trade and Industry (MITI). MITI was prestigious, attracting the best and the brightest from Japan’s elite universities who had passed the rigorous, meritocratic civil service exam. In addition to being prestigious MITI was powerful, overseeing Japan’s industrial transformation, approving investment loans from the Japanese Development Bank, exercising authority over foreign currency allocations for industrial purposes, licenses to import foreign technology, tax incentives and competitive policy – all shrewdly employed to induce and direct investment in priority industries.<sup>41</sup>

The developmental state acts to advance the welfare of its citizens, not just the interests of the ruling elite. It plays a central role in the country’s competition for shares of the world’s wealth, not just the competition for territory and power. It

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<sup>40</sup> Evans, *Op. Cit.*, (1995), pp. 47-70. Evans credits Chalmers Johnson with respect to Japan (*MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-1975*. Stanford: Stanford University Press, 1982); and Gordon White and Robert Wade with respect to Korea and Taiwan, (e.g., “Developmental States in East Asia,” *IDS Research Report #16*. London: Gatsby Charitable Foundation, 1984).

<sup>41</sup> *Ibid.*, p. 48.

embodies a meritocratic, results-focused culture. It nurtures and leverages strong linkages with civil society actors, particularly private capital – while avoiding the clientelism that could derail the state’s broad development goals. Evans emphasises these last two features of the developmental state: “The efficacy of the developmental state depends on its ability to combine a meritocratic bureaucracy with a strong sense of corporate identity, with a dense and intensive set of links between state and society.”<sup>42</sup> Evans characterises these features of the developmental state as “embedded autonomy.”<sup>43</sup> While recognising the importance of an active state exercising its authority on behalf of its citizens, Stopford and Strange agree that a developmental state is defined more by its vision and skill than by its exercise of power: “A strong state is less effective in international competition than the shrewd state; it is good judgment and a clear vision of priorities that counts.”<sup>44</sup>

Synthesizing the discussion thus far, four key features of the developmental state can be deduced. The developmental state: (i) establishes a vision and priorities for national development; (ii) engages directly and indirectly in the competition for shares of the world’s wealth to advance the welfare of its citizens; (iii) leverages a dense and varied network of relationships with civil society to accomplish its policy aims; and (iv) attracts and nurtures talent in an independent, meritocratic, results-focused culture. To these four must be added an essential fifth: the activity of the state must yield positive developmental outcomes broadly in line with the vision and strategy the state adopts. Without results, the developmental state must surely forfeit its claim to be “developmental.”

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<sup>42</sup> Peter B. Evans, “Predatory, Developmental and Other Apparatuses: A Comparative Political Economy Perspective on the Third World State” Paper presented to the Latin American Studies Association XV International Congress, San Juan, Puerto Rico, September 21-23, 1989, p. 2.

<sup>43</sup> While he was writing about the developmental state earlier, he most fully expounded this thesis in his 1995 book *Embedded Autonomy*. Evans, *Op. Cit.*, (1995).

<sup>44</sup> John Stopford and Susan Strange. *Rival States, Rival Firms: Competition for World Market Shares*. Cambridge: Cambridge University Press, 1991, p. 217.



Evans recognises a spectrum from the developmental state archetypes of East Asia on one end, to self-seeking “predatory states” on the other. He describes Brazil as an “intermediate state” on this spectrum, neither hewing closely to the post-war Japanese developmental ideal, nor to the predatory model characterised by Mobutu’s Zaire. Evans highlights the distinct lack of meritocracy in the Brazilian state bureaucracy, which was “populated on the basis of connection rather than competence.”<sup>45</sup> And he notes that the Brazilian state’s relationship with the private sector tended to be characterised by traditional oligarchic power. The Brazilian state was certainly “embedded”, but lacked “autonomy” in its pursuit of broad development goals.

México was no further along the developmental spectrum than Brazil in the 1970s and 1980s.<sup>46</sup> For a start, México’s ruling party, the Partido Revolucionaria Institucional (PRI), was notorious for its clientelistic tendencies. Nevertheless, like Brazil, México exhibited evidence both of developmental intention and results. For example, both states exercised considerable will and skill to get the foreign automakers to expand local automobile production in their respective countries in the 1970s. At the end of that decade the Mexican state even procured an initial commitment from the auto TNCs to export from México.<sup>47</sup> Each country was building skills and experience orienting investment to developmental ends.

The clientelism and lack of meritocracy in the state bureaucracies of Brazil and México *in general* is irrefutable. However, when it came to the development and implementation of industrial policy in informatics, the *specific* situation is different. Policy formulation and implementation in this new sector required considerable specialist knowledge. In both cases, highly educated individuals who had been outside the state political machinery were enlisted to formulate and initially implement the

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<sup>45</sup> Evans, *Op. Cit.*, (1995), p. 61.

<sup>46</sup> Evans doesn’t discuss México in this regard, but refers to other writers who have noted similarities between México and Brazil as ‘intermediate states’.

<sup>47</sup> Douglas C. Bennett and Kenneth Sharpe. Transnational Corporations Versus the State. Princeton: Princeton University Press, 1985, especially pp. 220-224.

market reserves in computers. Chapters 3 and 7 describe the particulars in each case. Suffice it to say for now that with respect to computers state policy and, to some degree, power, was placed in the hands of highly knowledgeable actors who were, at least at first, relatively independent of political and industrial ties. Thus, with respect to the specific sector in question, the states of Brazil and México exhibited more of the features of the developmental state archetype, without approximating the East Asian ideal.

The foregoing discussion of the developmental nature of the host country state, and the dynamics of its policymaking and policy enforcing roles, are important foundation stones for this comparative case study. It assumes the host country state will engage directly with foreign capital to advance specific development goals. It envisages a positive, constructive role for the host country state beyond simply creating a favourable context for the activities of firms and markets.<sup>48</sup> It recognises the complexity of the host country state and the importance of its competence and connectedness. It establishes a basis for comparative analysis of host country state actors and policies. In short, the conceptual work on the developmental state helps to unpack a key actor in the bargaining “play”, and so makes a critical contribution to the understanding of firm – state relations. However, the host state is just one of the actors. The same nuanced understanding is needed for the other actors: the TNCs, local capital, and the industry itself, which is propelled along by its own dynamic.

#### The Bargaining Model

While dependency theory had its roots in imperialism, the bargaining model arose ostensibly from traditional economic thinking. In its general terms the bargaining model attained widespread acceptance in the late 1980s. In 1987 Kobrin called it “*the* currently accepted paradigm of host country–TNC relations in international political economy.”<sup>49</sup> It was accepted both by mainstream economists

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<sup>48</sup> Or conversely, beyond simply excluding foreign capital or nationalizing their assets.

<sup>49</sup> Stephen J. Kobrin, “Testing the Bargaining Hypothesis in the Manufacturing Sector in Developing Countries”, International Organization, v. 41, n. 4, Autumn 1987, p. 610.

such as Kindleberger, Vernon and Bergsten, and by the dependency theorists such as Evans as noted above.

Recognising the conflicting interests of host countries and international capital, the bargaining model holds that host countries can harness FDI and direct it to the country's advantage. Indeed, it holds, prolonged contact with foreign capital actually facilitates the host country's ability to strike a favourable bargain. Thus, the bargaining theorists argue that developing countries can maximise local capital accumulation through selectively encouraging and orienting foreign investment.

The assumptions of the bargaining model are fourfold: (i) relations between host countries and transnationals are characterised both by antipathy and mutuality of interest; (ii) there is the possibility of joint, or shared, gains (two oligopolists negotiating in a non-zero-sum game); (iii) the actual distribution of benefits depends on the relative bargaining power and skills of each; and (iv) there has been a shift over time in relative bargaining power in favour of the host countries (the "obsolescing bargain").<sup>50</sup>

The ability of host countries to influence the actions of foreign investors is thought to be a function of:

- (i) Host country ability to monitor investor behaviour and industry behaviour;
- (ii) The cost of duplicating or forgoing what the investor offers;
- (iii) Competition within the industry;
- (iv) The vulnerability of the foreigner's assets and earnings to adverse treatment by the host country;
- (v) The ability of the host country to discount the international political tension caused by investment disputes;

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<sup>50</sup> Early exponents of bargain theory as described here are Charles Kindleberger, Six Lectures on Direct Investment, (New Haven, CT: Yale University Press, 1969); Raymond Vernon, Sovereignty at Bay: The Multinational Spread of U.S. Enterprise, (New York: Basic Books, 1971); and Bergsten, Horst, and Moran, Op. Cit., (1978).

(vi) The degree of uncertainty with regard to the investment project.<sup>51</sup>

Later scholarship on bargaining theory drew the important distinction between the *potential* power and *actual* power of the host country state. While the list of factors above largely determine potential power, actual bargaining power is thought to be a function of the relative demand for each other's resources, the constraints that prevent potential power from being implemented, and the ability of either party to limit the behaviour of the other directly. Put succinctly, actual power depends on the ability and willingness of the host government to exercise their potential bargaining power in order to extract more favourable terms from the TNCs.<sup>52</sup> Connecting this insight to the prior discussion of the developmental state, one sees actual bargaining power as a combination of situational and positional assets with the host state's level of embedded autonomy.

The "obsolescing bargain" – the shift of bargaining power to the host country over time – has been the subject of a number of studies and is accepted as widely applicable to extractive industries. The hypothesis is that once initial risks are overcome—capital is sunk, technology is diffused and the project begins to show a positive return—the host government can successfully seek to shift the negotiated position, extracting greater concessions from the foreign investor. The foreign investor's bargaining chips, be they access to capital, technology or managerial skills, have already been played. The TNC resists, claiming sanctity of contract, while the host country argues that the terms of the original bargain were unfair. Pragmatically, however, these arguments matter very little; the fact of the power shift remains.

While the obsolescing bargain has been successfully applied to the extractive industries, its applicability to manufacturing industries remains a subject of debate.<sup>53</sup>

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<sup>51</sup> Bergsten, Horst, Moran. *Op. Cit.*, pp. 369–370.

<sup>52</sup> See for example, Shah M. Tarzi, "Third World Governments and Multinational Corporations: Dynamics of Host's Bargaining Power," *International Relations*, 10.3 (May 1991), pp. 237-249 and reprinted in Frieden and Lake, *Op. Cit.*, pp. 156-166.

<sup>53</sup> In addition to Kobrin's and Tarzi's works referenced above, see for example, Edmund J. Malesky, "Re-Thinking the Obsolescing Bargain: Do Foreign Investors Really Surrender their Influence of Economic Reform in Transition States?" Paper presented at the Annual

Manufacturing investments do not, in general, entail the degree of risk, the national salience, or the large sunk costs typical in extractive industries. Also, manufacturing firms with diversified product lines have more flexibility and control than extractive investors.

More pertinent to a discussion of the computer industry, manufacturing investors in industries with high optimum production scale and technological intensity would seem to be protected from the obsolescing bargain because the local market is unlikely to be large enough to support efficient manufacturing or generate competitive research and development budgets. Thus, most bargaining theorists agree with Bergsten, Horst and Moran that:

"Where technology is complex, rapidly changing, and tightly held—*such as in computers*—the shift of bargaining power toward developing (and other) host countries will proceed least rapidly."<sup>54</sup>

In his statistical study of the obsolescing bargain in manufacturing, Stephen Kobrin admitted that his results were largely inconclusive, but felt able to make the following observations:

"The results indicate that obsolescence is possible [in manufacturing industries] and that shifts in bargaining power to host countries are most likely in relatively low technology industries that are not integrated globally... Shifts in relative bargaining power depend on whether the rate of technological and managerial development in the host country is greater than the rate of innovation in the industry... In contrast to the resource-based industries, obsolescence does not appear to be structurally inherent in manufacturing."<sup>55</sup>

Tarzi acknowledges that TNCs can be expected to regain their bargaining advantage when "the rate of change in technological complexity of the foreign investment regime grows faster relative to the host country's capabilities and rate of

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Conference of the International Studies Association, University of California San Diego – IRPS, March 24, 2005

<sup>54</sup> Bergsten, Horst, & Moran, *Op. Cit.*, p. 380; emphasis is mine. Malesky, Kobrin and Tarzi all concur.

<sup>55</sup> Kobrin, *Op. Cit.*, pp. 634, 636.

innovations.”<sup>56</sup> Tarzi goes on to assert a conclusive verdict with respect to the possibility of obsolescence in the computer electronics industry:

“The pace and complexity of research and development in computers and electronics is, for the most part, beyond the capability and geographic reach of any of the host governments in the Third World.”<sup>57</sup>

In light of the foregoing theories and the empirical work that accompanies them, Brazil's early success in bargaining with the international computer industry seems all the more surprising, while México's apparent failure at the same game would seem predictable. Yet, both Adler in the case of Brazil, and Grieco in the case of India, argued that the obsolescing bargain did indeed apply to the computer industry; these countries had altered the terms of the bargain in their favour. They argued that conventional bargain theory is in fact too pessimistic; host countries can strike a favourable bargain even in high technology industries. This thesis will directly address the apparent contradiction and controversy with respect to the applicability of the obsolescing bargain in the Mexican and Brazilian computer industries.

Apart from refinements such as the distinction between actual and potential bargain power, and a growing number of attempts to prove, disprove, or refine the obsolescing bargain assumption, how has bargain theory developed since the 1970s and 1980s? Four scholarly recognitions and insights emerge from a survey of more recent international political economy scholarship related to bargain theory<sup>58</sup>: (i) bargaining has become an accepted paradigm of state – firm relations; (ii) bargaining complexity has multiplied, challenging the administrative capacity of state and firm

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<sup>56</sup> Tarzi, reprinted in Frieden and Lake, *Op. Cit.*, p. 159.

<sup>57</sup> *Ibid.*, p. 160.

<sup>58</sup> In addition to the specific citations noted below, the author has benefited from Fieldhouse, David. “‘A New Imperial System’? The Role of the Multinational Corporations Reconsidered.” From Wolfgang Mommsen and Jurgen Osterhammel, eds. *Imperialism and After*, Allen & Unwin, 1986, pp. 225-240; and Jeffrey A. Hart and Aseem Prakash. “Strategic Trade and Investment Policies: Implications for the Study of International Political Economy,” *The World Economy* 20 (1997), pp. 457 – 476. Hart and Prakash look at technological flows across national boundaries, noting they are imperfect and therefore offer first-mover advantages for domestic firms, with the right state intervention. As such they are more optimistic about effective host-country bargaining in high technology industries.

actors; (iii) a general shift of power from the state to markets has occurred; and (iv) attempts at a grand theory of host state – firm bargaining are confounded. Each of these is considered briefly below before concluding this discussion of the theoretical, conceptual context for the thesis.

#### Bargaining: An Accepted Paradigm

Writers may disagree over relative bargaining power, but they do not deny the premise that states and firms have both mutual and conflicting interests and are seen to negotiate these through a bargaining lens. Bargaining is now an accepted paradigm for state – firm relations. Stopford and Strange recognise this general acceptance:

“There is a growing consensus among writers on transnational corporations in developing countries that the relationship between the parties is the product of bargaining, whether explicit or implicit.”<sup>59</sup>

The authors cite “a new pragmatism in the mutual attitudes of host country states and TNCs replacing old bitterness, bigotry and mutual incomprehension.”<sup>60</sup>

This shift in attitude and pragmatic embrace of a bargaining relationship is driven by mutual dependence. The role of the state has shifted, from one that is primarily concerned with power and territory vis-à-vis other nation states, to one that is now competing more for the means to create wealth within their territory. The state needs production for the world market to be located on its territory, regardless of who is organising or owning it. TNCs can be an engine of economic growth and wealth creation if they can be attracted to invest and appropriately incentivised to drive local value-add. For their part, TNCs too are competing aggressively for world market shares, with all the advantages and disadvantages of a global capital market that rewards and penalises short-term performance. TNCs are competing for new markets and are flexible to locate production where it makes business sense. The combination leads inevitably to both cooperation and conflict between developing world states and transnational corporations.

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<sup>59</sup> Stopford and Strange, Op. Cit., p. 134.

<sup>60</sup> Ibid., p. 5.

### Bargaining: Complexity Multiplied

Acknowledging the *de facto* bargaining relationship between states and firms, scholars have recognised that the construct sounds more two-dimensional than it actually is in practice. Stopford and Strange posit a triangular bargaining challenge: government – company, government – government, and company – company.<sup>61</sup> They argue that the lasting effectiveness of a bargain struck is determined by the success or failure of bargaining on all three sides of the triangle. In reality there are a multiplicity of bargains within each side of this triangle, for example: bargains between political parties supporting the government; bargains with local private sector business associations; bargains with the military, etc. Making matters more complex, the changing competitive structure of industries acts on the bargaining landscape to constrain choices by firms and states.

In this researchers' view, a triangle is inadequate to capture the true complexity of the bargaining process and possible outcomes. The bargaining process is more aptly described as a game of three-dimensional chess with competitive moves on one plane affecting an actor's position on the other two. As if that weren't complex enough, where bargaining is taking place in industries that are globally dynamic, the spaces on the boards and the pieces themselves may be changing rapidly as the game is being played. Scholars argue "national policy must therefore be crafted and implemented in the clear knowledge of the international structures of particular industries and the strength of individual firms seeking market access."<sup>62</sup> This seems like a sensible conclusion but as will be demonstrated in the cases studied here, this foreknowledge was in all likelihood impossible. When Brazil fashioned its market reserve, policymakers could not possibly foresee the sea change in industry structure that would occur inside the next decade: one that spawned a new product segment that would cannibalize the minicomputer industry that the reserve was designed to

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<sup>61</sup> *Ibid.*, especially pp. 19-31, though in truth, the entire book is dedicated to exploring the complexities of these relationships.

<sup>62</sup> *Ibid.*, p. 96.



protect and develop; one where microelectronics and software would become the real sources of technological innovation, not computer hardware; one where Intel and Microsoft (young firms hardly visible outside the USA in 1977) would come to dominate critical parts of the industry and set new global technical standards.

The more realistic challenge is adaptability of policy, not foresight. States have to be more competent and nimble wielding instruments from their policy toolkit to attract and direct foreign investment. The shrewd state may be better than the strong, but in the cases studied, nimble would have been better than shrewd. For their part, TNCs must become more politically sophisticated and adept as they seek to strike bargains not only with host states but also with their home countries and other firms. In all cases, the actors' political and administrative capacities are severely tested.

#### Bargaining: General Power Shift from State to Market

While bargaining has become the dominant modality of host state – TNC relations, scholars have identified a general shift in bargaining power from the state to the market, and more particularly to the transnational firms that serve the market. Interestingly, this view is in direct opposition to the view of early bargain and dependent development thinking that power generally shifted to the state over time, due largely to the growing experience and institutional capacities of the state to manage relations with TNCs. In *The Retreat of the State*, Susan Strange elaborates the general decline of state power in the world economy and the reasons for it. The verdict is summarised thus:

“Where states were once the masters of markets, now it is the markets which, on many crucial issues, are the masters over the governments of states.”<sup>63</sup>

According to this view, states can no longer direct where production happens; they can only bargain. TNCs on the other hand, have many options in an increasingly

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<sup>63</sup> Susan Strange, *The Retreat of the State: The Diffusion of Power in the World Economy*. Cambridge: Cambridge University Press, 1996. It is worth noting that Strange's point is a general one, applying to all states, not just those in developing countries.

globalised economy. States control access to labour and land, two factors whose importance to determining competitiveness has fallen in relation to technology and capital. In contrast, TNCs have better access to technology and capital than developing country states.

Strange identifies technology as the primary driver of the shift in balance of power from states to markets and posits three related premises underlying the power shift: (i) Politics is a common activity that is no longer the sole preserve of states; (ii) Power over outcomes is often exercised unintentionally by all who buy and sell and deal in markets; and (iii) Authority over economic transactions is legitimately exercised by agents other than the state. These three premises serve to limit the state's power to manage the national economy and the state's culpability for economic outcomes. No matter how embedded and autonomous the state is, many aspects of the functioning of markets and firms now lie outside its control.

#### Bargaining: Impossibility of a Grand Theory

While acknowledging a general shift in bargaining power to the TNCs, it is clear from the foregoing discussion that a grand theory of host state – TNC bargaining has proved elusive. The general assumptions and factors outlined at the outset of this discussion on bargain theory remain largely in tact. However, the complexity of the multi-dimensional bargaining process, and the pace of change in the global economy have confounded scholars seeking to articulate a new and improved Bargain Theory that accounts for the multiplicity of variables. “Today, the complexity of the factors involved in... transnational bargaining, and the multiplicity of variables at play, incline us to deep scepticism about general theories.”<sup>64</sup> “All our findings suggest that many of the conventional frameworks of analysis fail to deal adequately with the contemporary dynamism of change.”<sup>65</sup>

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<sup>64</sup> Susan Strange, “States, Firms, and Diplomacy”, *International Affairs*, London 68.1 (January 1992), pp. 1-15 and reproduced in Frieden and Lake, *Op. Cit.*, p. 67.

<sup>65</sup> Stopford and Strange, *Op. Cit.*, p. 203.

Attempts to apply statistical game theory clearly cannot yield meaningful insights. The state is not, in reality, a rational actor in the game theory sense. There are too many different, conflicting agendas and an inevitable gap between policy intention and implementation. In truth, though political scientists often want to treat TNCs and their managers as rational actors that too is a mistake. TNC executives may have a fiduciary responsibility to maximise shareholder value, but they often do not act in value-maximising ways. TNCs are complex political organisations in much the same way states are.

So it is not surprising that widely divergent outcomes are observed by scholars analysing empirical studies of host country – TNC bargaining. “The divergence of policies and outcomes in these countries [Brazil, Kenya and Malaysia] seems to us especially striking and not susceptible to interpretation by any single model of bargaining power.”<sup>66</sup>

The acknowledged impossibility of a new and improved unified bargain theory is in some senses a welcome relief. The more limited task of this thesis is to document and compare two specific historical instances of host country – TNC bargaining with respect to a single industry. The aim of this research project is to examine historical decisions, actions and interactions in order to explain specific policy outcomes and draw clear but limited implications for existing bargain theory. The foregoing discussion of the complexities of host state – TNC bargaining demonstrates that this limited objective is challenging enough. It requires a thorough interdisciplinary historical documentation and exploration of (a) domestic and international politics at both macro and sectorial levels; (b) industry structure development and competitive dynamics; (c) market response and influence; and (d) firm level strategy, success and failure. As such, the case studies integrate and synthesise perspectives from history, politics, economics and business. Without examining these different dimensions of

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<sup>66</sup> Ibid., p. 3.

the bargaining process, it is impossible to understand and interpret the who-gets-what outcomes with respect to the computer industry in the two countries studied.

### **Overview of Findings and Conclusions**

In attempting to explain the different policy choices and outcomes in two countries with respect to the same industry, it has been necessary to focus on the continuing interplay between market and political forces. In so doing it has been essential to carefully define the exogenous from the endogenous 'variables' in these cases of TNC-country bargaining. Writers from different disciplines have tended to treat either policy or market forces as exogenous. Economists have tended to regard policy as an exogenous factor when looking at the workings of the market, while political scientists often have tended to treat the market as exogenous in their analysis of the policy-making process. Neither of these approaches satisfactorily explains the historical outcomes in the cases studied, and neither can help to anticipate future developments in the local industries.

Instead it has been necessary to treat both sector-specific policy and private investment decisions as endogenous variables, focusing on the continuing interplay between the two. In so doing, this thesis explores a number of mutual adjustments which have taken place in each case: (i) the adjustment of top political authorities to their supporters; (ii) state officials to each other (including top authorities); and (iii) state officials and market agents (both investors and consumers, foreign and domestic) to each other.<sup>67</sup> Thus, the thesis explores the objectives of each constituent group in this process as well as the devices at their disposal to influence the outcome of the process.

The exogenous 'variables', then, are the evolution of the international industry, the macro goals of the host country regime, the industry's importance to these macro

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<sup>67</sup> See Charles Lindblom, *Politics and Markets: The World's Political-Economic Systems* (New York: Basic Books, 1977), and *The Policy-Making Process* 2nd ed. (Englewood Cliffs, NJ: Prentice-Hall, 1980) for further elaboration of this kind of approach.

goals, the industry's complexity, and other situational factors (e.g., the historical endowment of a technological base, potential market size, geographic proximity to export markets, etc.).

The findings of this thesis underline the multi-dimensional complexity faced by state and firm actors in the bargaining process. The dynamic, three-dimensional chess metaphor is indeed apt. In both case studies the objectives of each constituent group changed over time, and investments made constrained future policy choices; the variables in the analysis were constantly changing in value and importance.

The specifics of the two cases demonstrate the limitations of a general bargain theory that does not take adequate account of host country politics and divergent interests within national and international organisations. It also fails to pay sufficient attention to industry dynamics and the firm-level decisions of the local investors that the host country is seeking to promote. In the cases studied, many of the most significant bargains struck were not state-to-firm, or firm-to-firm, or state-to-state, along the sides of a triangular bargaining model.<sup>68</sup> The bargains most significant to the ultimate who-gets-what outcomes were often those struck *inside* the institutions themselves, be they the states or the firms. The bargaining "game-within-the game" proves very important in the cases studied. It is through analysis of the on-going interplay of policy and market & industry forces over more than a decade in the history of México and Brazil that the variable nature of bargaining gains and losses becomes apparent.

The cases share a number of exogenous factors in common: a growing sensitivity to the vital importance of information technology to economic development and national security; the dynamic growth of the microcomputer market; the growing accessibility of the fundamental technological building blocks of microcomputers in an increasingly fragmented international industry; the relative attractiveness of the domestic Brazilian market, and of the Mexican market as an

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<sup>68</sup> Stopford and Strange, Op. Cit.

export base. The confluence of these exogenous factors, among others, created a window of opportunity for the two countries to alter their positions with respect to the international industry.

Indeed, both countries successfully shifted dependency further back in the industry chain. This is significant both in what it says and what it doesn't say. The situation of dependency can be altered (and was in both cases) in favour of the host country, contrary to the expectations of most *dependencistas* and bargain theorists. However, both countries remained strongly dependent upon the international computer industry and that dependence continued to condition the development of their respective computer industries (and many other industries dependent upon computer electronics) on into the future.

This thesis documents a number of Mexican policy achievements that the so-called 'IBM decision' of 1985 obscured. The Mexican computer industry development programme and its promulgators encouraged local investors into the business of assembling microcomputers and peripherals, prompted initial technology transfer through domestic/foreign joint ventures, and helped improve the balance of trade in the sector by restricting imports and extracting export commitments from TNCs. The programme established some order in a chaotic market and helped to generate professional/technical employment opportunities. The policy initiative largely failed, however, in its aims to foster national investment in R&D, horizontal integration (i.e., the development of Mexican component suppliers) and create Mexican-majority-owned industry leaders in microcomputers and peripherals.

México's policy development, successes and failures were conditioned by the complex interplay between market and political forces. Given the perceived importance of the industry to economic development, computers became a privileged political product in the late 1970s, providing privileged access to policy-makers. Moreover, the specialised nature of the industry provided an opportunity for a small cadre of elites to influence policy formulation. Indeed, the opportunity expanded quickly from influence to responsibility for implementation. México may not have

been the archetype of the “developmental state”, but at least with respect to the country’s computer policy in the early days, a meritocracy in policy responsibility applied, if only because no one else understood the industry.

But sustained policy success was elusive. Policy-makers were unable to generate and sustain broad based political support at the highest levels of government. The change of government in 1982 swept away key political sponsors among the top authorities. Changing economic fortunes shifted macro goals from nationalist industrial development to increasing balance of payments surpluses and attracting foreign investment. The ongoing interests of the state as *consumer* of computers continued to override state preference for Mexican production or consideration of direct state investment in the industry. Finally, the mounting pressure of the TNCs and the increasing militancy of the US government on behalf of US companies brought about explicit changes to stated policy. Meanwhile, Mexican private investment in the industry was sparse and what little there was proceeded either cautiously or purely opportunistically.

The Brazilian case shows a shift in dependency still further back in the industry chain. However, subsequent chapters will demonstrate that the policy successes are rather more limited and temporary than the authors reviewed above have suggested previously. Brazil succeeded in shifting its dependence from foreign computer hardware (micros and minis) to foreign microelectronics and software for a longer period of time. The policy was successful in attracting the capital of major Brazilian investors, stimulating Brazilian employment in the industry, limiting TNC market share for an extended period of time, and extracting technology licensing agreements from computer TNCs. However, innovation in the industry continued to be introduced largely from outside the country and the market demonstrated a stubborn propensity to sidestep the regulatory and legislative strictures to access foreign technology.

Computers became a privileged political product some ten years earlier in Brazil than in México. And the policy-making elites had considerably more success in generating and sustaining broad support for the policy from 1976 to 1984. The

Brazilian state took the lead in investment in the industry and then organised protected concessions for national computer makers licensing foreign technology. The fast growing market protected from international competition attracted hundreds of new entrants who could not keep pace with the dynamics of the international industry. Many of these companies soon were actively seeking not just technology but capital from computer TNCs.

Moreover, the persistent uncompetitiveness of the Brazilian informatics industry gradually drove key informatics-dependent industries to lobby for a more liberal regulatory regime. Their voices, combined with those of the TNCs and the US government, led to the growing *de facto* liberalisation of the market reserve in the latter half of the 1980s. Before the 1984 Informatics Law expired in 1992, policy priorities shifted away from protecting the domestic market for Brazilian firms to attracting foreign investment, technology and trade with the aim to enhance international competitiveness.

Hence, this study does not just validate and document a shift in dependency. To stop there is misleading because such a statement is too 'stagnationist' (to use Palma's term in his criticism of the first two approaches in the dependency school). In both cases, the forces that acted to drive the shift are still at work; the bargaining game is not over. Just as the study shows that a shift in dependency occurred, so too does it show that the shift is not progressive and one-directional; the bargaining gains won by México and Brazil were not secure. In fact, the analysis exposes a reverse and complex trend toward greater dependency in both countries. For this reason one may not employ these two cases to support the obsolescing bargain in high technology industries.

Events in both countries since the primary research for this dissertation underline a central point of the thesis. Positional assets and relative bargaining power alone cannot adequately explain the policies and their results. Observers and analysts, whether they are traditional economists espousing bargain theory or political scientists holding to dependency theory, tend to pay too little attention to



entrepreneurial and managerial talent as determinants of market success. Decades after the reserve policies were adopted and then abandoned, a few domestic players in both markets have not only survived, but have thrived amidst the changing policy and industry environments. The market reserve enticed some to enter, but their success and the concurrent failure of so many others can only be explained by differences in corporate strategy choices and managerial capability.

Bargain theorists have similarly underestimated the importance and complex impact of the hyper-dynamism of the industry. The rapid globalisation of the informatics industry and its impact on economic productivity across sectors made the market reserve policy ever more difficult and costly to maintain. Meanwhile, the explosion of the microcomputer segment and the disaggregation of the global informatics value chain opened up opportunities for domestic players in Brazil and México to source essential components and operate more competitively in the most dynamic part of the industry in the 1980s and 1990s.

Finally, the very dynamism that opened up these opportunities also made it difficult for a state to respond and adapt in order to play an effective on-going influential role that Evans envisages,<sup>69</sup> nurturing and cajoling domestic and foreign capital to serve a defined development agenda. This is a central challenge for policymakers in a high-tech globalised world. Stopford and Strange emphasise the importance of crafting policy based on a sound understanding of the competitive dynamics in the industry,<sup>70</sup> but that is easier said than done with respect to the hyper-dynamic informatics sector. Host state competence and even prescience may be essential, but adaptability is more important. The concluding chapter offers observations and ideas about more flexible mechanisms a developmental state may use to encourage the development of internationally competitive high-tech sectors.

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<sup>69</sup> Evans, *Op. Cit.*, 1995. Evans uses the term “husbandry” to describe this role. For more discussion about Evans’ concepts of state roles, see my Afterword to the Brazilian Case.

<sup>70</sup> Stopford and Strange, *Op. Cit.*, p. 96.

## **Structure of the Thesis**

From this introduction and overview, the dissertation moves in the subsequent four chapters to a detailed consideration of the case of Brazil. Chapter 2 outlines the general ideological, political and economic context in which the informatics policy was developed and implemented. Chapter 3 then documents and analyses the development of computer policy in Brazil and the country's experience with the international computer industry. Chapter 4 contains an evaluation of the policy's impact on the development of the industry to ascertain what bargaining gains were achieved. Chapter 5 comprises an *Afterword* that summarises the main developments in the Brazilian case since 1990, when the government began to enact liberal market reforms. Chapters 6, 7, 8 and 9 discuss in the case of México in parallel fashion. The tenth and final chapter summarises the cases side by side and then offers conclusions and implications for theory and practice of TNC-country bargaining in high technology industries.

## **THE CASE OF BRAZIL**

## CHAPTER 2

### INTRODUCING THE CASE OF BRAZIL: GENERAL POLITICAL AND ECONOMIC CONTEXT

#### Introduction to the Brazilian Case

In 1977 the government of Brazil moved to reserve the domestic minicomputer industry to Brazilian-owned firms. Subsequently, an indigenous computer industry developed under the protective rubric of the market reserve. This industrial development was characterised by a number of important successes: a remarkable increase in employment in the sector; the development of a critical mass of scientists and technicians in computers; the emergence of a national capability in minicomputer, microcomputer, and peripherals manufacturing; an increase in local research and development efforts in computers; and a reduction of foreign dominance of the end-user market. In the late 1980s and early 1990s these policy achievements were cited as evidence of the possibility of successful bargaining by Third World nations in high technology industries.<sup>71</sup>

Over time the policy came under increasing pressure and was moderated by a number of factors and events. These included the economic crisis in the wake of the failed Cruzado Plans, the transition to civilian rule and the changes in party politics, the rapid pace of technological change, the increasing demands of the local market, and the pressure from the computer transnationals and the U.S. government.

The purpose of this chapter is to establish the general ideological, political and economic context in which computer industrial policy was formulated. This is important background to the following chapter's examination of the factors and events that (i) explain the policy decisions that were made with regard to the industry and served to sustain the policy up to the late 1980s; and (ii) acted to alter the policy

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<sup>71</sup> Emanuel Adler and Joseph Grieco both affirm this. See Adler, *Op. Cit.*, (1987), and Grieco, *Op. Cit.*, (1984). See also the later work of Peter Evans, *Op. Cit.*, (1995).

and its prospects for continued success. Chapter 4 analyses the policy and the industry in sufficient detail to ascertain to what extent the policy objectives were met.

This analysis reveals that Brazil successfully capitalised on an opportunity to alter its position with respect to the international computer industry; dependency was indeed shifted further back in the industry chain.<sup>72</sup> The success achieved owes in large part to the broad and sustained support from diverse influences in the country: academic elites with a personal and ideological interest in the development of a national computer industry; the Ministry of Trade and Industry which was concerned with a worsening balance of trade; the military which was concerned with national security and technological autonomy; national developmentalists in the National Development Bank (BNDES); and the private sector which responded to the state's strong lead, seeing a profitable opportunity in a protected market.

These are indeed rather peculiar allies. The military is not a natural bedfellow with nationalist academic elites, for example. However, the strategic nature and ubiquitous relevance of the industry meant that support for a sectoral development policy could be so diverse both in its sources and rationales. Moreover, the relation of technological autonomy to development in general was broadly accepted among power elites in Brazil; it was not a new concept. These diverse actors shared a common perception of Brazil's future as an economic and military power on the world stage, and the necessity of technological capability to that status. This "national developmentalism" provided a stable foundation for the policy initiative in computers in the 1970s and 80s.

Not only did the power elites share a common perception of the goal, Brazil's history indicated an accepted means to the desired end. The Brazilian state would need to fulfil the familiar roles of lead investor, cartel-maker, and regulator in order for the indigenous industry to develop. These were roles the state had played in many

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<sup>72</sup> "Further back in the industry chain" means that dependency on foreign technology and supply shifted from computer hardware equipment to the microelectronic components that drive the hardware.

industries identified as strategic. The computer industry was no exception. As such, the market reserve in computers was not a new and daring departure from traditional economic policy for Brazil when it came into force in 1977. It was simply a new area in which an old formula was applied.

While these factors enabled the country to capitalise on the opportunity to shift dependence in the computer industry, the opportunity itself was created primarily exogenously. In particular, the dynamics of the worldwide computer electronics industry in the 1970s and 1980s worked in such a way as to lower the capital and technological barriers to entry into the sector.

While dependency was altered, by no means was it eliminated. Indeed, some of the important bargaining gains achieved by the market reserve were temporary. The market reserve was substantially dismantled after 1990 when liberal market reforms were adopted. In any case, by then a globalised industry structure with *de facto* international technological standards controlled by a few transnationals placed unbearable pressure on the protectionist policy. Thus, the case of Brazil serves as a salient reminder that bargaining gains are not secular and progressive. Indeed they are all the more vulnerable in a volatile economic, political, and technological context. The computer industry in Brazil exists in precisely such a context.

### **The Ideological, Political, and Economic Context**

Brazil's unique historical political and economic situation in the latter half of the twentieth century provided fertile ground in which a nationalist computer policy could develop and be sustained. The following pages examine (i) the shared perception of Brazil's future which provided the goal that united the diverse power groups behind the computer policy, (ii) the historical means to industrial development, namely, state intervention, (iii) the stable political situation after 1964; and finally, (iv) the government's industrial policies and the post-war economic growth which together provided favourable investment conditions for public and private capital alike in this new industry.

### National Developmentalism: The Uniting Ideology

"We are not just regulating the computer industry; we are constructing a country."<sup>73</sup> This statement reflects the perception of a great many proponents of the national computer policy in Brazil.<sup>74</sup> The attempt to develop an indigenous capability in computers was rooted in a deeply-held vision of Brazil's future as a world economic (and for some, military) power. The country's vast territory and rich natural resources fed this vision and together with the Estado Novo helped to spawn an ideology of economic policy-making which some have called "National Developmentalism."<sup>75</sup>

This national developmentalism gradually became institutionalised in the 1940s and 1950s during this period of strong economic growth through import substitution. It was reflected in, and propagated by a series of ambitious development plans in the post-war period which included: the SALTE Plan for Health, Food and Transport (1950–54); the planning effort of the Joint Brazil–United States Economic Commission (1951–1953); the establishment in the early 1950s of the National Development Bank (BNDES) to finance numerous infrastructure projects and later played a pivotal role in the planning and finance of the national effort in computers; the 1953–55 BNDES/ECLAC/United Nations effort at systematic planning; and President Juscelino Kubitschek's National Development Council, Programme of Targets, and special incentives programmes. This post-war series of development plans and the intense discussions around them "spread a sort of political mystique of

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<sup>73</sup> Author interview with Roberto Spolidoro, Deputy Secretary of the Special Secretariat for Informatics, Brasilia, October 1987.

<sup>74</sup> See Adler, *Op. Cit.*, 1987, pp. 238ff.

<sup>75</sup> See, for example, Albert O. Hirschman, "Ideologies of Economic Development in Latin America," in Hirschman, *A Bias for Hope: Essays on Development and Latin America*, (New Haven: Yale University Press, 1971), pp. 270–311; and Frank Bonilla, "A National Ideology for Development in Brazil," in K.H. Silvert, ed., *Expectant Peoples: Nationalist Development*, (New York: Random House, 1963), pp. 232–264.

development—what came to be called *desenvolvimentismo*—among the leaders of Brazilian public and political opinion."<sup>76</sup>

It is important to remember that the quest for development was more than an ambition for increases in per capita income.

"It is also, and most importantly, this 'conquest of decision centers,' which were previously in foreign hands, and a new ability to strike out on one's own, economically, politically and intellectually. For this reason, the quest for development is also a quest for self-discovery and self-affirmation and thus comes to be indissolubly tied to a new nationalism which is so noticeably a feature of the intellectual scene in Latin America."<sup>77</sup>

National developmentalism received new impetus after the coup d' état of 1964. In order to justify extended military rule, military ideologues explicitly linked national developmentalism with the military's own national security doctrine.<sup>78</sup> However, while espousing the rhetoric of economic nationalism, the military's economic policies were contradictory, largely encouraging the integration of Brazil into the international economy.<sup>79</sup> This fact does not weaken the argument that national developmentalism influenced policy-makers; indeed, it is a testimony to the vitality of this ideology that the military's departure was not made explicit. Moreover, when external forces threatened economic prosperity and the country's balance of payments, the military government responded with policies that coherently reflected the ideology of national developmentalism. The response to the oil crisis in the early 1970s, which emphasised energy autonomy via the alcohol fuels programme is a classic example of this.

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<sup>76</sup> Lincoln Gordon and E. C. Grommers, United States Manufacturing Investments in Brazil: The Impact of Brazilian Government Policies, 1946–1960, (Boston: Harvard University Press, 1962), p. 123.

<sup>77</sup> Hirschman, Op. Cit., p. 304. In referring to the "conquest of decision centers," Hirschman is using Celso Furtado's phrase. See Celso Furtado, Formação econômica do Brasil. (São Paulo: Companhia Editora Nacional, 1971).

<sup>78</sup> See Alfred Stepan, "The New Professionalism of Internal Warfare and Military Role Expansion," in Stepan, ed., Authoritarian Brazil, (New Haven: Yale University Press, 1973), pp. 47–65.

<sup>79</sup> Peter Evans makes this point in Dependent Development, Op. Cit., (1979).



Power elites in Brazil long recognised the importance of indigenous technological capability to national development. Technology was increasingly seen as the prime means of control over the 'decision centres' that Brazil was seeking to conquer. Therefore, technological autonomy became an intrinsic aim of national developmentalism.

Brazil's implicit and explicit science and technology policy since the Estado Novo reflected the elites' recognition of the importance of technology to the country's development.<sup>80</sup> Prior to 1962 there was little science and technology policy related to the commercialisation of technology. However, shortly after the Second World War the federal government became obsessed with the development of a national nuclear power capability. This ambition led to the establishment in 1951 of the National Research Council (CNPq), which remained an important centre of research in science and technology.

In 1964 the new military government created the Scientific and Technical Development Fund (FUNTEC) within the National Development Bank (BNDES). FUNTEC was to engender an increasing national supply and demand of high technology by financing research and the purchase of Brazilian equipment. Some years later FUNTEC was to provide initial funding for the development of the country's first computer.

In 1968 the government explicitly recognised technological development as a policy goal in its Strategic Development Programme 1968–70. This programme called for the incorporation of science and technology into the productive system through "real" technology transfer and through the development of a Brazilian capacity to innovate.

In 1971 the first National Development Plan (I PND) was published identifying the development of science and technology as a national objective. I PND instituted the Basic Plan of Scientific and Technological Development thereby endorsing a policy

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<sup>80</sup> Adler, *Op. Cit.*, (1987) pp. 156–162 provides a summary chronology of the main developments in Brazil's science and technology policy up to 1979.

pursuing technological autonomy. In 1974 II PND reinforced the importance of technology to Brazil's development strategy.

Thus, for some time leading up to the mid-1970s when Brazil launched its national experiment in computers, there was a strong official emphasis placed on technological autonomy as both a means to achieving the country's development goals, and as a development objective in its own right.

#### State Intervention: The Usual Approach

While the ideology of national developmentalism provided a basic rationale for the policy effort in computers, the historic role of the Brazilian state informed the specific approach to developing a national capability in this industry.

Brazil had a long history of state-control of the economy. "From Vargas's initial ascent to power, the state approached the economy with an attitude of conscious interventionism."<sup>81</sup> The federal government participated directly in the country's economy through direct ownership in key sectors such as railroads, shipping, airlines, steel, petroleum, petrochemicals, ports, electricity, telecommunications, and mining. Indeed, in 1987, eight of Brazil's twenty largest companies were state-owned.<sup>82</sup> The public sector accounted for half of the country's gross national product, and the government made half of the total investment in the state of São Paulo, the industrial powerhouse of the country.<sup>83</sup>

So one of the legacies of the Estado Novo was a centralised political machinery that was increasingly disposed to direct intervention in the country's economy. The result was a local private sector that was dwarfed on the one hand by the state conglomerates, and on the other, by the transnationals.

However, it is misleading to stop there. State intervention and control in the economy was not just a 50-year-old phenomenon in Brazil. It can be traced back to

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<sup>81</sup> Evans, Op. Cit., (1979), p. 86.

<sup>82</sup> Exame, "Mehores e Maiores," September 1987, p. 82. "Largest" in terms of total revenues. Eight more are foreign owned and the remaining four are owned by Brazilian private capital.

<sup>83</sup> "Brazil: Tomorrow's Italy," The Economist, January 17, 1987, p. 24.

the tradition of "cartorias"—the officially-granted charters with which the Portuguese controlled the local economy. The coffee cartels are perhaps the most significant early example of this. The modern Brazilian state continued in this tradition, granting concessions in public utilities, and later in computers.

The government intervened in the computer industry in a number of different ways that included both direct ownership and the granting of concessions. The government proposed to lead investment in this new and risky sector of the economy by first investing public funds via the BNDES in a 'flagship' company: Cobra. The government envisaged the computer flagship as a tri-pe company, owned and operated jointly by the government, Brazilian private capital, and foreign capital.<sup>84</sup> However, the government was unable to attract investment from any of the major computer transnationals or any major Brazilian capital. Cobra received computer technology from Ferranti—a relatively small British electronics firm—but was financed almost entirely out of state funds. Several years later the government granted 'concessions' to five national minicomputer manufacturers, prohibiting others from competing in this growing market. The federal government exercised further control in the industry via a plethora of regulations concerning foreign trade, access to credit, and the use and deployment of computer equipment.

#### The Political Situation: Stability and Nationalist Influence

An oft-cited aid to Brazil's economic miracle of the late 1960s and early 1970s is the political stability provided by military rule. Clearly, the 1964 coup d' état was welcomed by business interests, both foreign and domestic alike. Equally clear was the economic growth that followed 1964, which is examined in more detail in the next section.

The military government championed the goals of national security and the restoration of economic growth. National security was to be maintained by the

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<sup>84</sup> See Evans, *Op. Cit.*, 1979, for further elaboration of the tripe concept, especially as applied in the petrochemicals industry.

authoritarian, repressive, and (self-styled) apolitical military regime. Growth was to be powered by a state-led economy that opened gradually to market forces.

As already noted, the successive military regimes championed the national developmentalist cause in theory; but were often internationalist in practice. During the period of military rule from 1964 to 1974 foreign investment increased substantially and the foreign transnationals grabbed a bigger share of the Brazilian economy.<sup>85</sup> But so long as political repression was severe, nationalist dissent was not a factor.

However, in 1974 President Geisel began to relax the political repression and nationalist voices were once again raised to highlight the discontinuity between the military's rhetoric and practice. These nationalist attacks were directed not so much at the military government; but rather at foreign capital which had contributed significantly to the recent economic miracle, but which was perceived to have usurped the rightful place of local private capital.

So the political context engendered by military rule was characterised by two factors: (i) political stability that fostered a favourable investment climate and contributed to the high rates of economic growth in the 1960s and 1970s; and (ii) increasing pressure on the government to keep faith with national developmentalism and restrain the foreign transnationals. The first of these factors meant that there were financial resources that the government could invest in a nascent computer industry. The second provided further motivation to make such an investment and limit foreign capital participation.

#### Industrial Policy and the Economic Situation

"After the second world war the industrialization changed from a stopgap effort into a determined policy to alter drastically the structure of the Brazilian economy. The basic reason for this change was a realisation by the policy makers that Brazil could not attain a high rate

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<sup>85</sup> Foreign Direct Investment as a percentage of GDP more than doubled in those ten years, growing from 0.40% in 1964 to 1.09% in 1974 (Banco do Brasil statistics).

of growth in the future by relying chiefly on the export of its principal primary commodities whose world market was shrinking."<sup>86</sup>

In 1950, industry accounted for 23.5 percent of Brazil's Gross Domestic Product (GDP), while agriculture contributed 26.7 percent, and services 49.8 percent. Just twenty years later in 1970, industry contributed 35.4 percent while agriculture's share dwindled to 11.0 percent (services: 53.5 percent).<sup>87</sup> As Baer asserts, the rapid industrialization of the Brazilian economy is directly attributable to a conscious government policy of import substitution in the post-war years.

In the 1950s, the government pursued largely autarchic industrial development through a variety of measures including: a multiple exchange rate system designed to protect certain industries and encourage particular capital goods imports, credit incentives for industry, fiscal incentives favouring manufacturing investment, and a protectionist tariff system.

The so-called "Law of Similars" which was devised in the late 19th Century was revived in the 1950s. The law was effectively a tariff policy that was designed to limit the importation of items that were locally produced in sufficient quality and quantity to satisfy the domestic market. Effective tariffs on the importation of such goods averaged 250 percent.<sup>88</sup> As the law included no reference to price, in practice this tariff meant that imports were viable only if domestic production cost more than three-and-a-half times as much as the foreign product. It was under this "Law of Similars" that the market reserve in computers was first initiated in the mid-1970s.

The government introduced another tariff law in 1957 that was designed to protect newly-stimulated industries with tariffs ranging from 60 to 150 percent.

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<sup>86</sup> Werner Baer, Industrialization and Economic Development in Brazil, (Homewood, Illinois: Richard D. Irwin, Inc., 1965), p. 35.

<sup>87</sup> Conjuntura Econômica, various issues, cited in William G. Tyler, The Brazilian Industrial Economy, (Lexington, MA: D.C. Heath & Co., 1981), p. 10.

<sup>88</sup> Baer, Werner. The Brazilian Economy: Growth and Development, 4<sup>th</sup> Edition. (Westport, CT: Praeger, 1995): 206.

These restrictive tariffs and a complex bureaucratic system of import licensing served to keep demand for imports in check despite a grossly overvalued national currency.

Interestingly, these restrictive policies did not discriminate against foreign investors per se; they only discriminated in favour of those already established in Brazil.

"The operation of the Law of Similars has been a most powerful incentive for foreign investors to move from importing into assembly, or from assembly into full-fledged manufacturing. The essential feature of this incentive has been fear of outright exclusion from the market, rather than hope for preferential treatment in relation to competitors. In many cases, the mere report that some Brazilian or competing foreign firm was contemplating manufacture, with the implication that imports of similar goods would henceforth be ruled out, was the critical factor impelling U.S. companies to move to preserve their market position by building local plants."<sup>89</sup>

While these policies were successful in producing high rates of industrial growth until 1962–63, they also produced economic distortions in resource allocation and considerable inflation.<sup>90</sup> Ultimately, these autarchic policies fell victim to the change in government in the mid-sixties. After the coup of 1964, the new military government began to open the domestic economy more to market forces, sought to stimulate exports through a variety of measures, and reduced the government's budget deficit by controlling spending and introducing tax reforms.

The stability of the military regime and its economic policies encouraged capital accumulation and stimulated the Brazilian economy. During the period of Brazil's "economic miracle" (1968–74) GDP grew at an average annual rate of 11

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<sup>89</sup> Gordon and Grommers, *Op. Cit.*, 1962, pp. 23–24. Accordingly, one would have expected the computer TNCs to invest in the local production of minicomputers in 1974 when the Brazilian government was setting up Cobra. However, the Law of Similars had not been applied rigorously between 1964 and 1974. Nevertheless, as seen below, the Law was back in vogue by the mid-seventies in the wake of the oil price shock.

<sup>90</sup> Inflation grew from 12 percent per year in 1950, to 87 percent in 1964. Source: *Conjuntura Econômica*, various issues, cited in Tyler *Op. Cit.*, p. 3.

percent. (See Table 2.1)<sup>91</sup> Industrial growth proceeded at a higher rate still. Inflation was reduced and both exports and imports were stimulated during this period.

**TABLE 2.1**  
**The Brazilian Economy: Selected Indicators**<sup>92</sup>  
**1968 to 1986**

Year	Annual Growth %		-----Billions of US Dollars-----				
	GDP	GDP/Capita	Exports	Imports	BOT	External Debt	Int'l Reserves
1968	11.2	8.1	1.9	1.9	0	4.3	0.3
1969	10.0	6.8	2.3	2.0	0.3	4.4	0.7
1970	8.8	5.8	2.7	2.5	0.2	5.3	1.2
1971	13.3	10.2	2.9	3.2	-0.3	6.6	1.7
1972	11.7	8.7	4.0	4.2	-0.2	9.5	4.2
1973	14.0	10.8	6.2	6.2	0	12.6	6.4
1974	9.8	6.8	8.0	12.6	-4.7	17.2	5.3
1975	5.6	2.8	8.7	12.2	-3.5	21.2	4.0
1976	9.0	6.0	10.1	12.4	-2.3	26.0	6.5
1977	4.7	1.8	12.1	12.0	0.1	32.0	7.3
1978	6.0	3.1	12.7	13.7	-1.0	43.5	11.9
1979	6.4	3.5	15.2	18.1	-2.8	49.9	9.7
1980	7.2	4.6	20.1	23.0	-2.8	70.3	6.9
1981	-1.6	-4.0	23.3	22.1	1.2	79.9	7.5
1982	0.9	-1.5	20.2	19.4	0.8	90.5	4.0
1983	-3.2	-5.5	21.9	5.4	6.5	92.9	4.6
1984	4.5	2.0	27.0	13.9	13.1	102.4	12.0
1985	7.9	5.7	25.6	13.2	12.5	102.8	11.6
1986	8.0	5.8	22.3	14.0	8.3	109.0	6.8

The miracle began to fade when OPEC initiated steep increases in the price of petroleum in late 1973. Heavily dependent upon imported oil, Brazil's international petroleum bill rose from US\$ 606 million in 1973 to US\$ 2.6 billion in 1974.<sup>93</sup>

"The terms-of-trade shock and the concomitant balance-of-payments problems presented a policy dilemma to the Brazilian authorities, involving contraction and adjustment to the new international economic situation on the one hand, and temporary expedients,

<sup>91</sup> Ibid., p. 5.

<sup>92</sup> Sources: *Conjuntura Economia*, various issues summarised in Tyler, *Op. Cit.*, pp. 3, 15; *Ministro da Fazenda, Secretaria da Receita Federal, Importação 1986*, Year 15, Vol. 1; *Lloyds Bank, Economic Report on Brazil, 1985 and 1986*; *World Development Indicators*, World Bank Group, online database.

<sup>93</sup> *Conjuntura Econômica*, and *Boletim do Banco Central*, various issues, cited in Tyler *Op. Cit.*, p. 6.

delaying tactics, and autarchic retrenchment on the other. Because of the perceived risks of cutting the on-going growth process through contractionary macroeconomic policies, the response involved mostly the latter."<sup>94</sup>

The oil shock gave further impetus to Brazil's quest for energy self-sufficiency. Meanwhile however, the government financed continued economic growth and BOP deficits with foreign debt, and instituted severe import restraints. Total external indebtedness increased from \$US 12.6 billion in 1973 to nearly \$US 60 billion in 1980, and \$US 103 billion by 1985. (See Table 2.1) By 1980 Brazil's total external debt was almost one-fourth of the country's GDP, and by 1984 Brazil's debt equalled one-half GDP.<sup>95</sup> On the one hand, the country's ability to finance growth with foreign debt postponed the need for a radical adjustment to new international economic realities. On the other hand, Brazil's increased indebtedness now conditioned all economic policy choices and decisions.

The "autarchic retrenchment" began in 1974 with widespread tariff increases. In addition, nontariff barriers were raised considerably, and direct controls over public sector imports were tightened. Furthermore, the list of forbidden imports grew. It became impossible to get an import license for a growing number of finished consumer goods.

At the same time, interest in import substitution as a strategy for economic development was revived. ISI fit rather nicely with nationalist anger about import dependence and a growing foreign debt. Hence, the government extended import substitution policies to intermediate and capital goods. Investment in these sectors was encouraged through subsidized credit schemes and protection from imports.

The results of these policy reactions to the changes in the external economic environment were: a reduction of GDP growth from the dizzy heights of the miracle years, but nevertheless sustained at a healthy 7 percent per year (1974–79); increased foreign debt from US\$ 12.6 billion in 1973 to US\$ 57 billion in mid-1980; international

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<sup>94</sup> *Ibid.*, p. 6.

<sup>95</sup> Lloyds Bank Group, *Economic Report: Brazil*, 1985 and 1986 issues.



reserves little changed at about US\$ 6 billion; exports growing from US\$ 6.2 billion in 1973 to US\$ 15.2 billion in 1979; but, imports growing even faster, from US\$ 6.2 billion to US\$ 18.1 billion in the same period; and an increase in inflation from 20 percent in 1973 to 55 percent in 1979. (See Table 2.1) The closing of the domestic market was successful in limiting manufactured imports; however, the successive oil price rises ensured the dramatic increase in total imports. Meanwhile, the shift back to ISI constrained export growth. The reduction in export growth rates was particularly worrisome for Brazilian policy-makers given the burgeoning foreign debt.

Hence, in 1979 with the transition from Geisel to Figueiredo, (and from Velloso to Delfim Netto in the Planning Ministry) the pendulum of economic policy swung back in the direction of liberalisation. In December 1979 the government initiated economic policy reforms. The centrepiece of the reforms was a maxi-devaluation of the cruzeiro, reducing its nominal value by 30 percent. Some fiscal tax credit subsidies were eliminated at this time and the government proposed to simplify the tariff system. The implicit aims of the policy shift were to make Brazilian industry more competitive and stimulate export growth.

The new government was successful in stimulating exports, but needed to keep devaluing the cruzeiro in order to do so. There was another maxi-devaluation of the cruzeiro in February 1983, and in 1984 the cost of the US dollar was raised in cruzeiro terms by 224 percent compared with an inflation rate of 211 percent in that year.<sup>96</sup>

The devaluations of the cruzeiro also served to inhibit imports, which declined from a high of \$US 23 billion in 1980 to \$US 13 billion in 1985. However, the major reasons for the decline in imports were the severe recession experienced in 1981–83 and the continuing import restrictions on most items. In the face of high world interest rates, economic recession, and the Mexican debt crisis, which halted the flow of foreign funds to Latin America, Brazil approached the IMF in December 1982 for the first time. The government agreed to an austerity programme in exchange for debt

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<sup>96</sup> Lloyds Bank, *Op. Cit.*, (1985), p. 23.

rescheduling and fresh loans to balance the external accounts. However, Brazil failed to meet the agreed inflation targets and IMF funds were frozen from May 1983 to March 1984. In November 1984 Brazil initiated new negotiations with creditor banks, and under pressure from the IMF and World Bank, simultaneously lifted import restrictions on several thousand items. Firms were allowed to increase imports by 20 percent during 1985 under the quotas set by the central bank's foreign trade department.

Viewing the development of Brazil's market reserve in computers in the context of the foregoing wider discussion of economic policy and performance, notice first that the initiative to develop a national computer manufacturing capability came in the early 1970s when the economic miracle was at its most inspirational. The high rates of GDP and export growth, and the accumulation of investment resources presaged a bright future and provided a strong investment climate for an aggressive science and technology policy. It was in this context that the government committed investment resources via the BNDES to the establishment of a national minicomputer industry.

Later, the oil price shock intensified pressure for energy independence and import substitution. Some of the autarchic policies that had fallen out of favour during the miracle years were now more acceptable. This provided those who sought to reserve the computer market to Brazilian companies with a favourable political and economic climate in which to institutionalise protection for the nascent industry. This happened in 1977 when the minicomputer market was in fact reserved.

During the recession of 1981–83 the market reserve policy was expanded and strengthened, fitting well with the need to restrict imports at this time. Interestingly, even under pressure from foreign lending institutions to liberalize foreign trade during 1983–84, the policy survived and was even codified in law. Yet the Finance Minister at the time insisted the market reserve be limited in its duration to eight years (until 1992). It is thought that this limiting clause, written into the law itself, was necessary to justify the reserve to foreign creditors at a delicate time in negotiations.

However, one cannot predict the level of support for a protective computer policy simply by analysing the macroeconomic context of the day. A good understanding of Brazilian industrial policy must recognise the high degree of autonomy and discretion that middle-level civil servants exercised over policy decisions. The bureaucratic nature of the state apparatus and the depth and complexity of the state's involvement in, and regulation of, industry means that practical policy decisions were often taken by the implementers of policy.

While the foregoing discussion has given us a broad context for an analysis of the Brazilian computer policy, it remains incumbent to examine the "micro-politics" surrounding the policy and the industry. Tyler implies the need for such an analysis:

"Consumption goods receive the heaviest tariff protection, followed by intermediate goods and then finally capital goods. Beyond this basic characteristic... there is no readily identifiable rationale in the structure of protection. No factor of production can be identified as being favored. It almost appears as though the structure of protection is random, worked out haphazardly through producer access and influence in the decision-making process over time. Once imbedded, protective instruments take on an inertia of their own, making it very difficult to remove them despite changing circumstances."<sup>97</sup>

Having established a general context then, the next chapter moves to a more detailed and specific consideration of the factors and events that led to the development of the Brazilian computer policy.

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<sup>97</sup> Tyler, Op. Cit., p. 20.

## CHAPTER 3

### EVOLUTION OF BRAZIL'S INFORMATICS POLICY

The purpose of this chapter is to describe the evolution of Brazil's informatics policy, paying close attention to the factors and events that (i) explain the policy decisions that were made with regard to the industry and served to sustain the policy up to the late 1980s; and (ii) acted to alter the policy and its prospects for continued success.

#### **Genesis of the Policy: The Sixties and Seventies**<sup>98</sup>

In 1960 the first digital computer was installed in Brazil at the Pontifical Catholic University (Pontifica Universidade Católica or PUC) in Rio de Janeiro. This first-generation computer, the B-205, was based on valve technology and manufactured by Burroughs Corporation in the United States. A consortium comprising the Ministry of War, the National Research Council, the National Nuclear Energy Commission, the National Steel Company, and the university itself paid the price tag of \$400,000. For its contribution each member of the consortium had the right to utilise the equipment on a time-sharing basis for a period of eight years.<sup>99</sup>

The importation was not without its difficulties. The purchase first needed the approval of the National Economic Council, the Group of Studies and Application of Electronic Computers, and the Bank of Brazil. The process took a total of eighteen months before the large mainframe computer arrived in Rio in April 1960.

The installation of this computer was seen to be an event of national importance. President Kubitschek personally inaugurated the computer while Cardinal

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<sup>98</sup> In tracing the history of the Brazilian policy up to the 1980s I am indebted to the work of several other researchers, especially: Adler, *Op. Cit.*, (1987); Tigre, *Op. Cit.*, (1983); Evans, *Op. Cit.*, (1986) pp. 791–808; and Silvia Helena, *Rastro de Cobra*. Caio Domingues & Associados Publicidade Ltda., 1984.

<sup>99</sup> Georg Herz, "Del Castillo, o esquecido na informática brasileira", mimeo. reproduced from *Folha de São Paulo*. February 19, 1986.

Montini of Rome (later Pope Paul VI), who flew to Brazil especially for the occasion, inaugurated the newly formed Centre for Data Processing at the university.

The national importance and profile ascribed to the event by the country's leadership is significant. It is an indication of the importance Brazil assigned to high technology in general and computers in particular. This national profile proved vital to the later development of a national computer industry.

The involvement of the country's higher education institutions was likewise no coincidence; changes in these institutions provided fertile ground in which a national computer industry was later to flourish.

#### Cobra: The Industrial Focus

In 1961 a group of four engineers at the Instituto Tecnológico de Aeronáutica constructed a primitive digital computer prototype as a senior class project. This is the first known attempt to build a Brazilian computer. Funding from the National Research Council (CNPq) and a number of Brazilian companies enabled the young engineers to test the computer prototype for a period of 60 days. At the same time a number of other Brazilian colleges and universities began to develop programmes in electronic engineering.

While Brazilian academia began to train data processing engineers, the central government and a growing number of both private and state enterprises were becoming more involved in—and dependent upon—data processing activities. Their demand for data processing engineers soon outstripped the academic institutions' ability to supply them.

For now, Brazil had entered the computer age, but primarily as an importing consumer. IBM and Burroughs had established operations in Brazil in 1917 and 1924 respectively. But until the early 1970s these operations existed primarily for marketing and service. These companies had manufacturing plants in Brazil, but with respect to computers they were only producing some supplies and assembling peripheral equipment locally. Until the 1970s all of Brazil's computers were, like its first, manufactured elsewhere and imported. Furthermore, there was no local capital

involvement in the industry whatsoever, and no specific government policy relating to the industry.

Hence, the growing numbers of engineering graduates with an interest in data processing faced a limited number of creative opportunities. They could remain in academia and with limited funds continue research in electronic engineering or build prototypes of computers. They could operate data processing machinery for government, or enterprise. Or they could sell data processing equipment that was designed and manufactured elsewhere for one of a few computer transnationals.

The introduction of electronics into the coursework of Brazilian higher education together with the centralized design and manufacture strategy of the computer transnationals was generating a group of "frustrated nationalist technicians with strong personal and ideological interests in the creation of an [integrated] local computer industry."<sup>100</sup> Without the availability of willing venture capital, a local computer industry could only arise with strong government protection. As seen further below, several of these engineers gained positions in the central government bureaucracy and were able to exercise decisive influence in the development of a national computer policy.

Later in the sixties, the "frustrated technicians" were to gain important allies to their cause. In the mid-1960s the Brazilian navy began to realise the importance of computer electronics to modern naval vessels. Officials in the navy grew concerned about their dependence upon electronic equipment that could only be produced and maintained by foreign companies. Thus, for military reasons, the cause for developing a national computer capability gained an important ally.

The navy's champion for this cause was Commander José Luis Guarany Rego, an electrical engineer who had studied at the Digital Systems Laboratory in the Polytechnic School at the USP. Guarany was appointed Director of Naval Electronics

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<sup>100</sup> Evans, Op. Cit., (1986) p. 792.

in the late sixties. "Guaranys believed in a national [computer] industry" and was highly regarded by the engineering academics.<sup>101</sup>

At the turn of the decade the Brazilian navy purchased a series of six frigates from England. These modern vessels were in fact little more than platforms for computerized equipment. Guaranys thus had a contemporary illustration with which to justify his cause with his superiors.

In February 1971, at the initiative of Guaranys and the Brazilian navy, a special working group (Grupo Especial de Trabalho or GTE) was established in conjunction with the Planning Ministry, which had identified electronics as a priority area for national technological development. While the GTE was established jointly, the initial objective of the group reflected the overriding concern of the navy: "to promote the design, development, and construction of an electronic computer prototype for naval operations."<sup>102</sup>

The working group was formalised and established by presidential Decree 68.267 as GTE/FUNTEC 111. The group was capitalised under the auspices of the Scientific and Technical Development Fund (FUNTEC) with the navy contributing 3 million cruzeiros and the National Economic Development Bank (BNDES) contributing 7 million. Guaranys naturally represented the navy, while the BNDES was represented by Ricardo Adolfo de Campos Saur who was to continue a prime mover in the development of the national computer policy throughout the seventies and early eighties.<sup>103</sup>

In April 1971 the navy opted to purchase the FM 1600 computer for the new vessels from the British manufacturer Ferranti. In the following month, the navy received a proposal from E.E. Equipamentos Eletrônicos—a small private Brazilian company which had supplied a limited amount of electronic equipment to the navy in

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<sup>101</sup> Silvia Helena, *Op. Cit.*, (1984) p. 18.

<sup>102</sup> *Ibid.*, p. 20.

<sup>103</sup> Guaranys, on the other hand, never saw the fruits of his labours. He died suddenly in September 1973.

the past. This proposal was entitled "An Integrated Plan for National Computer Design and for the Support of Naval Digital Systems."<sup>104</sup> The proposal was that E.E. manufacture the FM 1600 under license from Ferranti. In addition, it proposed the creation of a simulation centre for the navy, the provision of maintenance services and training in manufacturing and maintenance, and vendor contracts for providing Ferranti software and parts. Although the proposal was not approved at the time, a tri-pe arrangement between Ferranti, E.E., and the BNDES was established three years later.

In 1972 GTE/FUNTEC 111 unveiled the "First Basic Plan for Scientific and Technological Development (1973–74)." The plan envisaged the establishment of a national minicomputer industry based upon the association of the government with local and foreign firms; a tri-pe company was to be the vehicle for technology transfer. The tri-pe arrangement had worked well in the petrochemicals industry and was thus seen to be the way forward in this industry where transference of foreign technology and capital was required. The plan also envisaged the development of a domestic minicomputer prototype.

Pursuant to establishing a tri-pe company, Saur travelled abroad in early 1972 to visit foreign computer companies to assess alternatives to Ferranti. He visited Varian, Hewlett–Packard, Digital Equipment Corporation, IBM, AEG–Telefunken, CII, Philips, Fujitsu, and Ferranti and found that all except IBM and Philips were initially receptive to conditions of technology transfer and minority equity participation. Ultimately, however, AEG was not interested, H–P couldn't abide a minority position, and DEC was reluctant to the terms of technology transfer. Underlying this, these firms were primarily preoccupied with their burgeoning home markets for computers, and secondarily with exporting abroad. They had little motivation to share their technology in a venture that they did not control. Thus, only Varian, CII, Fujitsu, and Ferranti made proposals.

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<sup>104</sup> Helena, *Op. Cit.*, (1984), p. 21.



The search for a local partner was no less difficult. Local capitalists were not yet convinced of the government's resolve to invest the necessary resources to develop a national industry. Apart from tiny E.E., there were few options. So, in March 1972 the company was chosen as the national partner in the tri-pe venture. E.E. joined the working group in searching for and selecting a foreign partner.

Having purchased Ferranti equipment already, the navy was insistent that the English company be chosen. The BNDES, on the other hand, had a different agenda. The Bank's view was that the first Brazilian computer company should be a manufacturer of general-use computers; Ferranti's computers were of limited application.

Toward the end of 1972 the conflict within the working group came to a head when the BNDES representatives issued a paper signed by the President of the BNDES Marcos Vianna, the Secretary-General of the Planning Ministry Henrique Flanzer, the Assistant Secretary-General of the Planning Ministry José Pelucio Ferreira, and by Ricardo Saur. The report recommended an association not with Ferranti, but with the Japanese company Fujitsu, which, the BNDES claimed, had submitted the best proposal to the working group.

A solution was ultimately reached when the Planning Minister Joao Paulo dos Reis Velloso suggested that two tri-pe companies be established: one with Ferranti and one with Fujitsu. In April 1973 the Ministry proposed the creation of a holding company, Eletronica Digital Brasileira (EDB) whose shares would be held by state enterprises including the BNDES, Petrobras, and Telebras. EDB would then hold two companies. The first was to be called Digibras, held equally by the BNDES, E.E., and Ferranti, and would serve primarily the military market. The second was to be organised in the same way with Fujitsu as the foreign partner and would serve primarily the commercial market.

Ironically, however, the second company in association with Fujitsu was never established. Instead, the first company was to serve both the requisite military needs and the desires of the BNDES for a general-applications minicomputer. In July 1974

the holding company EDB assumed the name of its subsidiary Digibras, and the Brazilian computer flagship company was dubbed Cobra SA. Later that year Cobra produced the first Brazilian-assembled minicomputer, the Argus 700, using Ferranti technology which was the process control system required by the Brazilian navy.

Meanwhile, with respect to the second goal of the working group—the development of a domestic minicomputer prototype—GTE/FUNTEC 111 signed an agreement with the USP, PUC and E.E. in July 1972. The project was called G-10 ('G' after Guarany's) and had as its aim the development of a minicomputer within two years. The Digital Systems Laboratory in the Polytechnic School at USP was to develop the hardware, and PUC the software for the computer.

The G-10 project focused the energy of some two hundred engineers and enlisted the support of the Federal Service for Data Processing (Serpro) which had been created in 1970 to serve the Treasury Department's data processing needs.<sup>105</sup> As the government's data processing needs grew, Serpro could not keep up. It needed to import more and more equipment, but the agency's U.S. suppliers were too preoccupied with the exploding American market to respond quickly to Serpro's orders. As a result, Serpro engineers began to do a small amount of hardware development and adaptation themselves. Two such 'developments' were the STV-1600 terminal unit, and a keyboard concentrator. Serpro's contributions, together with a computer terminal developed at the Federal University of Rio de Janeiro (UFRJ) produced the G-11 minicomputer as successor to the G-10.

Hence, the marriage of the navy's concern for national security and the BNDES's concern for technological development, together with strong support from the nation's universities, Ferranti, and E.E., bore fruit in the form of Cobra and the G-10/11 minicomputers. Once established, Cobra became the focus of the national efforts at computer development. The G-10 and G-11 were transferred to Cobra

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<sup>105</sup> Adler, *Op. Cit.*, (1987), p. 247.

which then employed many of those who worked on these projects at USP, PUC, and UFRJ.

In 1975, GTE/FUNTEC 111 was disbanded, and Digibras, Cobra's holding company, assumed responsibility for the national computer project. Digibras became "an industrial promotion agency to approve projects and set up research centres and companies to develop the sector."<sup>106</sup>

One of the first initiatives of Digibras in its new role was to seek another foreign supplier of technology so that Cobra could commercialise a general-use business computer. After attempts to draw in Data General (after DEC, the largest manufacturer of minicomputers), Fujitsu, and Nixdorf failed (see later), Digibras found a small American company, Sycor, that was willing to supply Cobra with minicomputer technology in exchange for freer access to the Brazilian market. In 1976 an agreement was signed between the two companies, which resulted in the Cobra 400 series minicomputer for business and accounting applications.

Cobra continued to supply computer equipment to the military and sold also to some government institutions such as Digibras and Embratel. However, the company was unable to penetrate the growing private commercial market, which continued the exclusive domain of TNC imports. The company's problems were exacerbated by a cumbersome management structure (which reflected the diverse ownership structure of the company), and a chronic lack of capital. Cobra, as a result, was a commercial disaster requiring continuous infusions of capital from the joint-venture partners just to keep it afloat. The capital requirements soon outstripped the resources of tiny E.E. whose share in Cobra dwindled to 5 percent within a year.<sup>107</sup> Ferranti continued to contribute, but Digibras was wary of allowing the foreign company's share of Cobra to grow. Hence, up to mid-1977, the BNDES supplied the majority of Cobra's capital needs.

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<sup>106</sup> Adler, *Op. Cit.*, 1987, p. 246.

<sup>107</sup> Helena, *Op. Cit.*, p. 31.

In mid-1977 a consortium of eleven banks including the two largest private banks, Bradesco and Itau, acquired 39 percent of Cobra's stock. The banks' interest in Cobra may be attributed to their growing needs for electronic automation and a desire to hedge against the likelihood of increased restrictions on imports of computer equipment from abroad. Their investment in the national industry in this way was highly significant. The capital injection helped to save Cobra from financial ruin and allowed the company to develop the next line of minicomputers, the 500 series, which were the first computers to be designed totally in Brazil, using 92 percent locally developed components.<sup>108</sup> More importantly, however, by virtue of their financial stake in the industry, Brazilian private capital was developing a vital interest in the institution and preservation of a market reserve. It is their interest that, in large measure, was to sustain the market reserve into the eighties.

#### CAPRE: The Political Vehicle

While Cobra became the industrial focus for the development of a national computer electronics capability, an agency was established in the central government, which was to become the political vehicle for the development of a national computer policy. During the late sixties and early seventies the demand for computer equipment and data processing services in Brazil grew rapidly, not least in the government bureaucracy itself. While this growth did not translate into an overt concern about computer imports until 1974/75, there was a perceived need to regulate and rationalise the use of computers in the federal government much earlier. This perception, together with the goal of the Planning Ministry to give incentive to the growing national capabilities in science and technology, led to the creation, by Presidential Decree 70.370, of CAPRE—the Commission for the Coordination of Electronic Data Processing Activities—on April 5, 1972.

CAPRE was established in the Planning Ministry with a mandate to: (1) take and maintain a census of existing data processing equipment in the federal

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<sup>108</sup> Adler, Op. Cit., p. 248. The 500 series was introduced to the market in 1980.

government; (2) rationalise computer purchases by the state; (3) finance federal data processing activities; and (4) set up training programmes for data processing personnel.<sup>109</sup> At this time CAPRE had no mandate to regulate imports or the activities of foreign computer firms in Brazil. The agency was to regulate the use of computers in the federal government and impulse the local industry through the establishment of *training programmes, not import restrictions*.

CAPRE's early organisation structure reflected these original objectives. The agency's decision-making council comprised representatives from the armed forces, the BNDES, the Finance Ministry, the Brazilian Institute of Geography and Statistics (IBGE), and the Modernisation and Administrative Reform Secretary. The interest of these constituents in computers is plain. The armed forces (apart from their ubiquitous presence in government at this time anyway) and the BNDES were pursuing the same goals as they did in the special working group. The Finance Ministry was included as the funder of CAPRE's initiatives and was looking to the development of a national industry that could substitute eventually for some imports. The IBGE was a large user of data processing equipment and services in its role as the keeper of statistics, and was also to assist with the census of computer equipment in the government. Finally, the Modernisation and Administrative Reform Secretary was primarily concerned with the rational use of computer equipment in government to assist it in its normative function.

While the constituents of CAPRE's council give us some hint as to the real agenda of the agency, the key to understanding its ambitions lies in its situation in the Planning Ministry and its Executive Secretary, Ricardo Saur who had represented the BNDES in GTE/FUNTEC 111. While the agency fulfilled its role as census-taker and regulator of computers in government, its early actions were concerned primarily with promoting the local industry and seeking thereby to limit imports.

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<sup>109</sup> Sílvia Helena, "A Indústria de Computadores: Evolução das Decisões Governamentais," *Revista de Administração Pública*, Vol. 14, No. 4 (October–December 1980), p. 81.

In January 1973 CAPRE established a Permanent Working Group comprising representatives from the BNDES, CNPq, the Studies and Projects Financing Agency (FINEP), and the Ministry of Education, which was tasked to promote a National Programme of Data Processing Centres. These were to be national centres for research and education in data processing technology. Their objectives were described as achieving economies of scale, extending the life of computer equipment, promoting the development of a national industry, assisting the process of technology transfer, and limiting imports.<sup>110</sup> Later that year CAPRE, together with the Ministry of Industry and Commerce, created a National Programme for Computer Training, which was to assist the development of a critical mass of trained resources in this area.

The spiralling costs of oil imports after the OPEC price raises heralded the end to Brazil's economic miracle in 1974 and indicated a need for limiting imports. The new Geisel government established restrictions on the imports of consumer goods by federal agencies in that year. The growing trade deficit in computers compelled the federal government to look for ways to explicitly restrict imports in this area as well. Between 1969 and 1974 computer imports had grown 600%. By 1974 they were the third most important product after airplanes and tractors among manufactured imports, accounting for \$100 million in foreign exchange costs.<sup>111</sup>

Already existent in a regulatory role within the federal government, CAPRE received new powers, which allowed the agency to act to limit computer imports directly by increasing tariffs. In December 1975, CAPRE was invested with the power to review and decide on all proposed imports of data processing equipment via Resolution 104 of the National Foreign Trade Council (CONCEX).

CAPRE's political fortunes grew further in 1976 when it was restructured by Presidential Decree 77.118 and given direction to develop a national informatics

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<sup>110</sup> CAPRE, *Boletim Técnico*, No. 105.

<sup>111</sup> Clélia Piragibe, "A Indústria de Computadores: Intervenção do Estado e Padrão de Competição", (Tese de Mestrado Economia Industrial, 1983) cited in Evans, *Op. Cit.*, (1986) p. 794.

policy. The agency's new council was headed by the Secretary General of the Planning Ministry and consisted of the president of CNPq, representatives of the military, and the ministries of Finance, Education, Industry & Commerce, and Communications. The replacement of the IBGE and Modernisation and Administrative Reform Secretary by CNPq, and the ministries of Education, Industry & Commerce, and Communications reflected the change in CAPRE's mandate from one of regulating the use of computers to one of developing an integrated national computer industry.

More significant to the day-to-day policies and activities of the agency were the executive secretariat (still headed by Saur) and its consultative commission of scientists and engineers. Herein lay the "frustrated technicians"<sup>112</sup> or "ideological guerrillas"<sup>113</sup> who worked with Saur to develop and promote the cause of a national computer industry.<sup>114</sup> The executive secretariat exercised considerable freedom in the development of policy initiatives. In CAPRE, Saur and his group had a strong political vehicle for the development and protection of the nascent domestic computer industry.

It is worth pausing in the story here to note that while Brazil at this time was hardly a model of the meritocratic developmental state in the East Asian mould, there was a meritocracy of sorts at work with respect to the management of informatics industrial policy. Owing more to their technical competence than to political patronage, Saur and the other 'técnicos' in CAPRE were given authority over national policy and its implementation. At this time in history, there were few others in the Brazilian state apparatus that were deemed competent and confident enough to manage it.

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<sup>112</sup> Evans' term, *Op. Cit.*, (1986) p. 792.

<sup>113</sup> Adler's term, *Op. Cit.*, (1987).

<sup>114</sup> *Ibid.* Adler identifies the main actors as Saur, Ivan da Costa Marques who later became chief executive at Cobra, Mario Ripper who was one of the four engineers who developed the computer prototype in 1961 and later became executive director of Serpro, Arthur Pereira Nunes who played a leading role in the establishment of ABICOMP, the computer manufacturers' association and lobby group, and Claudio Zamitti Mammana, a physicist at the University of São Paulo and later President of ABICOMP.

In its endeavour CAPRE received the implicit support of President Geisel. Geisel's Second National Development Plan included the "basic electronics industry" as one to be emphasized. In addition, the Second Basic Plan for the Development of Science and Technology sanctioned the creation of a local minicomputer industry controlled by local capital.<sup>115</sup>

1976 and 1977 were pivotal years in the development of the national computer policy. In these years the policy direction faced its first strong test by the computer transnationals led by IBM and Data General. By 1976, the large computer transnationals were beginning to take notice of what was happening in Brazil. Responding to the import restrictions and the calls for a national minicomputer industry, IBM pursued a high-profile and high-risk strategy. IBM attempted to preempt the minicomputer plan by producing its System 32 minicomputer at its Sumare plant in the state of São Paulo in 1976. The company launched an aggressive marketing campaign, announcing the impending availability of the new system. The campaign succeeded in generating a good deal of interest in the marketplace as IBM collected some 400 statements of interest from local business.<sup>116</sup> IBM executives met with the Planning Minister Velloso and President Geisel himself, attempting to ensure approval of their project.

IBM's actions were largely dictated from World Headquarters in New York. The company had a policy that forbade joint ventures of any kind at that time, and regarded the unconditional transfer of technology as anathema. Moreover, the company believed that its contribution to Brazil's exports during this time of rising import bills would ultimately swing the policy decision in its direction.

However, IBM's challenge was too little and too late. The government's official policy thrust in this area had been the pursuit of tri-pe, from the initial search by GTE/FUNTEC 111 to the Basic Plan for Scientific and Technological Development issued

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<sup>115</sup> Helena, *Op. Cit.*, p. 20. Other areas for "rapid progress" were nuclear energy and space research.

<sup>116</sup> *Ibid.*, p. 50.



by the Planning Ministry. The unofficial policy objective of CAPRE was nothing short of unconditional technology licensing. Furthermore, CAPRE had developed considerable political momentum and had succeeded in gaining the support of Planning Minister Velloso. IBM was not even offering tri-pe; simply local production. In the end, IBM was ordered to shut down its minicomputer production line in Sumare and export the minis it had already produced and promised to an expectant market.

CAPRE responded to IBM's challenge in July 1976 with Council Decision 01, which paved the way for reserving the minicomputer market to national companies. At this time CAPRE also assumed control of state purchases of software and data processing services, thus effectively regulating a market in which the agency controlled the purchases of the largest buyer. CAPRE's effective power and influence was growing.

In May 1977, a second TNC challenge came from the second largest minicomputer manufacturer in the world, Data General. DG had established a wholly-owned sales subsidiary in São Paulo in 1975 through which it planned to market its US-built minicomputers. However, all of the purchase requests received by the sales subsidiary were still awaiting import license from CAPRE by May 1977. Furthermore, DG had been involved in negotiations with Cobra to license technology for a business computer. But DG refused to accept Brazil's condition that patents, blueprints, etc. be transferred to Cobra at the end of the license period, so Cobra opted to license from the obscure Sycor, Inc. of Michigan. Adding insult to injury, Sycor was granted exemptions from the same import licensing restrictions to which the other TNCs were subject.

Data General's Manager of Finance and Public Affairs, J.B. Stroup, issued a formal complaint of discriminatory trade practice against Brazil to the U.S. Special Trade Representative, Robert Strauss.<sup>117</sup> The complaint cited four effects of the

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<sup>117</sup> The Data General case, together with the full text of the letter from J.B. Stroup of DG to the Special Trade Representative of the President were reported in Data News, No. 33, August 17, 1977, pp. 4, 5.

Brazilian policy: (1) U.S. companies are unable to participate in a promising market; (2) there will be a loss of employment in the U.S. as exports to Brazil are prohibited; (3) if Brazil succeeds it will encourage other countries to pursue similar policies, thus exacerbating the effects; and (4) a U.S. company (Sycor) was being favoured over other U.S. companies. The complaint concluded by offering four "Options to Consider:"

- "(1) Bilaterally request that Brazil eliminate tariff and non-tariff barriers on U.S. minicomputers in exchange for shelving retaliatory U.S. barriers on Brazilian imports into the U.S.
- (2) Bilaterally request that Brazil eliminate technology transfer requirements for granting manufacturing licenses to U.S. firms in exchange for granting U.S. approval for such manufacturing licenses.
- (3) Establish U.S. regulations prohibiting ownership transfer of computer technology (hardware and software) to any wholly-owned foreign firm, but permitting manufacturing licenses.
- (4) Establish U.S. regulations prohibiting foreign government agreements with U.S. firms providing them exclusive exemption from import quotas or licenses."

The complaint seemed to have little or no impact in Washington. The only recorded reaction from the Special Trade Representative came almost two years later in 1979 when Strauss asked the Brazilian Embassy in Washington to inform him about computer import restrictions in Brazil.

"The matter was further discussed at the November 1979 meeting of the Consultative Subgroup for Brazil-US Trade. According to Relatorio Reservado (Number 683, p. 1) the Brazilian Foreign Ministry informed SRT [sic] that import control was only a provisional measure in view of Brazilian balance of payment difficulties."<sup>118</sup>

In Brazil, the complaint had no effect other than to harden public opinion and against the computer TNCs, and increase ministerial and CAPRE resolve to push ahead with the national computer policy.

In January 1977 Brazil's Economic Development Council (CDE) published five criteria for issuing fiscal incentives to companies in the computer industry: (1) degree of national content/components; (2) export potential; (3) extent of technology

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<sup>118</sup> Tigre, Op. Cit. (1983), p. 134.

transfer; (4) viability of companies already in the market; and (5) Brazilian capital majority.<sup>119</sup>

In June 1977, CAPRE published Decision 01/77 announcing that there would be a competition for government–granted minicomputer concessions. Firms, both local and foreign, were invited to submit proposals that would then be judged by CAPRE, deciding who would be allowed to produce minicomputers in Brazil. CAPRE was to make its choice on the basis of five criteria, which reflected the criteria published by the CDE six months earlier:<sup>120</sup>

- (1) Utilization of local technical resources to design and develop computer products. Technology transfer agreements with foreign firms were allowed but the recipient firms should display the capacity to learn and not become dependent on the supplying firm.
- (2) Degree of incorporation of locally–manufactured components;
- (3) Firms' market shares; it was important to avoid any monopoly situation developing in the industry.
- (4) Local ownership;
- (5) Net foreign trade balance.

By now, both foreign and local firms were convinced of the government's seriousness with respect to the development of a local computer industry. As a result, the competition attracted a good number of proposals. (See Table 3.1) Seven local firms submitted independent proposals, two submitted proposals for joint ventures with small foreign firms, and seven computer transnationals proposed projects with their own technology. In fact, several of the major computer transnationals submitted a number of different proposals.<sup>121</sup>

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<sup>119</sup> Adler, *Op. Cit.*, (1987) p. 251.

<sup>120</sup> Tigre, *Op. Cit.*, (1983) and Helena, *Op. Cit.*, p. 51.

<sup>121</sup> Helena, *Op. Cit.*, p. 64. In fact, Burroughs executives told me that they alone submitted seven projects some of which considered the possibility of joint–venture with a partner of the government's choice. Tri–pe, once sought by the government, was here explicitly rejected by CAPRE.

**TABLE 3.1**  
**Projects Submitted to CAPRE<sup>122</sup>**

<b>Proposing Company</b>	<b>Ownership</b>	<b>Technology</b>
Sharp/Inepar/Dataserv (SID)	Brazilian	Logabax(France)
Edisa	Brazilian	Fujitsu (Japan)
Labo Eletronica	Brazilian	Nixdorf (Germany)
Hidroservice/Mello	Brazilian	J.C. Mello (Brazil)
Elebra	Brazilian	Honeywell (USA)
Ifema	Brazilian	Ifema (Brazil)
Protodata/Isdra	Brazilian	Philips (Holland)
Docas de Santos	Brazilian	NEC (Japan)
Maico	Brazilian	Basic Four (USA)
IBM	American	IBM (USA)
Burroughs	American	Burroughs (USA)
Hewlett–Packard	American	H-P (US)
NCR	American	NCR (USA)
Olivetti	Italian	Olivetti (Italy)
Four Phase	American	Four Phase (USA)
TRW	American	TRW (USA)

Toward the end of 1977 CAPRE issued its decision. The agency rejected all of the offers of the transnationals, opting instead for three locally–owned companies which were to license technology from small foreign concerns: SID Informática, licensing technology from Logabax of France; Edisa, licensing from Fujitsu of Japan; and Labo, licensing from Nixdorf of Germany. The country's minicomputer industry was thus entrusted to Cobra, the state–owned flagship company which was licensing from Sycor, and these three private Brazilian concerns. A year later, a fifth company received a piece of the state–allocated minicomputer pie: SISCO, a company linked to one of Brazil's largest engineering consulting firms (Hidroservice) and the empire of Henry Maksoud. (See Table 3.2)

The licensing agreements were subject to the same principles. The Brazilian firm was allowed to buy the technology of the foreign company only once, having to

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<sup>122</sup> Helena, *Op. Cit.*, (1980), p. 98, quoted in Adler, *Op. Cit.*, (1987), p. 252.

develop subsequent models on its own, and technology transfer must be completed by 1982. Royalty payments were limited to three percent of sales.<sup>123</sup>

**TABLE 3.2**

**Authorized Minicomputer Manufacturers, 1977<sup>124</sup>**

<b>Company</b>	<b>Model</b>	<b>Technology Source</b>	<b>Description</b>
Cobra	Cobra-400	Sycor	64KB CPU oriented to banking transactions
	Cobra-500	Cobra	512K CPU expandable to 1MB
SID	SID-500	Logabax	64KB CPU similar to DEC PDP 11/34
Edisa	ED-300	Fujitsu	64KB CPU similar to IBM System 3
Labo	Labo-8034	Nixdorf	256KB CPU similar to Nixdorf 8870-1
Sisco	SCC-5000	Sisco	64KB CPU similar to DEC PDP 8
	MB-800	Sisco	256KB CPU similar to DG Nova 3

A number of factors explain CAPRE's ultimate decision to exclude the large TNCs. Most certainly those in CAPRE itself were determined to keep the large TNCs out of the market. However, without support at ministerial level, the técnicos could not have their way. As has been already noted, the Planning Ministry continued to give support to CAPRE but tended to favour tri-pe, which had worked in petrochemicals. The other government ministers also preferred joint-ventures with TNCs, expressing some worry that the national proposals were based more on enthusiasm than ability to deliver.<sup>125</sup> However, IBM's heavy-handed approach and the

<sup>123</sup> See Tigre, *Op. Cit.*, (1983) pp. 140ff.

<sup>124</sup> Source: Marc Burbridge, "Betting on Brazil", *Datamation*, May 1981.

<sup>125</sup> Adler, *Op. Cit.*, (1987), p. 264.

publicity surrounding the Data General trade complaint made it very difficult for the government to do anything that looked like a concession to the large TNCs. Furthermore, the consortium of eleven banks that had just invested considerable resources in Cobra were not keen to see the company overrun by foreign competition. Finally, at this time President Carter condemned Brazil's human rights record and subsequently abrogated the military cooperation treaty between the two countries. This hardened the Brazilian military in its drive for independence from foreign, or at least, U.S. suppliers. The military thus lent its support to a decision excluding the computer giants. In the end, the ministers agreed that CAPRE should use the conditions laid down by the CDE, which included considerations of ownership and technology transfer.

For their part the TNCs believed that their superior export prospects would outweigh questions of ownership and technology transfer. In this, the TNCs greatly misread the factors motivating policy at that time. They went much deeper than simply considerations of balance of payments. CAPRE was genuinely concerned to break the large foreign computer companies' stranglehold on the market. Clearly considerations of local ownership and absorption of technology were of greater importance to CAPRE than obtaining the latest technology, largest scale of investment, exports, or even supplying the immediate needs of the market. In order to make room in the market for the local firms, it was imperative that the large TNCs in general, and IBM in particular, be cut down to size. In the end, CAPRE was able to reject all of the TNC proposals claiming that they were judged fairly according to the established criteria.

IBM and the other TNCs reacted to the prospect of a closing market in the way one would expect. They proposed to invest in local production in order to get in before the door shut. However, this attempt was five years too late. By 1977, the minimum that the government would accept was joint venture with the foreign firm holding a minority interest. The goal of tri-pe in this industry had been present since 1972 when Saur began his search for a foreign partner. Had the foreign computer

firms chosen to invest in local production prior to 1972, they likely would have pre-empted the market reserve, which, in 1977, excluded them. In the 1977 decision, the Brazilian government not only excluded wholly-owned TNC participation, it also rejected tri-pe—the original strategy. In allowing foreign participation only through tightly controlled licensing arrangements, the government had effectively limited the TNCs more strictly than originally proposed in GTE/FUNTEC 111.

It must be emphasized, therefore, that Brazil's computer policy as implemented in 1977, differed from the usual import substituting policies implemented under the Law of Similar. The Law of Similar protects both foreign and domestically-owned producers as long as they produce on Brazilian soil. However, the initiative in computers sought specifically to exclude the foreign-owned producers entirely from certain segments of the market, whether they were proposing to import or produce locally.

However, pressure on the new Brazilian policy and its young beneficiaries did not abate. IBM decided to focus its efforts in Brazil on the manufacture of a line of small mainframe computers, its System 4331, which was close enough in price to the minicomputers to eat into their market. Though this proposal too was eventually rebuffed, IBM stuck with this basic strategy in Brazil and had considerable success with it, as will be shown later.

#### Changing of the Guard: From CAPRE to SEI

Events within the Brazilian government also cooperated at this time to institutionally insulate the new policy from attack. By the end of 1978 the military had selected General Figueiredo to succeed Geisel. Figueiredo was then head of the National Intelligence Agency (SNI). At the time of the change of the administration, a special working group was formed to reconsider Brazil's policy with respect to computer electronics. Not surprisingly, the intelligence community dominated this group. The group was concerned about the power that the civilians in CAPRE had over policy in this area that was deemed of great importance to national security. So, when

Figueiredo came to power in 1979, CAPRE was abolished and replaced by the Special Secretariat for Informatics (Secretaria Especial de Informática or SEI).

SEI was to report directly to the National Security Council and the President rather than through the Planning Ministry as CAPRE had done. Those appointed to direct SEI were people with strong military and intelligence links.<sup>126</sup> They were not "frustrated technicians" with a cause. They were rather less technical, but more interested in controlling the development of the industry for the sake of national security. Moreover, SEI's position under the Security Council gave the agency almost dictatorial power over the industry. In practice, SEI would decide policy and could implement it with the approval of one man: Conrado Venturini, who headed the Security Council. Some have speculated that had regulatory control over the industry remained in the Planning Ministry, the new minister Delfim Neto would have dismantled the policy.<sup>127</sup> Instead, under the Security Council, SEI was politically well-insulated and proceeded to expand the market reserve.

### **Policy Expansion and Pressure: 1980 to 1984**

SEI received an expanded mandate to stimulate and regulate all activities in the field of informatics, including microelectronics, software, components, data processing services, and later teleinformatics, process control systems, and transborder data flows. From 1980 to 1984 SEI exercised its great power, issuing a series of decrees and normative acts that expanded the scope of the market reserve. As the microchip grew in its pervasiveness, so too it seemed, did SEI's regulations, which were beginning to encompass almost anything electronic.

SEI's Normative Act 001/80 established criteria for informatics imports, which included the unavailability of locally-produced equipment and services. In practice

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<sup>126</sup> The first three secretaries of SEI were Octavio Gennari, Joubert Brizida, and Edison Dytz. Only seven out of 40 CAPRE staff were kept on, albeit in weak positions.

<sup>127</sup> Peter Evans makes this point and the opinion is shared by many connected with the industry in Brazil (author interviews). Evans, *Op. Cit.*, (1986) p. 796.



this meant that a prospective importer must submit a detailed proposal to SEI. SEI would then issue a request for proposal to domestic manufacturers (or potential manufacturers). If a domestic manufacturer claimed to be able to provide the desired equipment or service the import request would be turned down. There were, however, loopholes in the Act allowing imports for 'priority sectors' and 'state agencies.'<sup>128</sup> SEI also required that all computer equipment be registered with the agency, and that all federal government purchases be subject to SEI's approval.

Within a year of the transition from CAPRE to SEI, IBM decided to test the policy, once again proposing to manufacture its 4331 mainframe computer in Brazil. This time the company was successful, but SEI extracted important concessions prior to granting approval. SEI restricted the minimum memory of the system so that it couldn't be down-graded to compete directly with Brazilian-produced minicomputers. SEI also required 85 percent local content, limited the number to be sold in the domestic market to 242 units in four years, and required that IBM export three machines for every two sold to the Brazilian market. SEI also approved an IBM plan to produce magnetic disks for export.

The approval caused a good deal of initial alarm among the ex-CAPRE group that had previously rejected IBM's proposal. They were worried that IBM had just bought its way in with the promise of exports. SEI's rationale, on the other hand, was that the 4331 with memory restrictions would address a market segment not addressed by the local producers. The deal also yielded clear balance of payments benefits.

Two other TNCs also received approval for local manufacture that year. Burroughs was granted permission to produce the B6900 locally, in large measure to provide competition for IBM. Hewlett-Packard managed to convince SEI to approve the local manufacture of the H-P 85 desktop microcomputers, which were destined specifically for scientific and research applications. These applications were not

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<sup>128</sup> SEI, "Ato Normativo," 001/80, March 1980, mimeo.

specifically reserved to Brazilian companies. In return, the company agreed to export three units for every one sold in the domestic market.

Perhaps SEI's most controversial decision was Normative Act 16 which, among other things, listed the products falling within the market reserve, and therefore within the jurisdiction of SEI. The controversy arose partly because the list was a considerable expansion of what had been assumed previously. The reserve now was to include much more than simply data processing equipment. It included electronic biomedical instruments, and electronic measurement and testing equipment; in short, almost anything with a microchip. The reserve thus began to affect new user groups (importers) and manufacturing sectors.

SEI also targeted two areas that had been hitherto neglected in the regulations, but were at the heart of computer technology: software and microelectronics. SEI established a Software Registry and required the registration of all software marketed in the country, whether produced abroad or domestically. Furthermore, SEI approved only those microcomputer projects that used locally-produced software.

On March 6, 1981, by Decree 85.790, SEI established a Microelectronics Consulting Group and moved to extend the market reserve to areas of the microelectronics industry. Here SEI correctly targeted the roots of dependence in computer electronics. Microelectronic components are the fundamental building blocks of all modern electronic machines and devices. Mastery of this area is essential to any real technological autonomy. Without an indigenous microelectronics capability, Brazil would remain dependent and passive with respect to technological change. However, the establishment of a semiconductor industry was both highly expensive and risky.

A brief look at Brazil's situation with regard to microelectronics in 1981 demonstrates the ambitious nature of SEI's plan. Most integrated circuits (ICs) were being imported, though some discrete devices and some ICs were manufactured in Brazil, primarily for consumer electronics. There were virtually no diffusion operations in the country, only the assembly of imported chips. There were thirteen

semiconductor manufacturers in the country at that time; but only one (Transit) was nationally-owned. Transit was soon to close its doors due to financial and technological problems in an increasingly cut-throat international business. The Brazilian market required many different types of components; however the sales volume of each type was not large enough to justify their local production.

In May 1984 an Informatics Technological Centre was established at the University of Campinas (Unicamp) near São Paulo with a \$US 10 million annual budget. SEI then selected two of the best-financed Brazilian computer firms, Itautec (Banco Itau) and Elebra (Docas de Santos), to establish semiconductor diffusion plants nearby. SID (Bradesco) was a third player in this vital industry, acquiring an old-style front-end chip diffusion plant from Philco. SEI offered incentives to help the three Brazilian companies. Manufacturers purchasing integrated circuits diffused in Brazil by these companies would receive tax credits worth twice the value of the purchased ICs.

Itautec and Elebra attempted to purchase technology from a number of US firms that dominated the international industry at the time. However, the US firms refused to sell, so the Brazilian firms were forced to go to Europe for technology. Meanwhile, SEI put pressure on the TNCs with microelectronics operations in the country. The agency denied import licenses to these TNCs, preventing modernisation of processes and the introduction of new products. Several TNCs closed their operations and left behind Texas Instruments, Fairchild Electronics, Siemens, and Philips, which continued to limp along with what they had.

The foray into microelectronics continued to be the most ambitious venture of the national policy, and it saw very limited success. The three national companies did not have sufficient capital to invest in diffusion operations. Hence, they concentrated on IC design, process, assembly and test for a limited number of devices. As will be seen later, due to economic problems, the microelectronics plan was ultimately to fall largely dormant.

Now ousted from the civil service many of the CAPRE technicians moved to participate in the industry they helped create. After some initial concern, the market

reserve was now seen to be secure in the hands of SEI and many more local groups moved to get a stake in this growing and well-protected industry. In 1978, the local industry participants banded together at the direction of Ricardo Saur who became the Executive Director,<sup>129</sup> to form a nationalist computer manufacturers' trade association and lobby group called ABICOMP (Brazilian Association for the Computer and Peripheral Equipment Industries). ABICOMP's by-laws precluded membership by foreign-owned firms and became an important advocate for the interests of Brazilian capital in this industry.

In 1979 several important Brazilian financial conglomerates increased their stake in the national computer industry. These firms recognized both the increasing importance of computer electronics to their base business, and an attractive (protected) business opportunity. The two largest private banks in Brazil, Bradesco and Itau, already with a stake in Cobra, invested further in the industry. Bradesco took a 30% stake in SID and Itau financed a new wholly-owned subsidiary company: Itautec. (Others included Unibanco with Labo, and Iochpe with Edisa.) Meanwhile, one of the oldest and best established industrial concerns in Brazil, Docas de Santos, also entered the industry, acquiring a majority stake in Elebra.

The participation of these well-established firms lent a great deal of political clout and business credibility to the young industry. The banks also provided a captive market for one of the most dynamic sectors of the industry in the early 1980s: banking automation. The apparent early success of the market reserve and the Brazilian computer industry owes in large part to the phenomenal growth in this segment of the market – a fact that will be explored more fully in the next chapter.

The federal government, personified by the "frustrated technicians" of CAPRE, the industrial developmentalists of the BNDES, and the security-conscious military and intelligence communities had, up to this point, given impetus to the national computer

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<sup>129</sup> Ricardo Saur was the Executive Director (non-elected), Mario Ripper a Director, and Arthur Pereira Nunes Executive Secretary of the association. All were active members of 'the group' since the earliest days of the country's computer effort.

industry, rebuffing the pressures of the large computer transnationals while enticing local private capital to invest in the industry. Now that several significant private business groups (and an ever-increasing number of smaller capitalists and opportunists) had invested considerable resources in the industry, private capital had a vital interest in the preservation of the market reserve. The very livelihood of these companies depended upon it. A significant section of Brazilian private capital was by the early eighties no longer a reluctant participant or passive partner in a government industrial experiment; it was an active proponent of the market reserve in informatics.

Meanwhile, the explosion of the market for microcomputers and banking automation ensured the phenomenal success of the Brazilian computer companies and the apparent success of the policy. By 1984 the Brazilian companies had snatched nearly 50% of the annual sales of computers in the country.<sup>130</sup> (See Chapter 4 to follow.) Pro-reservists had much to cheer about.

But they weren't cheering about the minicomputer industry where the policy was initially targeted. Here the market was squeezed from below by much cheaper and ever more powerful microcomputers, and from above by IBM's small mainframes. Moreover, the Brazilian minicomputer companies had not yet mastered the technology licensed in 1977 (which was not even state-of-the-art at the time) when the developed world jumped another technological step ahead. The "super-minicomputer" had arrived. Specifically, none of the local mini manufacturers had mastered the 32-bit architectures that were introduced internationally in the early 1970s. Worse still, these Brazilian companies were losing money. All five of the original minicomputer manufacturers lost money in 1981 and all but SID, which relied on banking automation, continued to lose money up to 1984.<sup>131</sup>

SEI targeted the supermini as the next area to reserve, and received proposals from eight Brazilian companies. Cobra, SID, and Labo each proposed to develop a

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<sup>130</sup> SEI. "Panorama do Setor de Informática", *Boletim Informativo*, v. 7, no. 16 (August 1987).

<sup>131</sup> *Dados e Ideias*, "As 100 Maiores" v. 7, no. 51 (August 1982 and subsequent August issues to 1985)

supermini with local technology. Edisa, Elebra, Itaotec, Sisco, and ABC Sistemas each proposed to license foreign technology to produce a supermini computer. These five companies proposed to effect complete technology transfer and a high percentage of local content in their computers.

**TABLE 3.3**

<b>1984 Supermini Technology License Agreements</b> <sup>132</sup>			
<b>Company</b>	<b>Model</b>	<b>Technology Source</b>	<b>Year tech. avail. in int'l. market</b>
ABC-Bull	DPS 6/96	Honeywell	1980
Cobra	MV-4000	Data General	1982
	MV-5000		1983
Edisa	HP-3000/48	Hewlett Packard	1983
	HP-3000/68		1983
Elebra	VAX 11/750	Digital Equipment	1980
Itaotec	F-4000/200	Formation	1980
Labo	8890/72	Nixdorf	1981
Sisco	4460	IPL	1982

This new class of computers presented government regulators with a problem. One of the fundamental principles of the market reserve was that technology be licensed only once to avoid on-going dependence. A new round of licensing to obtain the desired 32-bit technology thus could be seen as a tacit admission of policy failure, giving ammunition to the opponents of the market reserve. However, market pressures were beginning to mount. The Brazilian users were growing more sophisticated and less patient. The installed base of IBM's 4341 small mainframes that were much more expensive than the minicomputers on the market, more than doubled between 1982 and 1984.<sup>133</sup>

<sup>132</sup> Source: Paulo Tigre, *Industria Brasileira de Computadoras: Perspectivas ate os Anos 90*, (Rio de Janeiro: Editora Campus, 1987), p. 93.

<sup>133</sup> Secretaria Especial de Informática, *Boletim Informativo* 14 (September 1985).

SEI at first favoured the three local technology proposals. But SEI worried that the new computers would be slow in coming and would not meet the demands of the market or the challenge from the small mainframes. Thus, in the spring of 1984, SEI authorized a new round of technology licensing, approving all five foreign technology projects. The other three companies had no hope of competing with their own technology and therefore suspended their efforts and sought foreign technology suppliers.

SEI justified its decision saying that the supermini was a new class of computer and they were simply moving the market reserve "up" from micros and minis to include superminis. On this basis, the principle of one-time technology purchase was not violated. Supermini technology was to be purchased only once and completely transferred.

The supermini round of licensing highlights a problem that continued to haunt the Brazilian reservists. Technology is not a commodity that can be purchased and owned. Rather, technology is a way of doing things. For technology to be fully transferred on a once-for-all-time basis, the technology must be assimilated to the extent that the local firm can keep pace with technological change in the field. As the necessity for supermini licensing shows, Brazilian industry was not able to do that. As the director of one of the national firms put it, "The effort to keep up with technology is at least as great as the effort to catch up with it in the first place."<sup>134</sup>

Without doubt, the new round of licensing was an admission of continued dependence upon international technology. However, it is a testimony to the government's steadfast commitment to the market reserve – and a real shift in bargaining positions at the time – that the major minicomputer companies agreed to license their technology to Brazilian producers this time. DEC licensed its VAX 11/750 technology to Elebra, Hewlett-Packard licensed to Edisa, and Data General finally licensed to Cobra. These very same companies had refused to license in 1977.

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<sup>134</sup> Author interview, October 1987.

### The Legal Codification of the Reserve

In 1984 twenty years of military rule in Brazil were coming to an end. A civilian government was to be elected at the end of that year, and take office in early 1985. Pro-reservists recognized a potential threat to the national informatics policy here. A change to democratic civilian rule brought with it political uncertainty and greater vulnerability. The secure political insulation surrounding SEI and its policy might yield to outside pressure with a change to civilian rule. So as early as autumn 1982 the pro-reservists, most notably ABICOMP (pushed by Saur and 'the group') with the support of the military, began to push for the codified legal recognition of the informatics policy before the shift to democratic civilian rule.

Powerful forces were arrayed on both sides of the issue. The pro-reservists included the military, the local computer industry represented by ABICOMP, several powerful financial and industrial groups who now had a direct stake in the local industry, academics, and nationalist politicians. The computer TNCs were naturally against the proposed law. Many industrial and commercial users of informatics equipment and services were also opposed. These users were bearing the economic costs of the market reserve in the form of higher prices and inferior technology (see later elaboration of this point). Although these economic costs were high in some cases, the users were still diffuse and not well organized. In Congress itself, Senator Roberto Campos was the most visible opposition to the policy. The outspoken senator saw the informatics bill as “simply an outburst of nationalism; a reaction to past foreign dominance and IMF humiliation.”<sup>135</sup> Campos presented a Bill to Congress calling for an end to SEI and the market reserve, replacing them with a tariff system and joint ventures regulated under the Ministry of Industry and Commerce. Though

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<sup>135</sup> Author interview, October 1987.



Campos made good use of the press to publicize his free-market views, he was politically alone in his opposition to the law in the Congress.

Perhaps the most dangerous opposition to the market reserve consisted of the regional development groups, most notably SUFRAMA which was responsible for regulating the Free Trade Zone in Manaus. Based in the Free Trade Zone was Brazil's consumer electronics industry, which benefitted from subsidies and duty-free imports, all in the name of regional development. SUFRAMA did not want the long arm of SEI to extend to this area of the electronics industrial complex. Thus, SUFRAMA had a history of antagonism to the policy in general and to SEI in particular. SEI's Normative Act 16, caused particular concern in SUFRAMA, but at the end of 1983 the two organisations reached an agreement that ensured the continuance of electronics manufacture and trade in Manaus. In the end, SUFRAMA's influence was marshalled primarily in an attempt to protect its own turf and to limit SEI's jurisdiction. In these modest objectives it succeeded.

After nearly two years of public debate, the national informatics policy had become a very high profile national issue. It took on symbolic significance in a number of ways. National sovereignty, and prestige in the world community as a technological force were seen to be at stake. On September 20, 1984, the government introduced a bill that was all that the pro-reservists had hoped for and Congress passed it with Campos casting the only opposing vote. In October 1984, President Figueiredo signed the bill into law, vetoing several articles having to do primarily with government investment in research and development programmes.

Although the pro-reservists were delighted with the outcome, the legal codification of the market reserve proved to be a double-edged sword. Necessary though it was to ensure the continuity of the policy, the law also considerably circumscribed SEI's discretionary power. This was not merely a coincidental effect of the law. Many in Congress were suspicious of SEI's power over this area of the economy. Congress wanted SEI to be more transparent and accountable in its decisions. One sub-secretary in SEI during this time noted that prior to the Informatics

Law their decisions were made "informally with the consent of the 'community.'" Informality had given way to a more "bureaucratic decision-making process."<sup>136</sup>

### **The Policy Shifts: Post-1984**

Though the informatics policy had widespread political legitimacy in Congress, the most vociferous support for the nationalist policy came from the left wing of the senior coalition partner PMDB (Party of the Brazilian Democratic Movement). However, this left wing was under pressure after the party swept to power in 1985.

The PMDB (previously the MDB) was a left-of-centre umbrella organisation for all those seeking a return to democracy by legal means. The PMDB's coalition partner was the Liberal Front Party (PFL), which was formed in 1984 by moderate and rightist members of the Democratic Social Party (PDS). In August 1984 the PMDB and the PFL formed an uneasy coalition to elect Tancredo Neves as president. After Neves' premature death just a few months after winning the election, his vice president and coalition partner, José Sarney (PFL), assumed the presidential mantle and tension among the coalition partners mounted. The tension was compounded by the fact that the PMDB itself was undergoing an identity crisis. As a loose coalition spanning a rather broad political spectrum, the PMDB was under constant threat of a split between the party's left (the "progressives") and the party's right (the "conservatives"). The "progressives" in the party grew more and more disillusioned as the government was seen to grant too many concessions to the more conservative minority partners in Sarney's PFL.

Sarney hoped that the results of the November 1986 elections would allow him to appoint more PFL conservatives to his cabinet to balance PMDB influence. Sarney's aim was to divide the ruling PMDB and forge a centre-right administration in which his influence would be increased.<sup>137</sup> The president was unable to achieve his goal. The

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<sup>136</sup> Author interview with Ricardo Maciel, who was SEI Sub-secretary for Strategic Activities before shifting to SID Informática, October 1987.

<sup>137</sup> Latin American Newsletters Regional Reports: Brazil, November 26, 1987.

PMDB was indeed deeply divided, but rather than pledging support to Sarney, the conservatives acknowledged the leadership of Ulysses Guimaraes, the PMDB party leader. Sarney's main political constituents remained confined to the military and some loyal friends in private business.<sup>138</sup>

In March of 1985 the new Ministry of Science & Technology was formed to which SEI would now report. Renato Archer, a close personal friend of Guimaraes—the powerful leader of the nationalist PMDB—was appointed to head the ministry. Archer, himself a vocal nationalist, was strongly committed to the market reserve as it was being applied. Colonel Edison Dytz, who was considered one of the most nationalist of SEI's secretaries, finished his term of office in 1985 and was succeeded by José Doria Porta who was considered less of an ideologue and more of a pragmatist. With the departure of Dytz went the last of those in SEI with strong links with the military and intelligence communities.

CONIN, the National Council on Informatics and Automation comprising sixteen government ministers and eight representatives of different sectors of society, was established by the Law to set policy. Thus, SEI was to be constrained to the implementation of policy reviewed and approved by CONIN.

In the elections of November 1986, the PMDB won a landslide victory, helped in large part by the astounding (though temporary and eventually disastrous) economic prosperity engendered by the government's "Plano Cruzado" earlier in the year. The PMDB gained 303 of the 559 seats in the constituent assembly (which was to draft the New Republic's constitution), and 22 of the 23 state governorships.<sup>139</sup> However, the Left Wing of the PMDB did not fare well in the elections.<sup>140</sup> In particular,

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<sup>138</sup> Mattias Machline, head of the Sharp electronics group which owned SID Informática was known to be a close personal friend of Sarney and was thought to exercise a good deal of influence over the president. (Author interviews).

<sup>139</sup> Latin American Newsletters Regional Reports: Brazil, February 12, 1987.

<sup>140</sup> Ibid., March 19, 1987.

several strong proponents of the 1984 law either lost, or resigned their seats in Congress in the November 1986 elections.<sup>141</sup>

After the elections and the failed Cruzado Plan, tension between the PFL and the PMDB was unbearable. After the PMDB's victory, the PFL was no longer needed and disassociated itself from the PMDB. The PMDB itself remained deeply divided and was held together only by the politically deft Guimaraes. Meanwhile, the president of the New Republic was increasingly politically impotent.

The implications for the informatics policy at this time were, if anything, detrimental. The policy had fewer champions in a more pragmatic Congress. It continued to enjoy broad, but not fervent, support there. Debates relevant to the policy were focused now in the constituent assembly as policy proponents attempted to "constitutionalize" aspects of the policy. The president remained uncommitted to the policy, except in public.

CONIN, the council that was established by the 1984 law to set informatics policy, was practically incapable of policy-making. With sixteen government ministers and eight others representing diverse interests, CONIN was too large and unwieldy. Moreover, one of the sixteen ministers, Antonio Carlos Magalhaes (Minister of Communication) was diametrically opposed to the market reserve. The meetings of CONIN were often characterized by vitriolic disagreement between Magalhaes and the Minister of Science and Technology Renato Archer. Hence, CONIN was largely paralyzed leaving the real policy-making power in the hands of SEI with the ministerial support of Archer. Some maintained that CONIN was designed to be ineffective so that SEI could get on with the job it had been doing since 1979.

Gradually, SEI began to change the way that policy was implemented. Author interviews with computer TNCs and computer importers in late 1987 revealed that SEI had become more "reasonable and open." The transnationals reported having less of an adversary relationship with SEI and noted that the secretariat even offered

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<sup>141</sup> Included here are Odilon Salmoria (Santa Catalina), Darci Passos (São Paulo), Bete Mendes (São Paulo), and Jose Eudes (Rio de Janeiro).

suggestions as to how the TNCs might invest in the Brazilian informatics industry without violating the law.

In 1986 IBM again tested the new regulatory environment. IBM and the large Brazilian steel group, Gerdau, proposed a joint venture to form GSI, a data processing services company. To the surprise of many, SEI approved the joint venture. Hardliners were shocked and outraged at what they took to be a flagrant violation of the fundamental spirit of the law: namely, that if joint ventures were allowed, the foreign partner must not also be the technology supplier. The Brazilian Association of Informatics Services Companies (ASSESPRO) made formal objection to the decision, alleging that the joint venture violated Article 12, Section II of the National Informatics Law that stipulated "the lawful and actual exercise of the power to develop, generate, acquire, and transfer and vary product and production process technology" must be under national control.<sup>142</sup> ASSESPRO argued:

"As is notorious, GSI was formed starting from IBM bureau of services. Clients, contracts and personnel of the said bureau have been transferred to it; also to it were transferred, reportedly at market value, IBM computers, programs, systems, and installations. The major income of GSI is related to data processing services, carried out in IBM computers, with IBM supporting and applying programs. And further: GSI technical staff, in almost its totality, came from IBM, having been essentially trained for applying IBM tools and products, in the rendition of its services. Thus, what significance does the clause [art. 12, II) ensuring the right of varying the technology have?"<sup>143</sup>

SEI justified its decision saying that the joint venture was not in manufacturing, but in services that were not strictly covered by the law. Moreover, IBM had simply sold its service operation to Gerdau—people and computers—retaining the rights to a share of the profits. So, it was argued, there was to be no on-going technological dependence. GSI was free to purchase or develop other computers in which to

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<sup>142</sup> Law 7232/84, Article 12, Section II.

<sup>143</sup> ASSESPRO, reprinted in Arujo e Policastro Avogados, "Informatics Joint Ventures," São Paulo, December 23, 1986, p. 20, mimeo.

perform its data processing services. However, the deal was so widely publicized that even if it abided by the letter of the law, it was seen as a precedent-setting victory for those against the reserve.

The IBM-Gerdau case points to another way in which the legal codification of the policy could work contrary to its intended purpose. Prior to the passage of the law, the TNCs were fighting an adversary that was difficult to pin down, always moving and changing. Codified in written law, the policy was more vulnerable. The TNCs were actively scrutinising the law with legal advisors in order to discover loopholes through which they could enter the hitherto forbidden Brazilian market.

With rather less publicity, in the summer of 1986 SEI also approved IBM proposals: (i) to invest \$70 million in new facilities for producing very large disk storage equipment thereby expanding its product line in that area; (ii) to produce enhanced models of its small mainframe model 4381; and (iii) to initiate local production of its large mainframe model 3090.

The IBM-Gerdau joint venture was soon followed by a number of others that were less controversial, but nonetheless indicative of a shift in the way policy was applied. Hewlett-Packard entered into a complex arrangement with lochpe, the regional banking group, to form a mini, and super-minicomputer manufacturer called Tesis. Tesis was formed using the physical assets (plant and people) of H-P do Brasil whose operations had been emasculated by the market reserve. H-P circumvented the rule limiting foreign ownership by purchasing debentures of the newly formed company, which amounted to 50% of the company's initial capital. In other words, all of the equity capital, and therefore "ownership", of Tesis was controlled by lochpe; but H-P held the company's debt capital. The net effect was that H-P and lochpe each had a 50% stake in Tesis. H-P's debentures were convertible into shares, but H-P undertook not to convert them contrary to law applying at the time of conversion. In this way, H-P had a secure stake in the local industry now, and one that could be extended to whole ownership as and when the market reserve was lifted. Interestingly, this arrangement was worked out in consultation with SEI, and was

something that would not have been approved by SEI prior to 1986, in the opinion of representatives from H–P.<sup>144</sup>

Another notable example of foreign participation was Olivetti's entry into the Brazilian market with a new company called Tenpo. With a historically strong position in office equipment in Brazil, Olivetti had for some years been looking for a way into the booming microcomputer market. The only way to do this, according to Article 12 of the Law, was to set up a Brazilian–owned operation. So, in July 1987, Tenpo was established with 70% equity held by the directors, employees and dealers of Olivetti do Brasil (all permanently domiciled in Brazil), and 30% by Fides, a Swiss investment bank. Pro–reservists, worried that Tenpo would be just a 'front' company using Olivetti technology, protested the decision, but without success.

SEI's approval of these ventures indicates more than just a softening of the market reserve and the cleverness of the TNCs' legal advisors. The approvals are a reflection of SEI's greater political vulnerability after democratisation and its increased sensitivity to the growing dissatisfaction in the market. The joint–venture partners of the TNCs (for example, Gerdau and Lochpe) in turn had become important national political allies of the TNCs.

As seen in the next section, the complex dynamics of U.S. government pressure during 1985–87 also played a part in the approval of these investment proposals in particular, and in the way policy was implemented in general.

#### U.S. Government Opposition to the Policy

In spite of the letter from Data General to President Carter's special trade representative in 1977, the U.S. government remained passive with regard to the Brazilian market reserve in informatics until 1982. In December 1982, during President Ronald Reagan's first visit to Brazil and shortly after the debate over legislating the market reserve began, a few task groups were set up with officials and businessmen from both countries. In one of these meetings the question of

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<sup>144</sup> Author interviews with representatives of Hewlett–Packard, January 1987, and Tesis, August 1987.

informatics policy was formally placed under discussion. The report from the American side stated the "market restrictions and reserves cause frustration at best and retaliation at worst. The reciprocity policy that has been popular in Congress in recent years is a direct response to these restrictions in many countries."<sup>145</sup> As the debate over the proposed legislation continued in the Brazilian Congress in 1983 and 1984, representatives of the U.S. government frequently criticized the policy.

Suddenly on September 7, 1985—Brazilian independence day— President Reagan announced an investigation into Brazil's market reserve in computers under Section 301 of the Trade Act<sup>146</sup> which gave him power to impose retaliatory sanctions against Brazil if the investigation showed unfair trade practices. This investigation was launched not so much out of concern for U.S. computer companies harmed by the market reserve; rather it was announced in order to placate an increasingly protectionist U.S. Congress concerned about the burgeoning American trade imbalance. In fact, the TNCs that had already invested in the Brazilian market did not know about the announcement in advance and were, at best, ambivalent about it in the climate of increased flexibility with SEI. They remembered that previous heavy-handed attempts to pre-empt policy in the 1970s had backfired.<sup>147</sup>

This Section 301 was an historical marker for several reasons:

(1) It was one of the first to be self-initiated.

From 1974, when Congress, passed the Trade Act to 1985, the office of the U.S. Trade Representative (USTR) had received forty-eight trade complaints filed by American firms and trade associations. In 1979, Section 301 was strengthened, allowing the executive branch to initiate investigations without waiting for a specific trade complaint from the affected industry. The Section 301 investigation into the Brazilian market reserve, along with two other investigations announced at the same

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<sup>145</sup> Quoted in Edson Fregni, "Toward an International Service and Information Economy: A New Challenge for the Third World," February 1987, p. 10. mimeo.

<sup>146</sup> Reagan's announcement came in his weekly radio address to the nation on that day.

<sup>147</sup> Author interviews with TNCs in Brazil, August – October 1987, corroborated by Schoonmaker, *Op. Cit.*, (1995) p. 374.



time, was the first that did not specifically arise out of the demands of the affected industry.<sup>148</sup>

In the autumn of 1985 the U.S. Congress was set to pass a protectionist trade bill: the Textile and Apparel Trade Enforcement Act of 1985. The trade deficit was growing seemingly out of control, and the U.S. was seen to be losing its international competitiveness—even in traditionally strong sectors such as agriculture, services, and high technology. The administration had just allowed the free entry of footwear imports into the U.S. despite earlier findings by the International Trade Commission that foreign footwear imports were damaging U.S. producers. This action provoked bilateral condemnation in Congress, which labelled the administration "soft on trade."

Reagan desperately wanted to avert protectionist legislation; he was ideologically and publicly committed to free trade. In an attempt to show an aggressive, proactive stance on trade issues and placate a protectionist Congress, the administration scrambled to issue several trade complaints against surplus countries. Brazil was one of those singled out for its policy in computers. The others were against Korea for restricting entry of U.S. insurance firms, and Japan for restricting imports of U.S. tobacco goods. These three investigations joined the existing cases against the EEC for subsidizing canned fruit, and against Japan for restricting leather goods imports.

"The countries as well as the sectors chosen as targets for the Section 301 actions in September 1985... were not just sinners against the free trade regime; they were successful rivals or potential rivals, guilty of using neomercantilist techniques to improve their position in the hierarchy of nations relative to that of 'fair' players such as the United States."<sup>149</sup>

The decision to initiate the Section 301 against Brazil was made by the Economic Policy Council in the summer of 1985, without a great deal of study into the

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148 Office of USTR, "Section 301 Table of Cases," October 1986; cited in Peter Evans, "Declining Hegemony and Assertive Industrialization: U.S.–Brazil Conflicts in the Computer Industry," *International Organization*, Vol. 43, No. 2, (Spring 1989), p. 217.

149 Evans, *Op. Cit.*, (1989), p. 221.

case and without reference to the U.S. computer firms most affected by the market reserve. The major TNCs seem to have been informed of the decision (but not consulted) prior to its announcement<sup>150</sup> and the U.S. Consul General in São Paulo was assigned the task of putting the case together after the announcement.<sup>151</sup>

(2) Brazil's market reserve was not what the 301 was designed to address.

When the 301 against Brazil was announced, the prime complaint with the market reserve was restrictions on U.S. exports of computers and related products to Brazil. This was condemned in general terms as a violation of the principles of free trade, and in specific terms as damaging to American employment in the industry.

Section 301 of the 1974 Trade Act was designed as a mechanism to defend the international *trade* interests of U.S. companies. It had been most frequently used to impose tariffs on products that were being "dumped" at an unfair price on the U.S. market. The case of Japanese semiconductors was a classic example of this.<sup>152</sup> However, Brazil doesn't export computer equipment to the U.S. The market reserve is not per se, an unfair trade practice; it merely precludes U.S. companies from supplying certain computer products to the Brazilian market, or investing in certain sectors of the Brazilian industry. The market reserve may have been an "unfair investment practice," but it wasn't an unfair trade practice.

The law allows for the President to retaliate if the dispute cannot be resolved any other way. But in this case, "appropriate retaliation" was a problem. There was little point in slapping duties on imports of Brazilian computers; the only computers entering the U.S. from Brazil were manufactured by U.S. transnationals. Likewise, there was no point in refusing Brazilian computer companies entry into the U.S. computer industry; none were in a position to invest in the U.S. Reagan would have

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<sup>150</sup> Evans, *Ibid.*, p. 217.

<sup>151</sup> Unless otherwise noted, information concerning the Section 301 and subsequent bilateral negotiations comes from a series of author interviews with U.S. Consul General in São Paolo, Stephen Daachi, in September and October 1987.

<sup>152</sup> The U.S. semiconductor industry complained that Japanese-made chips were being marketed in the U.S. at below cost. After an investigation under Section 301, the Reagan administration announced import tariffs on Japanese semiconductors.

difficulty slapping an embargo on other Brazilian products such as orange juice; such a high profile abrogation of GATT would be hard to defend.

At the end of 1985 the U.S. Consul General in São Paulo submitted his comprehensive report on the Brazilian computer policy and its impact on U.S. companies. The report argued that the nature of the complaint was one of investment, not trade. However, the Reagan administration continued to face domestic political pressure on the trade issue. Hence, in May 1986, the Economic Policy Council decided that the market reserve constituted an unfair trade practice and that retaliation—of some kind yet to be determined—was justified.

(3) This 301 was one of the first to be taken against a developing country.

This added a rather different political dimension to the investigation and subsequent dialogue. The largest, most advanced economy in the world was threatening to retaliate against a country on the brink of economic ruin under the weight of more than \$100 billion foreign debt. Moreover, this fragile economy was being steered by an equally fragile new democratically-elected civil government.

As a foreign policy initiative, the Section 301 against Brazil was thus potentially disastrous. The United States "attacked its most important South American ally in the midst of a delicate political transition on the most politically sensitive industrial issue possible..."<sup>153</sup> As Evans rightly asserts, the Reagan administration very nearly allowed domestic political pressures to dictate a highly reckless foreign policy. These issues came into play in the bilateral talks between the two countries, as is detailed further below.

What was clear to the protectionists in Congress and the Department of Commerce was that Brazil—this fledgling developing economy—was running a \$5 billion trade surplus with the United States. Conflict had already been experienced with regard to Brazilian steel exports to the U.S., among other items. Hence, Brazil was considered an ideal candidate for venting U.S. frustrations over the country's

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<sup>153</sup> Evans, *Op. Cit.*, (1989), p. 223.

declining terms of trade. The message that the 301 was to send was that the U.S. was no longer willing, or able, to bear the costs of asymmetric trade and investment conditions, even with its newly industrialized partners.

(4) The 301 did not receive support from the major computer TNCs.

As we have seen already, the 301 complaint against Brazil was initiated by the Reagan administration in response to domestic political pressure, not primarily out of concern for the interests of U.S. companies. Indeed, what is remarkable is the distinct lack of support for the 301 by the companies involved. Even after the initiation of the 301, not a single U.S. firm responded to the USTR's request for written submissions.<sup>154</sup>

IBM, in particular, had carved out a growing and very profitable business for itself at the top of the market in mainframe computers. Having been hurt by nationalist sentiments several times already, IBM did not want the boat rocked now. The company made its concerns known to the USTR during the bilateral discussions with the Brazilian government. Burroughs (redubbed Unisys after its 1986 merger with Sperry) and H-P also had positions in the market and weren't particularly keen for more controversy over the policy.

Most telling is Data General, the company that pleaded unsuccessfully with the USTR in 1977 to act against Brazil's market reserve. DG had finally entered the Brazilian market in 1984 via a joint venture arrangement with Cobra. Now that the U.S. government was acting ostensibly on its behalf, DG did not respond enthusiastically. The company, like IBM, Burroughs and H-P, had established itself in the market and could do without the unsolicited 'help' from the U.S. government.

While the major TNCs with investments in Brazil would have been happier without U.S. government intervention, it is important to distinguish them from the new or potential investors/exporters. A leading U.S. producer of microcomputers and

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<sup>154</sup> Evans, *Op. Cit.*, (1989), p. 217. Two industry associations (the Computer and Business Equipment Manufacturers Association and the American Electronics Association) submitted brief letters on behalf of their members. Neither of the letters urged retaliation. Both advocated negotiation for incremental changes in the way policy is implemented.

a leading U.S. producer of software were later to solicit the assistance of their government in gaining access into, and concessions from, Brazil.

The United States and Brazil entered into bilateral negotiations, meeting half a dozen times from December 1985 to December 1986.<sup>155</sup> The first two meetings yielded nothing. The U.S. side stressed free market economic principles while the Brazilian side, represented by SEI, stressed the importance of computers to the country's development efforts.

The temperature of the debate was raised in the spring of 1986 when it became known that the U.S. Economic Policy Council had decided that the market reserve was indeed an unfair trade practice warranting retaliation. Nationalist Senator Severo Gomes (PMDB–São Paulo), one of the most ardent supporters of the informatics policy and one of the strongest voices in Congress, responded by threatening counter-retaliation. Gomes introduced legislation (which, in the end, was never even voted on) that would prevent U.S. TNCs from remitting profits, registering patents, exercising mineral exploration rights, and selling goods and services to the Brazilian government.

At this time, the U.S. State Department became involved, trying to smooth over a growing foreign policy problem prior to President Sarney's impending visit to Washington later that year. U.S. Secretary of State George Schultz seized the initiative and contacted the Brazilian Foreign Minister directly concerning the matter.<sup>156</sup> The Brazilian delegation to the next bilateral meeting in July was headed by a diplomat from the Foreign Ministry, rather than by SEI. From this point, the dispute essentially shifted from a clash of economic and development ideologies, to a matter of foreign policy concern.<sup>157</sup> The debate thus shifted to a ground where there was greater

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<sup>155</sup> (i) US–Brazil Trade Subgroup, December 1985; (ii) special meeting in Caracas, February 1986, between the Deputy USTR and SEI; (iii) special meeting in Paris, July 1986, between USTR and Foreign Ministry representatives; (iv) special meeting in Paris, August 1986; (v) special meeting in Rio de Janeiro, September 1986; and (vi) special meeting in Brussels, December 1986.

<sup>156</sup> See, for example, *Gazeta Mercantil*, "Itamaraty aguarda Schultz," May 1, 1986.

<sup>157</sup> Evans, *Op. Cit.*, (1989) makes this point.

possibility of mutual agreement. The more conciliatory tone<sup>158</sup> that followed suited the transnational companies with investments in Brazil.

The negotiations began to progress with each side taking a softer line. For its part, the U.S. administration backed away from its call for an end to the market reserve. It emphasized, instead, the need for transparency, timeliness, and predictability in the implementation of the reserve law with respect to import licenses and investment decisions. In taking this line, the USTR was reflecting the overriding concerns of the TNCs operating in Brazil. The USTR also took up a TNC concern about copyright protection for software, the latest target for market reserve legislation by SEI. The software bill proposed to restrict the importation of software when a "national equivalent" was available. The TNCs wanted the new law at least to recognise the intellectual property rights of software developers in order to limit piracy.

Meanwhile, the TNCs were managing to exploit the situation by striking individual deals with a seemingly more pliable SEI. Just prior to Sarney's visit to Washington IBM received approval for its disk storage plant and the extension of its mainframe product line. Just after Sarney's return, SEI granted approval for IBM's joint venture with Gerdau. SEI also agreed to narrow the scope of import restrictions at this time. Shortly thereafter, SEI approved Hewlett-Packard's joint venture with Lochpe. A year later, SEI approved a proposal by Texas Instruments to invest US\$130 million to establish a chip diffusion plant and expand its product line in Brazil. This decision by SEI was a retreat from its previous war of attrition against the foreign semiconductor firms. Clearly it may have been motivated in part by the failure of the domestic firms to develop their semiconductor manufacturing facilities. But there is no doubt that U.S. government pressure played a significant role. Senior management at TI in Brazil

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<sup>158</sup> Schultz sent his deputy, John Whitehead, to Brazil in late May 1986. Whitehead tried to calm Brazil's fears of U.S. protectionism and interference in Brazil. See, for example, Jornal da Tarde, "EUA garantem respeito a soberania do Brasil," São Paulo, May 28, 1986.

commented that the "timing was right" for the proposal in large part because of the bilateral discussions going on between the U.S. and Brazilian governments.<sup>159</sup>

For domestic public and congressional consumption, the U.S. administration continued to threaten retaliation without specifying its nature, imposing public deadlines for progress in the bilateral talks. This public sabre-rattling continued to cause a great deal of ill-feeling toward the U.S. government and TNCs in Brazil<sup>160</sup> making it very difficult for Sarney to make any public concessions in the negotiations. The victory for the democrats in the U.S. congressional elections of November 1986 increased the implicit threat of retaliation and U.S. protectionism.<sup>161</sup> Several deadlines passed without retaliation as the Brazilian negotiators asked privately for postponement on the account of upcoming elections (November 1986), debt negotiations, or later, constitution debates.

Finally, the Brazilian executive agreed to accept copyright protection on software and wrote this into a software bill that was to be debated in the Brazilian Congress. The USTR, Clayton Yeutter, saw this agreement as a concession that he could sell at home and agreed to table the investigation for the time being. Effectively unable to retaliate, Yeutter was searching for a way out of the ill-conceived 301.

However, the fragile truce was upended by subsequent events. With the software bill still pending in Congress, SEI refused to allow Microsoft—a leading U.S. software company—to license its microcomputer software, MS-DOS, for sale in Brazil. SEI based its decision on the fact that Scopus, a locally-owned company, had

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<sup>159</sup> Author interviews with TI in October 1987. Interviews with the U.S. Consul General in São Paulo confirmed that the TI proposal was discussed in detail during the bilateral talks.

<sup>160</sup> See articles appearing in the Brazilian business press at the time, including *Exame*, "O Desafio Americano," and "Últimos retoques no projeto de software," May 28, 1986, pp. 24–28, 30–31; *Istoé*, "Rotas de Conflito," December 31, 1986, pp. 54–58; and *Istoé*, "Choque na Reserva," May 27, 1987, pp. 60–62.

<sup>161</sup> The effects of Brazil's elections at that time are discussed further below.

developed a "functional equivalent" called SISNE. This infuriated Microsoft as SISNE was known to include some code that had been copied from MS-DOS.<sup>162</sup>

Meanwhile, Apple was hoping to gain entrance into the Brazilian market with its Macintosh microcomputer, on the grounds that it was different from any other micro produced in the country. However, a national company, Unitron, had successfully "cloned" the Macintosh and began to market the computer in Brazil. Apple was worried that SEI would approve the "pirate MAC" and thereby preclude Apple from entering the market.<sup>163</sup>

Microsoft and Apple took their cases to the U.S. Congress and the press. Congress again accused the Reagan administration of being soft on trade and the administration reluctantly re-opened the case. On November 13, 1987 the White House announced that it would indeed retaliate against Brazil. President Reagan moved to impose 100% tariffs on 66 Brazilian import items (including vehicles, aircraft, footwear, orange juice, iron, steel, and refined petroleum products) and placed an embargo on Brazilian computer imports. The tariffs, worth \$105 million, were imposed to offset the estimated lost business for U.S. companies.<sup>164</sup> One U.S. trade official put it this way: "This response is the only way we can show the Brazilians that we are not just a paper tiger."<sup>165</sup>

Finance Minister Bresser Pereira responded publicly to the announcement threatening to suspend imports of U.S. sulphur, fertilisers and wheat worth US\$105 million.<sup>166</sup> Meanwhile, however, the Sarney government managed to get the software bill passed through Congress after much debate with the requisite copyright clause.

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<sup>162</sup> For some time Scopus maintained that SISNE was original and any similarity was purely coincidental. Later, faced with overwhelming evidence, Scopus admitted that parts of MS-DOS had indeed been copied. See Veja, "Plagio de bits: Scopus admite copia de programa americano," July 29, 1987, p. 100.

<sup>163</sup> See O Globo, "Apple quer impedir donos da Unitron de irem aos EUA," July 16, 1987.

<sup>164</sup> See "Government Seeks to Avert U.S. Sanctions," in Latin American Newsletters Regional Reports: Brazil, January 7, 1988, p. 6.

<sup>165</sup> Quoted in the San José Mercury, (San José, California) "Software Dispute Heats Up", November 14, 1987.

<sup>166</sup> Latin American Newsletters, Op. Cit.



SEI ruled that Microsoft's MS-DOS version 3.3 could in fact be licensed; the earlier versions were the ones excluded.<sup>167</sup> And SEI withheld approval for the Unitron machine pending the independent development of more system software. In so doing the Brazilian government managed to do just enough to draw the sting from the main complaints against it. In February 1988 the U.S. plans for retaliation were suspended.

As Evans<sup>168</sup> argues, the 301 was originally initiated out of domestic political concern by a 'declining hegemon.' In the initiation of the 301, the U.S. state acted quite independently of the interests of U.S. TNCs, contradicting the classic dependency theory, which explains core state actions in terms of TNC interest. However, as the case progressed, the interests of the TNCs increasingly set the agenda. Leaving aside the domestic publicity campaign, which appealed not on the basis of content but rather on symbol, there was no other effective constituency for this foreign economic policy initiative than the TNCs. Hence they were able to shift the basis of the negotiations from the market reserve itself, to the expedition of copyright import licenses, the protection of software, and their own specific investment plans.

However, it is essential to distinguish the interests of the TNCs already participating in Brazil, and those of the companies wishing to enter.<sup>169</sup> The TNCs with vested interests (IBM, Burroughs, H-P) had formed alliances and managed to strike independent deals with the Brazilian government. They were anxious that the 301 did not upset what they already had achieved. The TNCs without vested interests (Apple, Microsoft), on the other hand, had nothing to lose and everything to gain by mobilising the support of their government. In late 1987 these companies, capitalising

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<sup>167</sup> This was an elegant sidestep. The fact is there was very little difference between the new and old versions of the operating software.

<sup>168</sup> Evans, *Op. Cit.*, (1989).

<sup>169</sup> There are two other groups of TNCs worth noting: (i) the large users of informatics in Brazil (discussed in the next section) who were in favour of the trade complaint but did not actively seek to influence the negotiations, and (ii) TNCs in Brazil operating in fine chemicals, and biotechnology which were potential targets for market reserve. These TNCs were hopeful that the U.S. government could apply sufficient pressure to make an extension of the informatics policy to other industries politically unacceptable at the highest levels in Brazilian government.

on the protectionist mood in Congress, were able to provoke a reluctant administration to defend their cause.

In the end however, the interests of the 'vested TNCs' coincided with the broader foreign policy concerns of the U.S. to prevent the further pursuit of the trade case despite the emergence of this focused private constituency for the 301. But what was the net effect of the U.S. government actions in 1985–87?

The effect of the pressure from the U.S. government on Brazilian policy is ambiguous. On the one hand it served to polarize the situation further, consolidating nationalist sentiment and increasing the Brazilian resolve to resist outside pressure. This anti-U.S. and anti-TNC sentiment later became embodied in the new constitution. Organisations such as ABICOMP and the Movement for Brazilian Informatics (MBI), together with Senator Gomes and like-minded nationalists with seats in the constituent assembly, used the trade dispute to gain support for a constitution whose clauses concerning foreign investment are drawn largely from the Informatics Law and are highly nationalistic. As one Brazilian computer businessman put it, "Clayton Yeutter has been the best ally to the market reserve we could have had." More immediately, it put conservative President Sarney in a "no-win" predicament. In a June 17, 1987 press conference, Sarney expressed an ideological disdain for the market reserve strategy in general. Sarney proclaimed that the country must "import technology, raise imports [sic] and slot into a world economy which is increasingly interdependent." The president was quick to make an exception for the computer industry saying that the informatics law had "proved useful for a time."<sup>170</sup> Hence, though he may have quietly sought to emasculate the policy under different circumstances, the president could not back away from it under such public pressure.

Likewise, in terms of its original official objectives, the 301 achieved very little.<sup>171</sup> The interests that the 301 sought to defend were those of the U.S. computer

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<sup>170</sup> Latin American Newsletters Regional Reports: Brazil, July 9, 1987.

<sup>171</sup> Even in terms of its unofficial objective to placate a protectionist congress and appear 'tough on trade,' the results cannot be termed satisfactory. Many in Congress, and even

firms that were prevented by the market reserve from exporting to Brazil. Yet after three years of investigation and negotiation, Brazil's market reserve was still firmly entrenched both in law and in practice.

However, the empirical evidence suggests that the pressure did increase the perceived cost of a negative response from SEI to a "reasonable" U.S. company investment proposal. Representatives of SEI commented that due to the high international profile of the policy, they had to work harder to justify a negative response to proposals for imports or foreign investment.<sup>172</sup> Specifically, the U.S. government pressure apparently aided several TNCs to strike favourable deals with SEI. IBM's success with its four proposals,<sup>173</sup> and SEI's approval of H-P's joint venture with Lochpe, Microsoft's licensing agreement for MS-DOS 3.3, and Texas Instrument's proposal to invest in expanded and modernised semiconductor facilities are all examples of these.

#### Pressure from the Market

Unlike México, whose computer decree explicitly aimed to achieve an internationally competitive supply to the domestic market from the beginning, Brazil's policy did not include a specific and immediate concern for the requirements of the local market. Indeed, the development of domestic computer capability was of necessity to take place on the broad shoulders of the domestic market that would bear the associated economic cost in the early years. (See Figure 3.1)

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several in the Office of the USTR and the Department of Commerce were unhappy with the decision to suspend retaliation against Brazil. They held that Brazil's concessions were superficial and insufficient.

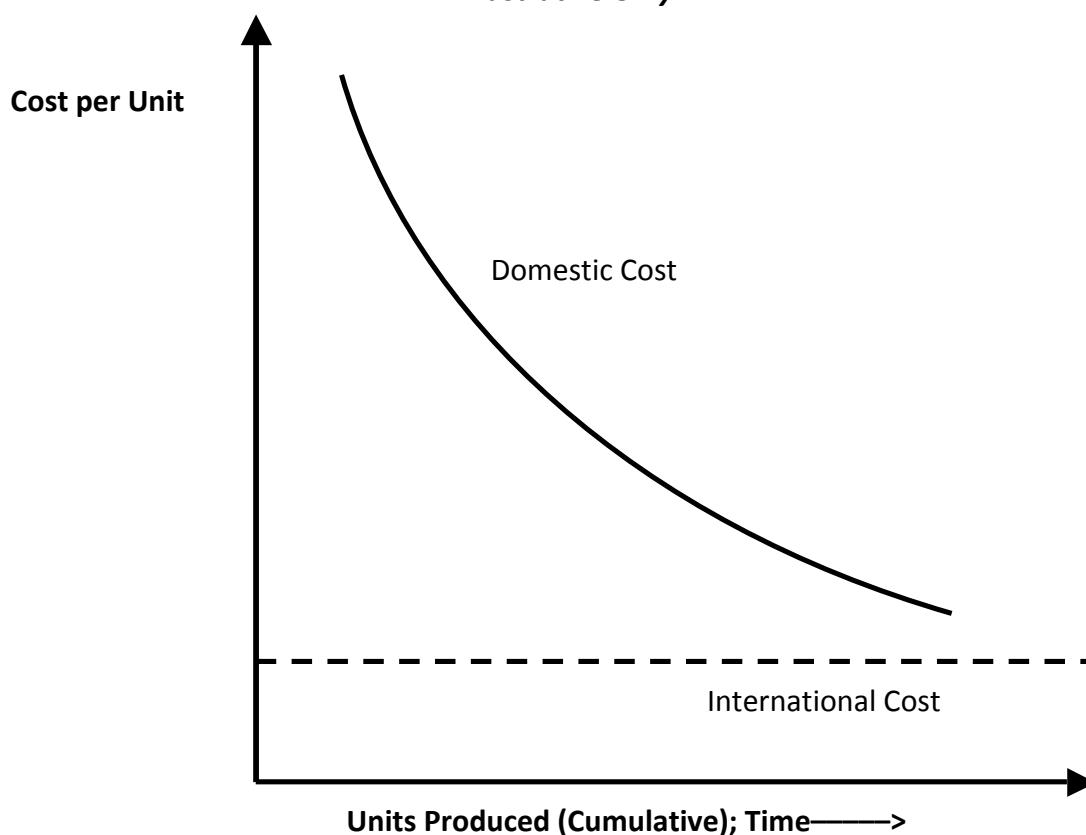
<sup>172</sup> Author interviews with senior representatives of SEI, October 1987.

<sup>173</sup> Gerdau extended local production of its small (4381) and large (3090) mainframes, and its new disk plant.

**FIGURE 3.1**

**The Learning Curve Effect: The Market Pays**

*Illustrative Only*



This economic cost is revealed in the price of Brazilian-made microcomputers. As Table 3.4 illustrates, the price of a standard IBM-compatible PC in Brazil was three times the U.S. price. Prices for computer equipment in Brazil remained high for a number of reasons including: (i) taxes and duties on imported components; (ii) the high cost of capital; (iii) high inventory costs due to the unreliability of supply and high interest rates; and (iv) the lack of scale economies.

**TABLE 3.4**

**Prices in US Dollars (1987)<sup>174</sup>**

**(1) "PC-XT" with 640 kB RAM; 1 floppy drive; 1 10 mB fixed drive; 220 cps dot matrix printer.**

	<b>Brazil</b>	<b>USA</b>	<b>Contraband</b>
Range	3,500–6,500	1,200–2,500	1,600–3,000
Average	5,850	1,850	2,460

**(2) "PC-AT" with 1 mB RAM; 1 floppy drive; 1 20 mB fixed drive; 220 cps dot matrix printer.**

	<b>Brazil</b>	<b>USA</b>	<b>Contraband</b>
Range	5,950–10,000	2,300–3,500	2,600–5,000
Average	9,160	2,900	3,860

In addition to higher prices, the market had to wait a considerable time before technology that was available on the international market became available in Brazil. This so-called "technology gap" averaged one to two years for standard microcomputer equipment.<sup>175</sup> For more sophisticated equipment, the gap was much longer. The products of the superminicomputer licensing agreements signed in 1984 (Table 3.3) had already been available internationally for two to five years prior to their introduction in Brazil.

These economic costs borne by the market since 1977 engendered two notable responses by users who grew in their sophistication. The first was a growing propensity to resort to illegal imports. The second was an intensified effort to lobby for greater flexibility in the implementation of the market reserve.

The price differential and technology gap noted above, together with SEI's ban on the importation of many parts and components, and the increasing importance of informatics equipment to every sector of the country's economy, resulted in a computer contraband trade of large proportions. It is estimated that contraband

<sup>174</sup> Schlochauer Associados, Consultoria e Representações Ltda., O mercado brasileiro de microcomputadores profissionais (1980–1990), São Paulo, October 1987.

<sup>175</sup> Tigre, *Op. Cit.*, (1987), p. 74.

microcomputers accounted for 25 percent of the country's installed base in 1987. The contraband trade in peripheral equipment and components was thought to be even worse. (See Tables 3.5 and 3.6) Altogether, the contraband trade in professional electronic equipment and software was thought to be worth some US\$ 300 million per year, or 20 percent of the reserved market.<sup>176</sup>

**TABLE 3.5**

**The Contraband 'Top Ten'**

<b>Product</b>	<b>Units Apprehended</b>
Integrated Circuits	11,913
Diskettes	1,910
Memory Chips	1,279
Disk Units	223
Printers	216
Microcomputers	180
Teclado	126
Video Display Units	65
Winchester Hard Disks	48
Magnetic disk heads	12

**TABLE 3.6**

**Contraband vs Market Price (Cruzados) for Selected Items**

<b>Product</b>	<b>Contraband Price</b>	<b>Market Price</b>
Winchester disks (20 MB)	28,000	125,000
Memory chips	60 to 250	120 to 500
Printers	40,000	70,000

The second market response to the policy—political action—was forcefully demonstrated when SEI attempted to expand the market reserve into the area of automobile electronics in the early eighties. Autolatina responded adamantly, claiming that there was a lack of competitive domestic supply to meet their needs.

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<sup>176</sup> This data together with the data for Tables 3.6 and 3.7 come from a review in *Exame*, "A porta aberta do contrabando," July 8, 1987, pp. 60–64. Data sources include the Policia Federal, the Secretaria da Receita Federal, SEI, the Society for Computer and Subsidiary Equipment Users (Sucesu), and original research by the author of the article. The findings were confirmed by my own interviews with major corporate users of computer equipment, all of whom were very familiar with the contraband trade.

Therefore, it was argued, Brazil's automobile exports would be jeopardized. SEI subsequently backed away from this proposed extension of the reserve.

Nevertheless, an important economic fact had been highlighted. Informatics was becoming vital to the competitive functioning of most industries. A lack of competitiveness in informatics had consequences for the entire economy, not just for the sector itself. Of course, this fact was not lost on the architects and proponents of the market reserve. It was this fact that was the very motivation of the national effort in informatics. However, while few Brazilians in the eighties questioned the goal of technological autonomy, the costs associated with, and growing uncertainty of, its achievement were brought into full relief against the backdrop of a fragile domestic economy.

After the Informatics Law was passed in 1984 and CONIN was established with policy-making power and authority over SEI, the users had a stronger political voice through which to make known their concerns. One of the eight non-ministerial seats on CONIN belonged to FIESP, the Federation of Industries of the State of São Paulo. FIESP was recognised as the most influential institutional political voice for private capital in the country. Created in 1931, FIESP represented 112 trade associations in the state of São Paulo which generated one-half of Brazil's GDP. FIESP thus represented both foreign and domestic companies in its role as industrial advocate.

In late 1987 FIESP submitted a paper to CONIN that reflected the concerns of its members. The paper, entitled "General Considerations about the Development of Industry, Technology, and the Market Reserve,"<sup>177</sup> adopted a very pragmatic tone. It is an indication of the deeply-rooted support for the national informatics policy that FIESP did not attack it explicitly. Instead, the paper began with an expression of FIESP 'support' for the national informatics policy, but went on to question the implementation of the policy. The paper itemised six areas of concern:

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<sup>177</sup> FIESP, "Considerações gerais sobre o desenvolvimento da industria, tecnologia, e reserva de mercado," mimeo; my translation where quoted.

(i) Firstly, SEI's control over imports and the slow, bureaucratic nature of the import licensing process was questioned. FIESP claimed that the need for prior permission from SEI for imports was a "great obstacle to the development of Brazilian industry."<sup>178</sup> FIESP called for the reduction of the number of items under SEI's authority, asking that they be placed under normal CACEX control where requests for import were processed more "efficiently."

(ii) Secondly, FIESP called both for greater fiscal support for national microelectronics companies, and the liberalization of the industry. Arguing that microelectronics is the technological heart of the sector, FIESP was concerned that the national industry had access to the latest technology. FIESP therefore wanted the national microelectronics firms to exercise free choice in the purchase of foreign technology.

(iii) The paper also took up the cause of joint ventures. FIESP criticised SEI for its paternal approach to joint ventures. Arguing that the law did not specifically prohibit joint ventures, FIESP maintained that the national companies were mature enough to decide what was a favourable joint venture agreement. In particular, SEI's exclusion of joint ventures involving the foreign technology supplier came under attack: "It is obvious the national entrepreneur associating himself with foreign capital will look for, above all, a partner [with] the latest technology."<sup>179</sup>

(iv) Fourthly, FIESP called for the restructuring of CONIN. Consisting of sixteen government ministers and eight others, and meeting only twice a year, the council was ill-suited to making policy decisions. FIESP wanted the creation of a permanent commission that could do the ongoing work in preparation for bimonthly meetings of the council to take decisions.

(v) Linked to (iv) above was the recommendation to reorganise SEI. FIESP wanted SEI's power more tightly circumscribed. Furthermore, FIESP was concerned that SEI's decisions and the criteria for them were transparent to all concerned.

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<sup>178</sup> Ibid., p. 2.

<sup>179</sup> Ibid., p. 4.



(vi) Finally, the paper addressed the subject of foreign technology purchasing. FIESP noted the basic objective of a national technological capability. FIESP continued, "Autonomy, however, does not have to be synonymous with auto-sufficiency, which cannot be attained by our country or by any other." The argument was that informatics was a means to development, and

"to reject or make difficult the access to foreign technology does not get us anywhere. To the contrary, it can condemn Brazil to technological retardation incompatible with the necessities of industry in general... We suggest a movement in the present attitude of SEI—which approves the acquisition of technology only in exceptional cases and only after long delays—to a position more agile and flexible."<sup>180</sup>

FIESP's concerns were thus to limit SEI's power, increase its own influence over the policy, facilitate the speedier processing of import requests, and allow the use of foreign technology to aid Brazilian industry. The computer TNCs, the national computer firms unable to support the ongoing research and development costs, and the Brazilian computer market now had a powerful and focused advocate for their interests.

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<sup>180</sup> Ibid., p. 5.

## CHAPTER 4

### THE POLICY AND ITS IMPACT

#### The Policy

This section summarises the Brazilian computer policy—its objectives, strategy, and measures—as a basis for evaluating the success of its impact in the industry. It also briefly highlights the institutions that were charged with the implementation of the policy.<sup>181</sup>

The basic objectives of Brazil's informatics policy remained constant from its inception in the mid-1970s to 1990:<sup>182</sup>

- (1) To control the process of informatisation in the country.
- (2) To develop Brazilian capability in information technology which will ensure the designing, development and production of electronic equipment and software in Brazil.
- (3) To create jobs in general, and job opportunities for Brazilian engineers and technicians in particular.
- (4) To limit the market share of computer TNCs in general—and IBM in particular— in order to ensure a leading position for national companies in the domestic market.
- (5) To achieve a favourable balance of trade in computer products and services.
- (6) To create openings for the development of a parts and components industry in informatics.

The policy was based upon several underlying concepts and assumptions. First was the assumed vital importance of information technology to the development of the country. The importance ascribed to informatics was grounded in a technocratic vision that sees technology as the solution to problems. The last chapter demonstrated how deeply rooted that vision was.

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<sup>181</sup> SEI has been examined in some detail already, along with some of the specific political pressures on Congress and CONIN. The objective here is merely to capture any remaining salient points, which have gone hitherto unmentioned.

<sup>182</sup> Compiled on the basis of the National Informatics Law, author interviews, and secondary sources regarding the early period (Helena, Tigre, Adler).

Secondly, the market was seen as a national asset that is to be used for the country's strategic purposes. The state's role then was to ensure that access to the internal market is in strict accordance with national objectives (which in this case were quite different than simply supplying the immediate demands of the market itself). Thus the interests of the consumer were subordinated to the collective interest as defined by the state.

The potential size of the Brazilian informatics market gave the state considerable bargaining leverage with respect to foreign capital. The potentially enormous domestic market is what sustained TNC interest in Brazil despite the antagonistic policy. In this respect, this case differs markedly from TNC interest in an export base such as in South Korea, Taiwan, or México.

Third is the assumption that technology is not transferable because its essence is learning-by-doing. One of the strongest proponents of the market reserve put it this way:

"Technology can only evolve in the process of doing things, and integrated to the rest of the economy. In this sense, there is no such thing as technology transfer. So-called technology transfer agreements don't really transfer anything, and only increase the dependence. When we import a new product or even set up a new plant transferred from abroad, we are only purchasing the results of foreign technology, not its essence."<sup>183</sup>

Brazil's strategy for achieving its goals had two fundamental features: the national market would be reserved to national companies; and the national companies could only purchase foreign technology once. This second tenet was included to prevent continued technological dependence via on-going licensing agreements.

The Informatics Law, passed by the Congress in October 1984 defined the main points of the policy as follows:

(i) The Congress will permanently supervise the policy and will revise every three years the National Informatics Plan (PLANIN). (Articles 1 and 7)

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<sup>183</sup> Fregni, *Op. Cit.*, p. 4.

(ii) The National Council on Informatics and Automation (CONIN) chaired by the President of the Republic, and in which sit sixteen ministers and eight representatives of significant sectors of society, will decide on all questions not clearly defined in the law. (Articles 6 & 7)

(iii) The Special Secretariat for Informatics (SEI), an organism of the Executive branch, will be responsible for supervising and controlling the information industries. (Article 8)

(iv) SEI will control imports of informatics goods and services for a period of eight years until October 1992. (Articles 4 & 8)

(v) Any company wishing to manufacture or market goods belonging to the informatics sector must submit a project for approval by SEI. (Article 8)

(vi) When considering projects for approval, SEI will give priority to national companies and national technology. Approval is automatic whenever both cases apply. (Article 9)

(vii) If no national projects are available, national companies will be allowed to use foreign projects and technology. (Article 9)

(viii) When no national company is in a position to supply a certain product deemed of interest to the national economy, then a foreign company will be allowed to manufacture it in Brazil. (Article 22)

(ix) A Brazilian company is defined as one that fulfils both of the following requirements: (Article 12)

1. All the voting shares and at least 70% of the total shares must belong to Brazilian permanent residents.
2. The company must have full technological and managerial autonomy.

(x) These rules apply to all goods and services in the informatics sector, including any product using digital technology, as well as to integrated circuits and software. (Article 3)

In addition to these regulations, the policy includes a variety of fiscal incentives for the sector in the areas of research and development, human resource

development, capitalisation of the national company, production, exports, software, and microelectronics. Tax deductions of up to 200 percent of expenditure were granted for research and development, the formation of human resources (training), and microelectronics components produced by national firms. Accelerated depreciation was also allowed as an incentive for capital expenditure in R & D and production.

As the policy was designed and implemented, the market reserve can be seen as a moving window in time (see Table 4.1). In 1977 microcomputers could only be produced with Brazilian technology by Brazilian firms. Minicomputers could incorporate foreign technology, but had to be produced by Brazilian firms. Mainframes were completely free with respect to both technology and capital. In 1984, the reserved market was 'moved up' to include superminicomputers. After 1984, low-end minicomputers could incorporate only domestic technology, while superminis could (and all in fact did) include foreign technology. With respect to capital, the reserve in superminis was not complete. Both ABC Sistemas (Honeywell) and Tesis (Hewlett-Packard) were joint ventures, though the majority of equity capital was in national hands.

**TABLE 4.1**

**Implementation of the Market Reserve, 1977 & 1984**

<b>Product Segment</b>	<b>1977</b>		<b>1984</b>	
	<b>Capital</b>	<b>Technology</b>	<b>Capital</b>	<b>Technology</b>
Mainframes	Free	Free	Free	Free
Superminis	NA	NA	Local/JV	License
Minicomputers	Local	License	Local	Local
Microcomputers	Local	Local	Local	Local

**Impact of the Policy**

This section examines the impact of the policy guidelines, beginning with an overview of the Brazilian computer industry and its market. First the product segments are defined, and then the dimensions of the market—its size and growth—and the major customer groups are outlined. This is followed by a more specific

evaluation of the impact of the computer policy guidelines with respect to their original objectives outlined above.

### Product Segments

In broad terms, the computer electronics complex comprises a number of product segments, including: computer hardware (mainframe, mini, and micro); peripherals (video display units, bank terminals, point-of-sale terminals, printers, magnetic storage devices, modems, etc.); software; microelectronics; data processing services; and computer maintenance.

For the purpose of regulating the industry, SEI defined six classes of computers:

- Class 1: microcomputers
- Class 2: minicomputers
- Class 3: small mainframes and superminicomputers
- Class 4: medium mainframes
- Class 5: large mainframes
- Class 6: very large mainframes

As previously noted, the Brazilian policy effort focused initially on the minicomputer in the mid-seventies and was extended to include microcomputers and peripherals. Later, in the eighties, the policy was extended further to cover microelectronics and, to a lesser extent, software, services, and maintenance.

Rather than attempting to cover each of these segments comprehensively, this analysis focuses on the areas that were of consistent importance to the policy-makers from the beginning: namely, computer hardware and peripheral equipment.

### Market Size

The Brazilian market for data processing equipment totalled \$4 billion in 1986, making it the eighth largest national market in the world.<sup>184</sup> While Brazil indeed represented a substantial market, it comprised less than three percent of the world market and less than five percent of the U.S. market. (See Table 4.2) Moreover, due

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<sup>184</sup> Informatica Hoje, March 31, 1987, p. 20 estimated \$3.2 billion; however official estimates vary between \$2.4 billion and \$4 billion, depending primarily on whether and how to account for the contraband market.

to the inflated prices for microcomputers and peripherals, the market size in dollar terms was somewhat exaggerated relative to the world market.

**TABLE 4.2**  
**1986 Computer Market Size (US\$ Millions)<sup>185</sup>**

	<b>Brazil</b>	<b>World</b>
Mainframes	\$1,100	\$35,125
Minicomputers	\$ 500	\$21,375
Microcomputers	\$ 500	\$24,125
Peripherals	\$ 750	\$59,750
Software	\$ 200	\$16,625
Maintenance & Services	\$1,000	\$44,250
	=====	=====
<b>TOTAL</b>	<b>\$4,050</b>	<b>\$201,250</b>

#### Market Growth

The Brazilian market for data processing equipment grew, in value terms, at a compound annual rate of 16% from 1979 to 1986. Growth slowed in 1983 and again in 1987 due to crises in the country's economy in those years.

**TABLE 4.3**  
**Evolution of Data Processing Equipment Sales in Brazil<sup>186</sup>**  
**1979–1986 (Millions of U.S. Dollars)**

	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>CAGR</b>
<b>Total</b>	830	860	1040	1508	1487	1728	2115	2375	16.2%

Market growth was fuelled primarily by the growth of microcomputer sales. The relative importance of minicomputers declined from 1979 to 1985 while the market for microcomputers experienced explosive growth. By 1985 the value of sales of micros (at a much cheaper unit price) was almost three times the value of mini sales. (See Table 4.4)

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<sup>185</sup> Sources: *Datamation*, SEI, ABINEE, ABES, Company Reports, author's estimates. The black market accounts for a substantial portion of micro and peripheral markets.

<sup>186</sup> Source: SEI, *Panorama do Setor de Informática*, Boletim Informativo, v. 7, n. 16, August 1987, p. 8. Figures exclude black market.

**TABLE 4.4**  
**Sales of Minis and Micros**<sup>187</sup>  
**(Millions of Current Cruzeiros)**

	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>
Minis	6,085	11,350	32,813	40,698	166,139	502,214
Micros	1,360	4,448	20,268	56,108	247,341	1,423,755
<b>Micros/Minis</b>	<b>.22</b>	<b>.39</b>	<b>.62</b>	<b>1.38</b>	<b>1.49</b>	<b>2.83</b>

The growth in installed base also reflects the importance of the microcomputer segment. As shown in Table 4.5, the installed base of micros grew at an average annual rate of nearly 68 percent while minis grew at 47 percent from 1977 to 1984. Interestingly, the larger mainframe segments also sustained healthy growth of 21 and 31 percent during the same period. It was the smaller mainframes that were worst hit during this period. This segment was squeezed between much cheaper, more flexible, and comparably powerful machines below, and much more powerful machines above.

**TABLE 4.5**  
**Growth of Installed Base by Class, 1977 to 1984**<sup>188</sup>

<b>Class</b>	<b>Average Annual Growth (%)</b>
1	67.8
2	46.6
3	9.3
4	3.3
5	31.4
6	21.3
<b>Total</b>	<b>58.6</b>

### Market Segments

Financial services companies were the largest users of data processing equipment in Brazil. These were followed by data processing bureaux, of which the largest were government-owned and operated. Together these two market segments

<sup>187</sup> SEI, *Op. Cit.*, (1987), p. 68.

<sup>188</sup> SEI, *Boletim Informativo*, 14 (September 1985), p. 11.



accounted for over a third of the installed microcomputers, nearly half of mainframes, and 80 percent of minis and superminicomputers. (See Table 4.6)

**TABLE 4.6**

**Market Segments' Shares of Installed Base, 1987 (%)**<sup>189</sup>

<b>Segment</b>	<b>Mainframes</b>	<b>Minis/Supers</b>	<b>PCs</b>	<b>8-bit Micros</b>
Finance	23	66	19	34
Data Processing	20	14	17	29

Table 4.7 shows the evolution of the importance played by the financial sector. The strong increase in this segment's share of the market in 1982 reflects the banks' increased expenditure on banking automation equipment supplied by the national industry. By 1985, however, the banks were slowing down their expenditure on automation and their share declined slightly. The growing importance of the industrial segment reflects the increase in demand for process control and automation equipment as well as the ongoing demand for more traditional electronic equipment.

**TABLE 4.7**

**Market Segments' Shares of Annual Sales (%)**<sup>190</sup>

<b>Segment</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>
Finance	20.7	19.4	29.6	30.4	29.5	28.0
Industry	26.2	25.6	29.1	28.2	27.7	32.5
Commerce	34.5*	37.9*	19.6	16.8	19.4	18.3
Services			9.8	15.6	10.3	8.7
Government	17.7	15.9	11.9	9.0	13.1	12.5

Notes: \* includes services; all data excludes purchases of equipment from TNCs.

On the surface, the government's share seems relatively small at 12.5 percent. However, one must bear in mind two points that conspire to keep the figure low. Firstly, the figure excludes state-owned financial institutions. If these are included,

<sup>189</sup> Dados e Ideias, "500 Maiores Usuarios de Informatica," 11.107 (April 1987), p. 23. After data processing bureaus, the next four segments were chemicals & pharmaceuticals, commercial firms (retail outlets, distribution), civil construction, and public services.

<sup>190</sup> SEI, Op. Cit., (1987), p. 44.

the government's share in 1985 rises to nearly a quarter of the total market.<sup>191</sup> Secondly, the figures reflect only purchases from national firms, leaving aside the mainframe market. The government and its enterprises are the prime users of these large, expensive machines. All things considered, the government—federal, state, and municipal—is the largest customer group in the market.

This thesis argues that Brazil's policy successes with respect to the computer electronics complex are more limited than the authors reviewed in the introductory chapter have suggested. The appropriate measure of "success" is the development of the industry with respect to each of the six policy objectives (elaborated in the previous section) that remained fundamentally in tact from the mid-1970s through the 1980s.

#### 1. To Control the Process of Informatization

Advances in information technology underlie the development of all technological innovation. Information technology is clearly seen as one of the key enablers of increased economic productivity and therefore growth. The "process of informatization," can be described as the process by which information technology is developed and used, transforming the economic, political, and social structures of society.<sup>192</sup> This first policy objective, thus, is a general and very ambitious goal that is critical to the development goals of the country as a whole. It's a goal that encompasses the five that follow, and is especially linked to the second goal—technological autonomy—a prerequisite to any real 'control' over the process of informatization. As such I do not attempt a rigorous discussion of this very general policy goal, preferring to focus instead on the specifics further below. However, as the overriding policy objective, it warrants some discussion here.

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<sup>191</sup> Ibid., 23.9 percent of total, to be exact.

<sup>192</sup> Adapted from Simon Nora and Alain Minc, The Computerization of Society: A Report to the President of France, (Cambridge, MA: MIT Press, 1980).

Technological innovations introduced into Brazil up to the early seventies had originated largely from abroad. Moreover, there was increasing concern that a few foreign companies led by IBM would control this strategic industrial sector. Thus, from the beginnings of an informatics policy in the 1960s, there was an awareness in Brazil among those in a position to influence policy of the importance of computer technology to national independence. Firstly, that awareness prompted the military to seek a greater degree of technological capability in a sector that was deemed vital to national security. Later, as more and more sectors of the economy became dependent upon computer technology, the need to control this process of informatization (or "computerization") was felt by a large cross-section of Brazilian policy-makers.

Control over the process of informatization thus became associated with sovereignty and Brazil's development goals. As explained earlier, the historic means to achieving development in Brazil had been through state direction and control. The computer industry was approached in the same way.

By virtue of the strong regulatory powers exercised by SEI (and CAPRE before it), and the legislative interest of Congress in this sector of the economy, the Brazilian state made a valiant attempt to exercise control over the informatization process in the country. The state exercised considerable skill in creating a greenhouse for local capital to invest, obtain a foothold in the computer industry and develop technological capacities in the 1970s and 1980s. However, the state was not able to legislate technological autonomy. Indeed, as will be discussed more fully later, the rapid development of the globalized industry structure with international technology standards controlled by a few TNCs like IBM, Microsoft and Intel, put the 'control over the informatization process' increasingly out of reach for policymakers.

## 2. Technological Autonomy

The second goal was the prime focus of the policy. From the early days, policy makers aimed to develop a Brazilian capability in information technology that would ensure the design, development and production of electronic equipment and software

in Brazil. Explaining the rationale for the market reserve, Colonel Dytz, one of the architects of the policy and later head of SEI, put it simply: “Local companies will not develop their own products as long as copying foreign products is much easier.”<sup>193</sup> In short, the overarching goal was technological autonomy.

Technological autonomy is sometimes confused with technological self-sufficiency. It is crucial not to make the same mistake here. Self-sufficiency in computer electronics is a recognised impossibility; not just for Brazil, but for most if not all countries. Autonomy, on the other hand, connotes an independence of choice and a freedom of control. Technological autonomy thus requires a level of technological competence that facilitates control over the areas and degrees of technological *interdependence*.

Measures of technological autonomy include the establishment of national informatics firms that are in fact designing, developing, and producing electronic equipment in Brazil. There is no doubt that a credible Brazilian capability in information technology developed as a direct result of the national informatics policy.

The most striking example of this fact was Cobra’s independent development of SOX – a legally legitimate clone of UNIX, the leading computer operating system, together with corresponding software applications and utilities. The Brazilian state flagship company dedicated \$20 million and 50 software engineers for six years to build and test SOX, which was internationally recognised and certified in 1989. As a demonstration of technological autonomy at that point in time, SOX is a powerful example. As a commercial product, it was a failure that was abandoned shortly after it was certified. Itautec’s banking automation products are a commercially successful example of technological autonomy, however.

Table 3.8 shows the phenomenal growth in the number of national firms established in the industry after 1977. As a percentage of the total number of firms

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<sup>193</sup> Author interview with Colonel Edison Dytz, Secretary General, SEI, October 1987.

participating in the industry, national firms increased from less than 10 percent in 1977 to 90 percent in 1986.

More importantly, these national firms have not been simple marketers of foreign–designed and foreign–made equipment either. In video display units, microcomputers, and minicomputers, these firms achieved nationalisation indices of between 85 percent and 98 percent. (In printers the nationalisation indices have been somewhat lower at 69 percent to 93 percent.)<sup>194</sup>

**TABLE 4.8**

**Selected Performance Indicators of Brazilian Informatics Firms**<sup>195</sup>

	<b>1977</b>	<b>1980</b>	<b>1983</b>	<b>1986</b>
1. Number of Firms Registered	4	29	80	310
Percent of Total (%)	<10	75	80	90
2. Expenditure in R&D (US\$ m)	—	30	67	154
R&D Expenditure/Sales (%)	—	8.7	9.8	10.1
R&D Expenditure/Employee (US\$)	—	4,130	4,260	3,850
3. Employees in R&D	—	1,200	2,045	4,900
R&D Employees/Total (%)	—	16.5	13.0	12.2

Table 4.8 also shows the increase in expenditure on research and development, which is an important means to technological autonomy. The Brazilian firms spent just over 10 percent of total sales on research and development, which is comparable to the levels spent in the OECD countries.

However, there are some disturbing implications from the statistics in Table 4.8. Firstly, the total expenditure on R&D of US\$154 in 1986 is a very small sum indeed, especially considering that the amount is spread across some 310 firms. IBM alone spent more than thirty times that amount on R&D worldwide in 1986. The rapid pace of technological change dictates a massive investment in research and development to keep up with the international industry. For this investment to be

<sup>194</sup> ABICOMP/SBC, *A Política Nacional de Informática, a Indústria Nacional e o Desenvolvimento Tecnológico*, May 1984, referenced in Tigre, *Op. Cit.*, (1987), pp. 72–73.

<sup>195</sup> Source: Piragibe, *Op. Cit.*, Figure VI.

economically viable, a large sales volume over which to amortize the investment is required. The lack of export success by the national industry (see later) means that the national companies are limited to the domestic market—a market too small to support the investment necessary to support significant investment in R&D. And so the vicious cycle continued.

Secondly, both the R&D spending per employee and R&D employees as a percent of total have decreased from 1983 to 1986. This reflects the increased economic pressure on the national firms in 1986 with the general slowdown in the market. In times of economic hardship, investment in research and development is more easily sacrificed than in areas necessary for near-term survival and success.

Technological autonomy requires the capability to assimilate as well as to adapt, extend, and improve upon imported technology. Without doubt, Brazilian companies have adapted, extended, and in some cases, improved upon imported technology. In the area of banking automation the industry can be said to have demonstrated credible innovation.

However, Brazil was not able to 'assimilate' foreign technology rapidly enough to meet the requirements of its own market, let alone the export market. A technology gap of between one and five years remained in the 1970s and 1980s. In minicomputer technology, Brazil opted for a second round of technology licenses to catch up to where the international market had been already for some time. Even in microcomputers, Brazilian companies continued to supply their market with equipment that cost three times as much as it did in the international market. (See Table 2.5, previous chapter).

As a result of the inability of the national manufacturers to satisfy domestic demand, the market made concerted efforts to sidestep the restrictive government regulations. These efforts were reflected in the large and rapidly growing contraband trade in professional electronic equipment and software.

While satisfying market demand in terms of levels of technology, supply, and price was never an explicit policy objective, the inability to satisfy the market inhibited

the achievement of the objectives of technological autonomy, national market share, and trade balance.

Furthermore, to the extent that the technology of the computer exists in the design and diffusion of the integrated circuits and the operating software, Brazil remained largely dependent upon the international supply of technology. The engine of high tech innovation in the industry was still largely in the hands of foreign companies.

### 3. Increased Employment

That the third objective listed above—the creation of employment, particularly for Brazilian engineers and technicians—has been achieved is beyond question. Even though much of this growth can be attributed to the explosion of the microcomputer market since 1981, it can be convincingly argued that national employment would not have grown so much had the market reserve not existed. It was government policy that put Brazilian firms in a position to take advantage of the rapid growth in this new market.

In terms of generating employment, the market reserve policy was an undisputable success, even though the transnationals reduced their payroll by nearly 40%. The Brazilian companies added employees faster than their sales grew from 1981 to 1986, and employed almost five times as many people as the TNCs in 1986.

**TABLE 4.9**  
**Employment in the Brazilian Data Processing Industry**<sup>196</sup>  
**1981–1986**

	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>
National	8,800	12,584	15,734	21,840	27,739	34,586
TNCs	12,200	11,797	10,010	9,684	7,382	7,425
<b>Total</b>	<b>21,000</b>	<b>24,381</b>	<b>25,744</b>	<b>31,524</b>	<b>35,121</b>	<b>42,011</b>

A specific goal of the CAPRE technicians was to generate employment at the graduate level in the areas of production and development. At this the policy has also had success. Table 4.10 supports Colonel Dytz' assertion that "Brazilian companies put college graduates into R&D, whereas the multinationals put them into sales."<sup>197</sup>

**TABLE 4.10**  
**Graduate Level Employment by Activity**<sup>198</sup>  
**Number of Employees per US\$100 Million Sales**

<b>Activity</b>	<b>1981</b>		<b>1986</b>	
	<b>Nat.</b>	<b>TNC</b>	<b>Nat.</b>	<b>TNC</b>
Production	75	59	112	57
Development	225	14	189	19
Sales	84	161	141	54
Maintenance*	64	10	33	13
Administration	122	118	115	109
<b>Total**</b>	<b>561</b>	<b>381</b>	<b>632</b>	<b>298</b>

\*per \$100 million of installed base

\*\*excluding maintenance

The only qualification one can make with regard to employment is a question about its longevity. With economic trouble and the consolidation of the industry, Brazil was set to experience a decline in employment in the sector in the late 1980s.

#### 4. Limit TNC Market Shares

The fourth objective was to limit the market shares of TNCs in general—and IBM in particular—in order to ensure a leading position for national companies in the

<sup>196</sup> SEI, *Op. Cit.*, (1987), p. 14.

<sup>197</sup> Author interview with Colonel Edison Dytz, Secretary General, SEI, October 1987.

<sup>198</sup> Ibid.



domestic market. The market reserve, by definition, accomplished this. The market shares of the TNCs taken as a whole necessarily decreased as a result of the reserve in the micro and minicomputer markets. TNCs' share of the equipment market fell from 77 percent in 1979 to 45 percent in 1986, their addressed market limited to the large computer segment. (See Table 4.11)

**TABLE 4.11**  
**Evolution of Data Processing Equipment Sales in Brazil<sup>199</sup>**  
**1979–1986 (Millions of U.S. Dollars)**

	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>CAGR</b>
National	190	280	370	558	687	847	1082	1315	31.8%
TNCs	640	580	670	950	800	881	1033	1060	7.5%
Total	830	860	1040	1508	1487	1728	2115	2375	16.2%
<b>TNC SHARE</b>	<b>77%</b>	<b>67%</b>	<b>64%</b>	<b>63%</b>	<b>54%</b>	<b>51%</b>	<b>49%</b>	<b>45%</b>	

In turn, several important national informatics firms developed since the introduction of the market reserve. Table 4.12 lists these major groups and their involvement in different segments of the electronics industrial complex.

The policy also had success in decreasing IBM's share of the market. From 1981 to 1986, when the market grew at an average annual rate of 16 percent, IBM's sales grew at four percent per annum. IBM's relative share of the market—that is the company's share as a multiple of the share of its nearest competitor—was reduced from 5.5 to 3.5 in the same period. (Refer to Table 4.13)

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<sup>199</sup> ibid., p. 8.

TABLE 4.12

Principle National Informatics Groups, 1987<sup>200</sup>

Parent	Computers	Components	Peripherals	Telecom	Consumer Electronics
Sharp	SID Infor- matica	SID Micro- eletronica	Digilab*	SID Tel- ecom/NEC	Sharp
Docas de Santos	Elebra	Elebra Mic- roeletronica	Elebra In- formatica	Elebra Telecom	—
Itau	Itautec	Itaucom	Itautec	Itautec	—
Acrescimo	Polymax	—	Eletrodigi	E.E.	—
ABC Sis- temas	ABC Bull*	ABC-Xtal	—	ABC Tele- informatica	—
Gradiente	Digiplay	—	—	—	Gradiente

Yet a relative market share of 3.5 remains impressive. IBM continued to dominate the Brazilian computer industry in terms of both sales and profitability despite the market reserve that relegated the company to the slower-growing mainframe segment of the market. IBM and Unisys together accounted for more than US\$ 1 billion in total sales. Even discounting IBM's and Unisys' combined exports of US\$145 million in 1986, together these two TNCs were larger than the next twelve national companies combined. The policy succeeded in limiting the TNCs' shares, but it did not succeed in securing a *leading position* in the industry for the national firms.

Interestingly, the TNCs held on to their share of the government business more effectively. In 1986, TNC equipment accounted for 80 percent of the installed base of computer equipment in government (value terms), down just five percentage points from 1983.<sup>201</sup> This not only reflects the government demand for mainframe computers. It also reflects the fact that certain government agencies and enterprises

<sup>200</sup> Tigre, *Op. Cit.*, (1987), p. 66. \* denotes joint venture with a foreign firm.

<sup>201</sup> Piragibe, *Op. Cit.*, (1987), Figure IX.

(most notably the military) were able to circumvent the market reserve for items and services of "strategic necessity."

The most successful Brazilian companies were partly owned by banking groups that provided them with captive markets for banking automation equipment. (See Table 4.13) The commercial difficulties experienced by the state flagship, Cobra, were noted previously. Table 4.13 shows that Cobra was the only major player to experience a decline in sales from 1981 to 1986.

**TABLE 4.13**

**Manufacturers of Computers and Peripherals (US\$ Millions)<sup>202</sup>**

Company	Ownership	Rank	1986		1981	
			Sales	ROS~	Rank	Sales
IBM Brasil	Foreign	1	812	18.8	1	671
Unisys	Foreign	2	235	NA	2	162*
Itautec**	Corp/Finan	3	147	11.0	71	4
SID**	Corp/Finan	4	116	4.7	15	23
Cobra	State/Finan	5	110	2.2	4	121
Elebra**	Corp/Finan	6	103	2.2	9	40
Scopus	Owner/Mgr	7	73	4.9	18	20
Microtec	Owner/Mgr	8	43	6.3	—	—
Labo	Mgr/Finan	9	42	8.9	8	45
Sisco	Mgr/Corp	10	41	0.2	22	19

~ROS = Percent return-on-sales (net profit/total sales) in 1986.

\*Unisys 1981 sales are the total of Burroughs and Sperry.

\*\*Sales of Itautec, SID, and Elebra comprise computers, peripherals, and components.

Providers of data processing services have been excluded.

The Brazilian computer industry became increasingly fragmented as many firms entered under the protection of the market reserve. The average Brazilian computer firm sold less than US\$ 5 million worth of equipment in 1985. The five largest national firms, which accounted for nearly 90 percent of the national market in 1979, accounted for less than half of the market in 1985. (See Table 4.14) While the increased competition may seem like a good thing, in fact it did not bode well for the

<sup>202</sup> Dados e Ideias, "150 Maiores Empresas de Informatica," v. 12, n. 111, August 1987; and Dados e Ideias, "50 Maiores no Brasil," v. 7, (December 1981). Brazilian currency converted to US dollars using average annual exchange rates published in Lloyds Bank, Op. Cit., 1986.

national firms, which lacked sufficient size to capitalise on the substantial scale economies that exist in the industry.

**TABLE 4.14**

**Industry Concentration (Brazilian Companies Only)<sup>203</sup>**

	1979	1980	1981	1982	1983	1984	1985
5 Largest	88.8%	65.8%	53.6%	51.1%	46.4%	47.4%	45.8%
10 Largest	98.0%	83.2%	77.5%	73.1%	65.8%	67.5%	64.7%

In 1987, the Brazilian companies experienced significant losses due to the downturn in the country's economy, the resultant slowdown of the domestic market, the increase in finance costs, and the companies' high levels of indebtedness. Itautec was one of the few Brazilian companies to make a profit during the first half of 1987 thanks to a large export order.

**TABLE 4.15**

**Performance of Selected National Companies<sup>204</sup>  
January to June 1987 (Cz\$ Millions)**

Company	Total Sales	Losses
SID Informatica	777.9	563.7
Scopus	636.3	392.0
Datamec	605.7	280.9
Edisa	479.9	232.4
Labo	533.7	207.5
Racimec	341.2	78.5

This highlights the economic vulnerability of these companies individually, and the national industry as a whole. The companies simply could not afford to invest in R&D or expand their distribution channels. As one SEI official put it, if the industry did not continue to grow at 30–35 percent per year,

"the market reserve will be impotent in avoiding the slow asphyxiation of national manufacturers due to the economic crisis and, when

<sup>203</sup> *Ibid.*, p. 30.

<sup>204</sup> "Um primeiro semestre pintado do vermelho," *Dados e Ideias*, v. 12, n. 113, (October 1987), p. 28.

protection by law ends in 1992, the local industry will not have the minimal conditions to face up to multinational competition."<sup>205</sup>

The banks had to move again to save the national industry by buying up companies and forcing consolidation in the industry. In 1989 Bradesco (via Digilab) bought 70 percent of Scopus, and Unibanco bought Labo and Medidata. Meanwhile, Citibank increased its equity share in Elebra to 22 percent. SEI welcomed this consolidation, seeing it as the only way in which the local industry could survive and compete with the TNCs.

In summary, the informatics policy in general, and the market reserve in particular, succeeded in limiting the market shares of IBM and the TNCs. This created space for a large number of Brazilian firms to stake out a position in the growing market. In particular, a number of significant economic groups developed more or less integrated operations in the sector. However, the national firms were unable to challenge IBM's overall leadership in the market, either in sales or profitability. Their lack of scale and dependence on imported components made national groups vulnerable competitors. As a result, the late 1980s' market slowdown forced a growing number of national companies to shut down or sell out to larger conglomerates led by the private financial institutions.

##### 5. Balance of Trade

Fifthly, the policy sought to achieve a favourable balance of trade in the sector. At first sight, SEI's figures seem to indicate some success with this objective while the reserve policy was in force. Within the industry itself there was a rough balance of trade in 1986. Imports of components and capital equipment amounted to US\$253 million while exports totalled \$246 million.<sup>206</sup>

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<sup>205</sup> Frederico Monteiro of SEI, quoted in Latin American Newsletters Regional Reports: Brazil, "Harder Times for the Computer Sector," p. 7.

<sup>206</sup> Import figures from SEI Op. Cit., p. 11; exports from Cacex and reported in Dados e Ideias, September 1987, p. 56.

TABLE 4.16

Imports (Millions of US Dollars)<sup>207</sup>

	1981	1982	1983	1984	1985	1986
National	81	50	49	90	96	75
TNCs	223	208	179	187	174	178
<b>Total Imports</b>	<b>304</b>	<b>258</b>	<b>228</b>	<b>277</b>	<b>270</b>	<b>253</b>

This is an important accomplishment of the policy, reflecting not only the stringent import restrictions, but also the partial success of national component suppliers.

However, when the informatics imports by firms and organizations outside the industry are added to account for balance of trade in the sector as a whole, a different picture emerges. In 1987, total imports were approximately \$1 billion, compared to exports of \$246 million.<sup>208</sup>

TABLE 4.17

External Trade in Informatics (US\$ Millions)<sup>209</sup>

Year	Exports	Imports	Balance
1977	164.7	101.6	63.1
1978	188.7	144.1	44.6
1979	219.7	258.9	- 39.2
1980	358.1	258.9	99.2
1981	379.1	304.0	75.1
1982	337.1	504.9	- 167.8
1983	275.2	440.1	- 164.9
1984	310.2	605.2	- 295.0
1985	322.5	n/a	n/a
1986	245.8	672.0	- 426.2

If illegal imports were included in the trade figures, the balance would deteriorate by another US\$ 300 million. Because of the rapid growth of the contraband trade and its magnitude, it would appear that the total balance of trade for the sector in fact worsened during the period of the market reserve.

<sup>207</sup> SEI, *Op. Cit.*, (1987), p. 11.

<sup>208</sup> *Gazeta Mercantil*, August 12, 1987, p. 14.

<sup>209</sup> Cacex, *Informacao Semanal*, (Banco do Brasil) January 1, 1987, n. 1029, p. 11.

Failure to achieve a balance in this sector can be attributed to shortcomings on both sides of the foreign trade equation. Continued reliance on the import of high-technology components and capital equipment related to the industry weighed down the debit side of the equation. The inability of the national companies to produce a wide range of internationally competitive computer and related products inhibited efforts to export and encouraged illegal imports.

Pro-reservists attributed the balance of trade problem to the computer TNCs operating in Brazil. They argued that the TNCs' import-to-sales ratios are higher than those of the national companies. (See Table 4.18)

**TABLE 4.18**

**Imports-to-Sales (%)<sup>210</sup>**

	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>
National	21.9	9.0	7.1	10.6	8.9	5.7
TNCs	33.3	21.9	22.4	21.2	16.8	16.8

However, this merely begs the question. If the necessary components and capital equipment had been available in Brazil, there would be no need to approve the imports requested. Comparing imports to exports, the national companies contributed most to the deficit, importing \$75 million and exporting only \$5 million in 1986. The TNCs imported \$178 million, but exported \$245 million.<sup>211</sup>

The fact that the TNCs were producing the highest value-added, most technologically-complex products explains their higher import requirements as much as their common practice of international sourcing. The policy was successful insofar as it could be with regard to TNC imports. As local suppliers were able, the TNCs sourced components locally as they were required to do.

## 6. Parts and Components Industry

The market criticised SEI most vigorously for its restrictions on the import of components. The national informatics policy, from the beginning, intended for an

<sup>210</sup> SEI, *Op. Cit.*, (1987) p. 11.

<sup>211</sup> *Ibid.*, p. 11; and *Dados e Ideias*, September 1987, p. 56.

*integrated and complete* computer electronics industry to develop in the country. In order to do this, it was deemed necessary to limit the importation of parts and components. One result of these tough import restrictions is the high nationalisation index in nationally produced micros and minicomputers.

In spite of these high nationalisation indices, the development of supporting industries in Brazil was slower and more limited than hoped. The technology-intensive components, such as ICs, microprocessors, magnetic disk heads, memory chips, diodes, and high impact printer elements were still supplied largely by imports. The reason for this is simply that the market remained too small to allow the investment required to develop these components.

Some suppliers developed for the lower technology items, in many cases with the considerable help of IBM, Unisys, and Hewlett-Packard, the largest TNC computer operations in the country. These companies established international purchasing offices via which the Brazilian subsidiary could export components to TNC operations in other geographic markets.

But the strategic area that SEI targeted in 1981—microelectronics—was a bitter disappointment. To begin with SEI could not adequately fund the effort in microelectronics that was envisaged. A commitment in 1984 of US\$70 million over five years was promised to incentivise the industry. However, it required US\$100 million to establish a modern diffusion operation for a limited line of semiconductors.

The three national firms for which the market was reserved, found themselves unable to commit the necessary resources either. As a result, they were able to supply only a limited number of components to the less demanding consumer electronics industry (SID, the industry leader, was the captive supplier of Sharp Consumer Electronics, its parent company).

Thus, by 1986, the local industry had not changed a great deal from 1981 when the area was targeted. There were then three nationally-owned firms competing, instead of one, and their share of the market had increased as a result of the reserve. However, the majority of ICs were still imported. And the only significant investment



in diffusion was coming from Texas Instruments. As the national firms struggled to stay alive in the equipment market, and TI strengthened its Brazilian operations considerably, it was unlikely that the objective of a nationally-owned integrated semiconductor industry would be realised.

**TABLE 4.19**

**The Microelectronics Industry, 1986**<sup>212</sup>

<b>Supplier</b>	<b>US\$ Millions</b>
Imports	180
– illegal	40
Domestic	120
– SID	40
– Itautec	20
– TI	20
– Elebra	7
– Others*	33
<b>TOTAL</b>	<b>300</b>

\*Others were primarily TNCs: Fairchild, Siemens, and Philips.

Despite these qualifications, the successes of the Brazilian policy in this area were impressive. In particular, the policy engendered: an increase in expenditure on research and development; an increase in technological ability, especially in banking automation; the development of a critical mass of technicians and engineers; an increase in employment; and the establishment of a number of strong national firms in the sector.

The consistency of the policy over such a long period contributed significantly to its success in attracting the capital of major Brazilian investors (including the country's two largest private banks), and in extracting technology licensing agreements for superminicomputers from computer TNCs that had refused to license seven years earlier in the hope that the market reserve would soon crumble.

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<sup>212</sup> Based on author interviews with participants in the industry during September and October 1987.

But one cannot credibly assert that Brazil's successes validate the strongest version of bargain theory. Nor can argue that Brazil's policy failures invalidate it. The situation is not static, it is extremely dynamic; and the bargaining game is never over. Bargaining gains in the case of Brazil were not progressive and one-directional.

The market reserve, combined with the advent of the microcomputer as a requisite piece of office equipment, created a profitable, expanding opportunity for Brazilian capital. Because the basic technology of the microcomputer—the "chip"—was available on the international market as a commodity, the technological and capital barriers to entry in the business were relatively low. As a result literally hundreds of companies began producing microcomputers and their peripherals for the Brazilian market. This fragmentation of the industry was sustainable as long as the market continued to grow exponentially, which it did until the failure of the Cruzado Plans and the resultant economic recession in 1986–87. Because even the largest of these companies lacked the scale economies necessary to produce micros at an internationally competitive price, a shift to the export market was impossible. This situation, exacerbated by a price war, resulted in many of these companies being forced out of business while even the most robustly financed Brazilian computer companies such as SID Informática began to record staggering losses.

Brazil's declaration of a moratorium on debt repayment in early 1987 added to the industry's woes. Imports of vital components were subject to severe delay thus bringing production, in many cases, to a standstill. The result was a domestic industry heavily in debt and facing an uphill battle for survival.

The result was even less capital to invest in research and development or larger production facilities. Meanwhile, technological developments in the international industry marched relentlessly ahead. The survivors in the local market would be the few that (a) carved out a competitive niche, most likely in banking automation; (b) combined strong financial backing with foreign technology agreements; or (c) opportunists pirating technology (euphemistically called 'reverse engineering') at the low end of the market. The medium-sized national companies investing in the full

design and production cycle would go out of business if they did not merge with other firms.

With the crisis in the industry in the late 1980s, developmentalist ideology also suffered and began to yield to survivalist pragmatism. Local capital sought foreign finance and technology anew and the government adopted a more lenient stance with regard to foreign involvement in the industry. Witness the technology agreements between IBM and SID, DEC and Elebra, IBM and Itautec, and the financial backing of Elebra and SID by Citicorp (the former in a debt-for-equity swap). The approval by the government of Texas Instrument's investment plans for a new microelectronics plant, after reserving this sector to three Brazilian firms was further evidence of a shift in relative bargaining power to foreign capital.

In sum one can say that Brazil succeeded in shifting its dependence somewhat from foreign computer hardware to foreign microelectronics and software. This shift brought with it both new opportunities and constraints. These sectors of the electronics complex were certainly less dependent upon sophisticated marketing capability. However, they were even more technology- and capital-intensive than the end-user equipment segments. Moreover, Brazil had tried for several years with very limited success to develop capability in these areas that more and more embody the "high-technology" in the equipment. Nevertheless, dependence was successfully shifted further back in the industry chain.

### **Summary Conclusions**

Following is a summary of the main observations with regard to the informatics policy in Brazil. These observations pertain to: (i) factors or events that initially led to the formulation of the market reserve; (ii) factors or events that helped to sustain the policy and aid its success; and (iii) factors or events that conspired to alter the policy. The order in which the summary points are made does not necessarily reflect priority or prior cause.

## I. Genesis of Policy

### 1. Lack of computer TNC responsiveness.

The lack of responsiveness of computer transnationals to the needs of the Brazilian computer and labour markets contributed to the development of the policy, which was eventually to exclude these TNCs from large segments of the national computer market. This lack of responsiveness was due to a variety of factors including: (i) the traditional strategy of centralized research, development and manufacturing; (ii) the practice of selling technologically obsolete products in frontier markets to extend product life span and generate large positive cash flows; (iii) the preoccupation with the exploding markets for data processing equipment and services in North America and Western Europe; and (iv) the fact that many of the computer companies were relatively new, and did not possess extensive networks of international subsidiaries. As such, they had not even begun to develop the kind of 'statesmanlike' skills that may have helped them foresee what was coming.

### 2. Growing numbers of Brazilian data processing engineers.

The modernization of Brazilian higher education led to a sharp increase in the number of graduates with training in data processing engineering. Because of the centralized manufacturing and R & D strategies of the TNCs noted above, these engineering graduates had a strong interest in the development of a national computer industry. Partly by virtue of the highly technical nature of this emerging industry, some of these same "frustrated nationalist technicians" came to have considerable regulatory power in the government.

### 3. The Navy's concern about technological dependence.

The Navy's realization of its own dependence on foreign technology after purchasing the sophisticated British frigates meant that those calling for a national computer industry now had a powerful ally. For its part, the Navy pursued greater technological autonomy by developing its own group of electronic technicians and supporting the joint development of Brazil's first minicomputer. Later, President

Carter's abrogation of the military cooperation treaty strengthened the military's resolve in its quest for technological independence.

#### 4. Modernization of Brazil's state bureaucracy.

The modernization of the Brazilian state bureaucracy increased the state's appetite for data processing equipment and services. The corresponding trade deficit in computers led to the eventual imposition of import controls.

#### 5. The energy crisis of 1973–74.

Certainly the OPEC price rises of 1973–74 served to concentrate the government's efforts to limit imports. The burgeoning trade deficit in informatics was one such area the government needed to control. Whereas the modernization of the state bureaucracy contributed indirectly to the imposition of import controls, the energy crisis gave the necessary final push.

#### 6. Brazil's historical predisposition to isolationism and concessionist protection.

Underlying all of the above was Brazil's historical predisposition to isolationism and its tradition of conceding protection to industry. The Brazilian industrialist was historically concessionist rather than entrepreneurial, and the state played an active role as "partitioner" of a vast array of local markets. Furthermore, the existence of a large internal market and the lack of significant cultural links with other parts of the world have encouraged Brazil to pursue a computer industry, among others, on its own.

### Efficacy of Policy

The following discussion of the efficacy of the Brazilian policy highlights the importance of market and industry developments, as well as domestic political considerations.

#### 1. Entrepreneurial fragmentation of the international computer industry.

The entrepreneurial fragmentation of the international computer industry in the 1970s and 1980s was important to the success of the policy. This meant that there were many small companies that were potential sources of technology even if the

major computer transnationals would not license technology to Brazilian companies when the reserve was first enacted.

## 2. Availability of integrated circuits and software on the international market.

Critical to the success of the Brazilian microcomputer manufacturers was the international commodity market for integrated circuits. ICs are the fundamental basis of microcomputer technology. Because they were (and are) mass-produced by a number of highly competitive semiconductor manufacturers that are not, for the most part forward-integrated, integrated circuits were available on a commodity basis.<sup>213</sup> Hence, the technological barriers to entry into the microcomputer industry were significantly reduced; microcomputer "manufacturing" was in fact more accurately described as "assembling". The availability of basic software (i.e. MS-DOS and UNIX) also served to lower the barriers to entry at the low end of the market. By using internationally standard operating systems developed outside the country, Brazilian computer-makers were able to introduce products for which there already existed a wide range of applications software. In so doing, they avoided the enormous capital investment necessary to develop the software themselves. The companies that chose to invest in the development of operating software (Scopus developed SISNE, the MS-DOS equivalent, and Cobra developed SOX, a UNIX equivalent) did so at great loss, especially since MS-DOS and UNIX were later accepted in Brazil.

While this situation facilitated the rapid entry and growth of Brazilian microcomputer companies, the Brazilian industry remained dependent upon foreign-produced chips and software. In this sense "control of informatization" and technological autonomy remained out of reach.

## 3. Explosion of the microcomputer market in Brazil.

Closely linked to (2) above was the explosion of the Brazilian market for microcomputers. The extraordinary growth of this market and the low barriers to

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<sup>213</sup> IBM sought (unsuccessfully) to raise the technological barrier to entry in microcomputers by incorporating proprietary chips—that is, chips designed and made by IBM—in its later line of microcomputers, Personal System 2.

entry for local firms meant that hundreds of firms were able to enter and (initially) profit from this business.

#### 4. Potential of the Brazilian market for informatics.

The enormous potential of the Brazilian market for informatics, confirmed by the demand for microcomputers, was a vital lever for the Brazilian policy-makers. The market potential sustained the interest of the computer transnationals despite an adverse regulatory environment. Computer TNCs that refused to license technology when the market reserve was implemented in 1977 did in fact license technology in 1984. The government thus effectively used the potential of its market to increase its bargaining power, controlling the terms by which foreign firms may participate in the growing Brazilian market.

#### 5. Importance of informatics to financial services.

The importance of informatics to the financial services industry provided a large captive market for the Brazilian computer firms and encouraged the banks' direct investment in the Brazilian informatics industry. The banks thereby financed the growth of the Brazilian computer firms in two ways: as major customers and major investors. The most successful Brazilian computer firms, Itautec, SID and Digilab owe much of their success to this fact.

#### 6. National profile of the policy.

The resilience of the policy was attributable in part to its great public visibility. From the inauguration of the first computer in 1960, to the launching of Cobra, to the disputes with Data General and IBM, to the debate over the proposed informatics law, to the Section 301, developments in the industry became national "events." The policy was successfully linked to wider concerns for national sovereignty. The policy was thus an issue of national importance. The country's leaders, therefore, could not publicly back down from the nationalist policy throughout the 1970s and 1980s without sustaining significant political damage.

## Changes in Policy

The following discussion of factors that acted to alter the policy course highlights the large number of new bargains that were struck during this period, bargains: within the state itself, state-TNC, state-state (US), firm (local sector)- state, and firm-firm.

### 1. Transition to civilian government.

The transition from military rule to civilian government affected the informatics policy in two important ways: (i) the policy and its implementers (SEI) were no longer insulated from political pressure inside the National Security Council; and (ii) the codification removed some of SEI's discretionary power and made it easier for the TNCs to identify and then exploit loopholes in the law.

### 2. Changes in party politics.

Leftists in the majority PMDB lost ground to more conservative voices in the party and in government. Some observers interpreted this as a natural result of the former opposition party coming to power, (i.e., there was now a vested interest in the status quo). In particular, several strong proponents of the 1984 law no longer had seats in Congress in the late 1980s.

### 3. U.S. government pressure.

Although the effect of American government pressure on Brazilian policy was ambiguous, it clearly raised the political stakes involved in pursuing the market reserve. The series of joint business arrangements involving U.S. and Brazilian firms in the industry, and the approval of TI's microelectronics plant, are, in some measure, attributable to this political pressure.

### 4. Economic crisis in the wake of the failure of the Cruzado Plan.

After a decade of extraordinary growth, the market for informatics equipment and services slowed in 1987. As a result, many of the smaller Brazilian computer firms went out of business, while most of the larger ones incurred severe losses. The remaining firms were without capital to fund new product development, or even purchase spare parts and supplies from abroad. In order to survive, many of the



Brazilian firms began to look for joint-venture partners based outside of Brazil. The economic crisis thereby increased the bargaining power of foreign capital and led to a greater number of joint-ventures in the industry.

5. Fragmentation of the Brazilian computer industry.

With the favourable regulatory environment and low barriers to entry at the dynamic low-end of the computer market, several hundred Brazilian firms competed for a share of the market. This fact was touted by pro-reservists as evidence of policy success. However, this fragmentation of the industry carried attendant costs. Even the largest of the firms was undercapitalized and unable to benefit sufficiently from economies of scale and learning curve effects so as to be cost-competitive in the international marketplace. The local firms were thus economically vulnerable and the Brazilian users had to bear these costs in the form of higher prices. The result was greater market pressure for the liberalization of the market reserve.

6. Increasing sophistication and militancy of the users.

As the industry developed in Brazil so too did the sophistication of users who increasingly demanded better products at lower prices. The growing problem of contraband in the 1980s was a reflection of user dissatisfaction with the local industry. Although the users were not particularly well organized as a political force, their dissatisfaction was made known through FIESP and SEI began to pay more heed to the needs of the market.

7. Expansion of the scope of the market reserve.

The expansion of the scope of the market reserve to include all kinds of electronic equipment and services mobilized opposition to the policy. In particular, the inclusion of automobile electronics in the reserved area greatly angered the automobile industry. This particular "user-group" became a powerful adversary to the policy and succeeded in forcing a retreat in the policy's scope.

8. Alliances of foreign and local capital.

The increasing number of joint ventures between foreign and local capital in this sector resulted from the factors noted above and, in turn, served to further

moderate the market reserve policy. The local partners, out of the interests of their joint ventures, became important political allies to foreign capital as well as business allies. Gerdau and Lochpe (joint venture partners with IBM and Hewlett–Packard respectively) were two cases in point. Foreign capital, once established in the market through joint–venture, had a better platform from which to negotiate with the government.

Stepping back and looking at the interplay of politics and industry from 1970 to 1990, it is clear that the global industry structure’s development constrained the effective policy choices available to those who sought to develop a national informatics industry. The protective rubric of the market reserve provided a critical umbrella under which national players could invest and grow. But by the late 1980s, a globalized information technology industry was taking shape. Its industry structure included hundreds if not thousands of companies all over the world investing in research and development and creating software applications for a handful of emerging global technology platforms (IBM, MS-DOS and later Windows, UNIX and Intel). Such an international industry structure placed enormous pressure on Brazil’s protectionist policy. Its domestic market, though impressive, was not nearly large enough to sustain national players at a sufficiently large scale to compete on either cost or technology. Over time, protecting the national informatics industry entailed enormous costs to the economy as a whole.

All that is not to say that a *laissez faire* policy was either the inevitable or best choice, however. This research project has documented significant enduring bargaining gains enabled by a policy that was credibly sustained for more than a decade. These include the shift in dependency from computer hardware to components, the development of a large cadre of industry professionals, the growth of national microcomputer manufacturers, the competitive presence of a few new entrants in defensible niches like banking automation, and the decision of leading TNCs including IBM to license technology to national players.

The challenge highlighted by Brazil's bold policy initiative in informatics is the ability of state actors – particularly those in an increasingly pluralistic political context – to manage complexity and rapid change. The sheer pace of change in a complex industry made it almost impossible for policymakers to effectively manage and adapt policy to an ever-changing industry landscape and set of market needs and opportunities. The task was exceedingly difficult even when the politics favoured centralised management of the industry. As political sponsorship eroded and decision-making decentralized, the task proved impossible.

## CHAPTER 5

### AFTERWORD

#### SUMMARY OF DEVELOPMENTS IN THE BRAZILIAN CASE SINCE 1990

This chapter contains a brief review of developments in the Brazilian case since 1990, paying closest attention to the transition in the early 1990s from the 14 year-old market reserve policy to a more liberal open market in informatics. It looks first at the changes in the policy, second at the development of the industry, and finishes by offering observations about the legacy of the market reserve policy and implications for host country – TNC bargaining.

#### **Policy Development: From Protection to Promotion**

The Informatics Law passed in 1984 was scheduled to expire in October 1992. Elected as President in March 1990, Fernando Collor de Mello was predisposed to accelerate the dismantling of the market reserve policy. Collor campaigned and was elected on promises of free-market reforms. Development policy shifted from protecting the large domestic market for Brazilian firms, to attracting foreign investment, technology and trade with the aim to enhance international competitiveness.

Consistent with these aims, Congress passed a new Informatics Law in October 1991 to replace the earlier version, effective October 1992. The new law:

- ◆ Dissolved SEI and created the Department of Informatics and Automation Policy (DEPIN – Departamento de Política de Informática e Automação) to dismantle the old policies and oversee the new;
- ◆ Sought to improve the quality of informatics in Brazil by stimulating competition between imported and locally-made products;

- ◆ Abolished the age-old Law of Similars – foundational to the import substitution development policy – and aimed to liberalize imports after October 1992;
- ◆ Dismantled local content regulations;
- ◆ Eliminated restrictions on production in informatics, removing obligations to apply for a government license to invest in the industry;
- ◆ Granted permission for technological joint ventures between local and foreign companies;
- ◆ Required companies to invest 5% of gross revenues in R&D activities. This included 2% involving cooperation with universities, research institutes or programs identified by the Ministry of Science and Technology as priorities.

A debate ensued over the appropriate tariff levels for imported components and finished products. This conflict not only pitted the TNCs against the Brazilian producers who wanted some on-going protection against imports. The TNCs had an ally in the local distributors who wanted low tariffs to make it easier to sell the imported products.

The prevalence of contraband products and activities influenced the debate about tariff levels. It was estimated that contraband accounted for 50-70% of the installed base of equipment<sup>214</sup> at this time. Lower tariffs would reduce demand for contraband products and gradually squeeze them out of the market.

ABICOMP, the powerful industry trade association, shifted its advocacy from promoting the interests of Brazilian firms to promoting production in Brazil regardless of ownership. Accordingly, ABICOMP admitted foreign players that were producing in

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<sup>214</sup> Schoonmaker, *Op. Cit.*, (2002) p. 144. This percentage is consistent with author interviews with industry players in 1987.

Brazil. In the spring of 1992, ABICOMP – including the newly admitted TNC members like IBM and HP – presented a tariff policy proposal to the government. After some negotiation, the government agreed a schedule that incorporated somewhat lower tariffs than ABICOMP’s proposal.

**Table 5.1**

**Import Tariffs Adopted May 1992<sup>215</sup>**

<b>Class of Imports</b>	<b>Before 7/92</b>	<b>10/92 – 7/93</b>	<b>7/93 –12/94</b>
Final goods	50%	40%	35%
Printed circuit boards (assembled)	50%	35%	30%
Modules, subassemblies	35-50%	25-30%	20-30%
Semiconductors	40%	20%	15%
Boards (disassembled)	30%	20%	15%
Critical inputs (e.g., chips)	30-50%	0	0

The discussion and adoption of the import tariffs illustrate the three-fold dilemma faced by policy-makers in the transition period during the first half of the 1990s: (1) How could they meet the need for international compatibility and competitiveness; while (2) not looking like a servant of foreign capital and foreign government pressure; while at the same time (3) providing some level of protection for those firms that had made investments under the old rules and developed indigenous products and technological capability? Attempts to triage these three objectives resulted in a complex mix of tariffs and national and local taxes to enable

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<sup>215</sup> Source: Paulo Bastos Tigre, “Brazil’s IT Sector: The Profile in 1992” (paper presented at “The Future of Information Technology in Brazil” conference, University of California, Berkeley, January 1993) and cited by Schoonmaker, *Op. Cit.*, (2002) p. 151.

the state to offer exemptions as a means of promoting local production, local content and R&D investment.

The liberalizing agenda introduced by Collor in 1990 largely continued with respect to informatics throughout the ensuing decades. President Fernando Cardoso signed a new Informatics Law in January 2001 with a primary focus on attracting foreign investment and promoting exports. It included some fiscal incentives and a requirement to invest in local R&D much like the Law that preceded it.

In the last decade, the Brazilian state has demonstrated greater commitment to national innovation. While largely respecting the liberal market reforms of his predecessors, the government of President Lula da Silva (2003 – 2010) has pursued a more activist state policy in this area, implementing a number of policies seeking to strengthen national technological capabilities and accelerate innovation. President Lula's central industrial policy statement in this regard was the *Política Industrial, Tecnológica e de Comércio Exterior* (Policy for Industry, Technology and Foreign Trade or PICTE). PICTE identified sectors that were key to innovation (e.g., software, semiconductors, renewable energy, biotechnology and pharmaceuticals), improved the institutional and regulatory environment and provided financial support (e.g., subsidies and tax incentives) and investment for industrial modernization and technological development. Early success can be seen in the automotive sector where flex fuel engine technology was led by local developments in bio-fuels and alternative energy-related innovations. However, progress in informatics is less apparent.

It is still early to assess the impact of Lula's initiatives – and well beyond the scope of this thesis. Nevertheless, it is both interesting and encouraging to see the state recognise the critical importance of innovation to economic development in a

globalized economy and to proactively implement an integrated set of measures designed to create a fertile ground for innovation and technological development.<sup>216</sup>

### **Post-Reserve Industry Development**

While the new law dismantling the key tenets of the market reserve was passed in 1991, some observers note that its implementation was halting,<sup>217</sup> adding to the uncertainty faced by industry players and would-be investors. To make matters worse, the country was beset by hyperinflation, burgeoning foreign debt and a severe recession in the early 1990s. These factors conditioned the development of the Brazilian informatics industry in the immediate aftermath of the market reserve.

One of the assumptions that lay behind the move to abolish the market reserve was a large, latent demand for internationally competitive information technology. Yet, the initial result of liberalization was not a big surge in computer imports and complete market domination by the TNCs. Several reasons for this have been posited, including customer confusion at the proliferation of product choice, the relatively high price of imported equipment (due as much to TNC pricing policies as to the import tariffs), the adequate functionality of the local installed base, and the very limited spending power of individual, government and corporate buyers in the midst of an extremely difficult economic climate.

Indeed, the transition period hit the industry hard in three notable ways: (1) a 32% decline in total informatics sales from 1989 to 1992; (2) a 30% decrease in total informatics employment in the same period; and (3) a staggering 67% decline in

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<sup>216</sup> The author is indebted to Dr. Mahrukh Doctor's research on Brazil's recent attempt to implement a national innovation policy. Mahrukh Doctor, "Furthering Industrial Development in Brazil: Globalization and The National Innovation System," A paper prepared for delivery at the 2009 Congress of the Latin American Studies Association, June 11-14, 2009, Rio de Janeiro, Brazil.

<sup>217</sup> Schoonmaker, *Op. Cit.* (2002) and Evans, *Op. Cit.* (1995) both refer to this.



research and development investment between 1989 and 1992. Brazilian-owned firms were hit harder than foreign-owned players during this time, experiencing a 47% decline in sales and 50% reduction in employment.<sup>218</sup>

Contracting sales coupled with uncertainty about the policy – how it would be implemented and how long the liberal market reforms would last – catalyzed more than ten transnational joint ventures (JVs) and alliances in 1990-91. In addition to wanting a hedge against an uncertain policy environment in the transition years, the TNCs were attracted by the local companies' installed customer base and distribution networks. For their part the Brazilian companies were interested in gaining access to state-of-the-art components and technology as well as capital to grow.

Digital and Elebra entered a joint venture under the new rules introduced in 1991, moving from the licensing agreement struck in 1989, whereby Elebra sold DEC's VAX and MICROVAX minicomputers, to an equity joint venture. By 1993, Digital had acquired 83% of Elebra's equity and integrated the Brazilian operation into its global supply chain.

In this wave of foreign/national alliances, IBM notably violated its standard practice elsewhere in the world and established a JV with SID Informatica where IBM had a 49% minority stake.<sup>219</sup> The venture – MC&A Personal Systems – was created to assemble and market IBM's PS/2 microcomputers. Exemplifying the difficult market environment, the company sold very few computers when the product was first

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<sup>218</sup> Schoonmaker *Op. Cit.* (1995): 389-390

<sup>219</sup> One shouldn't ascribe too much specific bargaining significance to IBM's decision to joint venture with SID and later with Itautec. The global industry was increasingly requiring even the large players to create alliances in order to compete. By the mid-1990s IBM is reputed to have entered over 300 global alliances. See John M. Stopford, "Competing Globally for Resources", *Transnational Corporations*, 4 (August, 1995).

introduced and was forced to reduce the price by 25% before sales accelerated.<sup>220</sup> IBM later increased its share in the JV to control 70% of the enterprise.

Itautec, the largest and commercially most successful of the Brazilian firms that developed under the protective rubric of the market reserve, also struck a deal with IBM. Itautec negotiated an agreement to manufacture and sell IBM's most successful mid-sized computer, the AS-400. Itautec was also able to leverage its leading market position in financial automation to negotiate a deal to become one of two worldwide manufacturers for IBM communications controllers. Itautec also partnered successfully with Microsoft to produce an operating system to sell with Itautec's brand of personal computers and struck a partnership with Intel for server distribution.

At one level these alliances between local and transnational capital can be seen as evidence of the market reserve's failure to nurture an enduring national industry. After all, some of the most important original beneficiaries of the reserve in the minicomputer sector – Elebra, SID and Itautec – all jumped into alliances with transnational capital as soon as the reserve's restrictions were abolished. With the lone exception of Itautec, the Brazilian firms each accepted a minority position within a year or two of the joint venture.

On the other hand, the alliances and joint ventures have been offered as evidence of the success of the market reserve.<sup>221</sup> Clearly, the local players had established a position in the market and developed critical assets and capabilities that large foreign players couldn't ignore. A sizable number of Brazilian players were

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<sup>220</sup> Schoonmaker, *Op. Cit.* (2002).

<sup>221</sup> Evans makes this point in *Op. Cit.*, (1995) pp. 185-189.

perceived as competent and desirable – perhaps even necessary – partners for foreign capital.

Indeed, the relationship between national and foreign capital in the sector changed markedly once the reserve was dismantled. Battle lines had to be redrawn. Old adversaries became allies. National firms traded a competitive position based on the protection afforded by their government's market reserve for a position bolstered by access to international technology and financial capital. In so doing, the very firms that the state had been protecting weakened the bargaining leverage of the state.

Rather than argue policy success or failure based on the alliances alone, it is more instructive to look more closely at the legacy of the reserve on its own terms. Did the market reserve policy, sustained over a 14 year time period, succeed in spawning an enduring national capability to design, develop and produce internationally competitive electronic equipment and software in Brazil? Evidence for success should be apparent in the operations of national players competing successfully with foreign capital across the industry value chain, a large trained professional class, sustained investment in R&D, and a rough balance of trade in the sector. With the benefit of a much longer hindsight, one sees the same picture as in the late 1980s, only with greater clarity. It's a mixed picture of qualified success in important areas and failure in others.

Without a doubt, the market reserve policy created space for a national informatics capability. The policy induced large private sector actors like Itau Group, Elebra, Gerda, SID and others to invest in the informatics industry and compete credibly in many of the sub-sectors of the industry, with the exception of mainframes and components.

Itau Group offers the clearest success story. Itau's entry into the computer industry in 1979 owed entirely to the market reserve policy. The Group went on to participate successfully in computers and peripherals (Itautec), semiconductors (Itaucom), telecommunications (SESA) and consumer electronics (Philco, purchased from Ford in 1987). In the late 1980s, Itautec had a 300-strong R&D team, though that was significantly reduced in the post-reserve climate. The company established an internationally competitive advantage in banking software and automation that survives to this day. Itautec began exporting ATMs to the US and Europe in 2001. As noted above, Itautec leveraged its leading position in the market to strike favourable alliances with international leaders IBM, Microsoft and Intel – a rare feat indeed.

There are not many success stories like Itautec but it is not completely isolated. A local systems integrator in the financial automation sector, PROCOMP, began operations in 1988 and by 1991 was the fourth largest local firm by sales and first in terms of profitability. Unlike Itautec, however, PROCOMP was acquired by an international leader in financial automation and ATMs, Diebold, and operates as a wholly owned subsidiary selling Diebold systems in Latin America.

Sistema, a producer of industrial automation systems, and its associated peripherals manufacturer, Rima, each achieved some measure of international market success in the 1990s. Sistema established a German joint venture that supplied process control systems in Europe. Rima set up an alliance with an Italian producer of microcomputers and proceeded to sell its printers in the Italian market.<sup>222</sup>

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<sup>222</sup> Frischtak, Claudio, "The International Market and the Competitive Potential of National Producers of Equipment and Systems," in Evans, Frischtak and Tigre, *Op. Cit.* (1992). Evans also cites Frischtak's analysis in Evans *Op. Cit.* (1995): 188-189.

In the market for PCs, Brazilian manufacturers maintained a credible position. In 1997, six Brazilian players supplied just over 25% of branded the market. Among them, Itautec was the national leader with 6.8% share, second behind Compaq with 10.4% of the market. So-called “white box” clones accounted for half the market meanwhile.<sup>223</sup>

Cobra, the original state-owned flagship in the sector, succeeded in creating an authentic national technology. After dedicating 50 software engineers to the task for six years, Cobra developed the SOX operating system and architecture for the superminicomputer in 1989. In spite of this technological success, however, Cobra was a commercial failure. Saddled with high costs and sluggish management, the company disastrously chose to enter the low margin PC clone market and incurred the wrath of local players. Here was the national flagship, intended to be a catalyst for the development of the industry, competing with local players at the commodity end of the market. Banco do Brasil acquired a majority stake in the company in the early 1990s and Cobra Tecnologia lives on today, a shadow of its former self.

In addition to the major groups that played across several sub-sectors of the informatics industry, national players developed at the dynamic lower end of the market. From 1991 to 1997 the number of firms in the sector grew from 420 to 522.

Nevertheless, the dominant player in the industry remained IBM throughout the 1990s, with sales five times higher than its nearest Brazilian competitor, Itautec. IBM and Unisys (Burroughs) were the two largest firms when the market reserve was instituted in 1977, and they were the two largest firms when it ended in the 1990s. Indeed a marked shift in market shares from locally-owned to foreign-owned firms

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<sup>223</sup> Data from IDC, cited in Detrick, Kraemer, Palacios and Tigre, *Op. Cit.*, (2001), p. 1209.

accelerated at the end of the 1990s as sales grew rapidly: “Gross sales of the information technology industries increased from US\$ 16 billion to US\$ 30 billion between 1996 and 2000, with foreign-owned firms expanding their market share from 48.2% to 65.8% at the expense of locally-owned private firms.”<sup>224</sup>

The development of a large cadre of professionals in the sector is a clear success of the reserve policy. In 1979 there were just over 4,000 university-trained employees in the informatics sector. Ten years later, in 1989 – just before the reserve was dismantled, that number increased six-fold to 24,000. By 1997, the Brazilian informatics industry employed approximately 100,000 workers of which 35-40% had college degrees – a 10-fold increase in 18 years.<sup>225</sup> Many of these professionals worked in the powerful technology cluster that developed in São Paulo state. Nevertheless, Brazil was unable to combine and maintain scientific R&D with a national enterprise of scale.

While imports were held in check and national content in computers was high during the period of the market reserve, the national industry as a whole was not internationally competitive. As a result, exports grew just 18% from 1981 to 1989.<sup>226</sup>

After the reserve was abolished, the balance of trade worsened markedly. By the year 2000, informatics exports were \$317 million – a 58% increase from 1989 – while imports were \$1,259 million – a 270% increase from 1989, resulting in a negative trade balance in 2000 of \$942 million.<sup>227</sup>

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<sup>224</sup> João Carlos Ferraz, David Kupfer and Marianna Iooty. “Industrial Competitiveness in Brazil: Ten Years After Economic Liberalization,” *CEPAL Review* 82, April 2004, p. 114.

<sup>225</sup> DEPIN, Evans, *Op. Cit.*, (1995) and Schoonmaker, *Op. Cit.*, (2002).

<sup>226</sup> SCT 1991 quoted in Borja *Op. Cit.* (1995).

<sup>227</sup> Associação Brasileira da Indústria Elétrica e Eletrônica 2001, cited in Schoonmaker, *Op. Cit.* (2002):167.

Imported informatics components comprised more than 60% of the value of imports in 1999 and 2000, reflecting the lack of a local microelectronics industrial complex. “The computer industry has managed to outgrow component production.”<sup>228</sup> While there was some public discussion about the worsening balance of trade and dependency on imported components at this time, the new Informatics Law passed in 2001 contained no provisions to encourage local component production or stimulate exports. Foreign investment alone did not help the balance of trade in informatics. But it is hard to argue that foreign investment was the primary cause of its worsening. Rather, the negative balance of trade can be seen as a legacy of the market reserve, which focused domestic players on producing for the domestic market – a market that was too small to support efficient scale. While access to the MERCOSUR free trade area<sup>229</sup> helped, the addressed market was still small in relative terms. Indeed, the whole of the South American computer market including Brazil is less than 10% the size of the US market.<sup>230</sup>

Over the time period under study, the informatics industry shifted from a world of proprietary hardware, developed and sold by a few large TNCs earning outsized profits, to a world where components and software are the key inputs and alliances have become the norm. Brazil remains dependent in informatics, but dependence had been shifted further back in the value chain of the industry to components. And in the dynamic global informatics industry, no country is self-sufficient.

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<sup>228</sup> Ferraz ET Al. Op. Cit., p 113.

<sup>229</sup> Established by treaty in 1991, MERCOSUR comprises Brazil, Argentina, Uruguay and Paraguay.

<sup>230</sup> Dedrick, ET. Al. Op. Cit., (2001), p. 1209.

## Concluding Observations

The Brazilian informatics case has been analyzed and discussed by academics and commentators since 1990. The most noteworthy discussion of the case for the purposes of this thesis is contained in Peter Evans' book, *Embedded Autonomy: States and Industrial Transformation*.<sup>231</sup> Following on from his earlier work, *Dependent Development*,<sup>232</sup> Evans essentially argues three general points:

1. Development outcomes depend on both the general character of state structures (contrasting the developmental state with the predatory state) and the role it pursues.
2. State involvement can be associated with transformation even in high tech industries.
3. Successful long-term transformation requires constant adjustments: state-to-local industry, state-to-foreign capital, state-to-state.

Evans then posits four types of state activity to promote industry development. He describes these four roles using some typically original nomenclature: (a) *Custodial* – the state as a rule-maker and regulator; (b) *Demiurge* – the state as a participant, establishing enterprises that compete in the market; (c) *Midwife* – the state assisting the emergence of new entrepreneurial groups by creating a greenhouse of reserves, tariffs and other incentives to encourage the desired investment; and (d) *Husbandry* – the state nurturing national industry by taking on complementary tasks like R&D and encouraging the newly born private sector to participate in priority initiatives.

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<sup>231</sup> Evans, *Op. Cit.*, (1995).

<sup>232</sup> Evans, *Op. Cit.*, (1979).



In the case of Brazil, the state played each of these four roles during the period in question. Through the Informatics Laws and the agencies CAPRE and its successor SEI, the state clearly played a custodial role, regulating the informatics industry using a variety of mechanisms. By investing in Cobra, the state also played Demiurge, though it seems unlikely that was the original intention with Cobra. Cobra was meant to take on risky R&D investment that the private sector would not. In so doing, Cobra was to be a catalyst for the local industry, not a competitor.

The Brazilian state as midwife seems most apt. The reserve policies created a greenhouse for local capital to develop over a 14-year period. After 14 years a national industry was established, but it was still adolescent and, with the exception of a few market niches, incompatible and uncompetitive with the international industry. Would the state successfully shift to play the husbandry role envisaged by Evans?

The short answer is no. Internal and external pressure to dismantle the greenhouse, combined with a rapidly changing, globalizing industry meant that the Brazilian state would never make the shift from midwife to husbandry.<sup>233</sup>

In fact, it is not clear that the Brazilian state *could* have played a successful husbandry role in informatics even if the political will and institutional fortitude existed for the task. The dynamics of the industry itself would have made this exceedingly difficult. In the context of a political democracy, is it possible for the relevant agencies of state to anticipate change and adapt policy accordingly? With all the alliances between national and foreign capital, which firms would enjoy the state's

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<sup>233</sup> Evans makes a somewhat different point here. He argues "intense struggles over regulating the inflows of foreign technology bequeathed a political culture in which state involvement was equated with policing... Husbandry might be the obvious next phase in a promotional strategy, but the political and institutional resources that had been absorbed by old strategies could not be recuperated quickly or easily." Evans, *Op. Cit.*, (1995): 213.

husbandry, even if extremely deft and skilful? Whilst it sounds appealing, the Brazilian case does not give us an example of successful high-tech husbandry in action.

With the benefit of hindsight, the researcher is left with many of the same conclusions drawn in the late 1980s. Brazil's informatics development policy succeeded in attracting national companies to invest in the industry and developing a cadre of technically qualified professionals. The policy also succeeded for a time in shifting dependency further back in the industry chain. Despite the policy successes documented here, the Brazilian case does not demonstrate the validity of the "obsolescing bargain" theory in high technology industries. Indeed, as noted in 1988, the bargaining gains were not secure and shifts in such a dynamic industry and policy environment were not unilinear. Now, with the benefit of a longer hindsight, these cautions are emphatically underlined. The specifics of the Brazilian support the general power shift from state to TNC over time, driven largely by technology, that Strange asserts.<sup>234</sup>

Observers and analysts of the Brazilian case pay too little attention to entrepreneurial and managerial talent as determinants of market success. Instead, they turn too soon to external, structural conditions and policy instruments to explain differential results. The market reserve can be credited with Itautec's *entry* into the computer industry (i.e. successful midwifery), but it is impossible to explain Itautec's sustained success amidst the failure of so many other firms without reference to the quality of the firm's strategy and management. State husbandry – no matter how deft – is a poor substitute for sound strategic choices at the firm level and strong management to implement them.

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<sup>234</sup> Strange, *Op. Cit.*, (1996) and discussed in the Introduction.

Observing the Brazilian case, development economists have noted the hyper-dynamism of the informatics industry, but underestimate its importance. Static models that predict outcomes based on structural factors lack explanatory power in such a dynamic industry (and, in any case, are of little use to policy makers and industry participants who need to make decisions in real time).

In the 1970s, Brazilian policy makers could sense the coming importance of information technology and set out to develop a national informatics industry. They believed that their domestic market was large enough to attract Brazilian private capital into the greenhouse they constructed, resulting in a world-class industry. And they believed that the national market was attractive enough to afford them sufficient bargaining power with the TNCs who still controlled the top end of the market.

In a few short years, the informatics industry transformed from a world of proprietary hardware, developed and sold by a few large American TNCs earning outsized profits, to a global industry and disaggregated value chain where components, software and networking are the key inputs, and alliances became the norm. This change opened up opportunities for local players and policy makers. Internationally competitive high technology resided in a chip and could now be sourced on the open market. In a sense, everyone was just “assembling” computers. Yet, the globalization of the industry that brought international standards (especially in operating software) made it ultimately impossible to build a national industry that did not conform.

At the same time, informatics shifted from being an important industry to develop, to being the critical competitive lynchpin of the whole economy. For Brazil, lower labour costs would no longer be enough. These needed to be combined with

productivity enhancements enabled by technology and knowledge management. Brazil risked being caught in the middle, with higher labour costs than China or India, but not yet a highly productive IT-enabled producer. As a result, local industry became a powerful voice to shift the policy agenda from *industry development* to *world-class technology diffusion*.

The hyper-dynamism of the industry forced a restructuring of the many bargains that were struck earlier. Perhaps the most noteworthy fact arising from the case is the impossible challenge the industry dynamics presented to policy makers. Policy was simply unable to keep up with the pace of change in the industry. Strange's general comment about the state's limitations is overstated, but it seems directionally correct in the Brazilian informatics case: "Their [the host state's] failure to manage the national economy, to maintain employment... is not a matter of technical incompetence, nor moral turpitude nor political maladroitness. It is neither in any direct sense, their fault, nor the fault of other governments. They are, simply, the victims of the market economy."<sup>235</sup> Industry dynamics required greater adaptability among policymakers and their policy.

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<sup>235</sup> *Ibid.*, (1996) p. 14. Edited from the middle of the quote is a long list of macroeconomic outcomes.

## **THE CASE OF MÉXICO**

**CHAPTER 6**  
**INTRODUCING THE CASE OF MÉXICO:**  
**GENERAL POLITICAL AND ECONOMIC CONTEXT**

**Introduction to the Mexican Case**

In September 1981 the Mexican Bureau of Industries in the Ministry of Resources and Industrial Promotion (Secretaria de Patrimonio y Fomento Industrial or SEPAFIN) published a "Development Programme for the Manufacture of Electronic Computer Systems, Their Main Modules and Peripheral Equipment." This was the government's first coordinated attempt to foster a domestic computer industry in México.

At this time there were no Mexican firms involved in computer manufacture and few Mexicans with knowledge and skills in computer electronics. The policy initiative was thus extremely ambitious, requiring strong, broad commitment within the Mexican government and a favourable investment climate. In the end neither was forthcoming. Proponents of the policy initiative received neither support nor repudiation from the government above. They were left to regulate the industry as best they could in the context of economic crisis and an export-oriented macroeconomic policy.

In order to understand the computer policy formulation and implementation processes they need to be viewed clearly in political and economic context. This exploration of the Mexican case begins therefore with a brief review of the general political and economic situation at and just prior to the computer decree.<sup>236</sup> This review reveals a number of significant obstacles to the successful implementation of an industrial development programme for computers. These obstacles include the worsening of the country's economic fortunes and the resultant preoccupation with the external debt and balance of payments; the growing disillusionment with import

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<sup>236</sup> This review is not meant to be exhaustive. The author's aims, rather, are to highlight the salient political and economic characteristics of this period that have particular relevance to the policy effort in computers, and to establish chronological 'signposts' referenced later.

substituting industrialisation (ISI) policies and the greater emphasis on international competitiveness and exports; the alienation of the private sector industrialists—foreign and domestic alike—after the banks nationalization, devaluations, and the imposition of exchange controls; and finally the transition of presidential power and the concomitant loss of nationalist/expansionist policy support at the cabinet level in the Mexican government.

Following the establishment of the general political and economic context in this chapter, Chapter 7 goes on to describe the evolution of México's 1981 computer policy. One can see here the uphill challenge faced by the promulgators of the computer development programme. The Mexican experience in computer electronics had been characterised by three mutually-reinforcing factors: (i) the historical dominance of the Mexican market by the computer transnationals; (ii) the lack of Mexican computer scientists and technicians owing to educational policies that neglected this particular area until the advent of the 1980s; and (iii) the limitation of the Mexican state's role to that of a consumer of computer electronics. In addition, there was little private sector support for the policy initiative and the United States government privately pressured the Mexican government not to implement the policy almost before the ink had dried on the plan. U.S. concern was voiced at a time when México was particularly vulnerable to such pressure from its influential northern neighbour.

These general and specific political and economic factors inhibited the successful implementation of the policy. IBM successfully exploited the situation in its negotiations with the Mexican government concerning a proposed investment in microcomputer manufacturing. In July 1985 IBM obtained an exceptional ruling which contradicted the programme's explicit prohibition of foreign-controlled microcomputer operations in the country. Thus the policy was further altered and conditioned by the pressure of the computer TNCs led by IBM.

For its part, the Mexican government leveraged the policy guidelines to bargain successfully with IBM and other computer transnationals for increased investment and export commitments.

Despite the conditioning of the programme by these factors and events, the initiative did succeed in some of its objectives. Chapter 8 contains a detailed analysis of the policy achievements compared to its original objectives.

### **The General Political and Economic Context (1970 – 1982)**

By 1970 México had experienced thirty years of remarkable economic growth and industrialization. Overall, the Mexican economy grew at an average of 6.5 percent annually between 1940 and 1970, during which time inflation averaged only 4.4 percent.<sup>237</sup> In addition to the rapid economic growth of this period, the Mexican economy underwent a structural transformation from agriculture to manufacturing. Industrial growth experienced peaks in the 1940s and 1960s, averaging in excess of 11% and 9% per year in these respective decades.<sup>238</sup>

Much of the credit for this remarkable industrial growth and transformation was attributed to the long-standing policy of import substituting industrialization (ISI). ISI policy employed a system of import licensing to encourage foreign companies to construct plants in México rather than to import from abroad to serve the domestic market. Import substitution was emphasized first in nondurable consumer goods, and later in intermediate and capital goods.<sup>239</sup>

This period of the "Mexican Miracle" was not without its problems, however. Economic growth was not uniformly linear; rather there were often wild fluctuations from year to year. Moreover, the benefits of growth did not trickle down the socio-

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<sup>237</sup> Roger D. Hansen, The Politics of Mexican Development, (Baltimore: The Johns Hopkins University Press, 1974), p.

<sup>238</sup> Dale Story, Industry, the State, and Public Policy in México, (Austin, Texas: University of Texas Press, 1986), p. 21.

<sup>239</sup> Ibid., pp. 23–28.



economic ladder. Income inequality was exacerbated by the government's regressive taxation policy and expenditure priorities that neglected social welfare.<sup>240</sup>

The country's industrial strength became concentrated in the hands of a very few firms located primarily in one of three urban centres: México City, Monterrey, and Guadalajara. In 1975, 80 percent of all industrial firms accounted for just 3 percent of total value-added. By contrast, 2.6 percent of manufacturing firms produced 77 percent of the country's industrial value-added. One scholar on México comments: "These concentrations in terms of size and location have had negative social effects (unemployment, urban congestion, and the like) and have stymied the development of a more diversified national industrial plant."<sup>241</sup> Foreign investors, in particular, controlled strategic and dynamic sectors of the economy. In 1970 TNCs controlled 85 percent of the rubber industry, 79 percent of electrical machinery, 68 percent of chemical products, 62 percent of nonelectrical machinery, and 50 percent of transportation equipment.<sup>242</sup> Though not yet considered strategic, the Mexican computer industry was at this time the exclusive domain of a handful of foreign firms.<sup>243</sup>

Finally, in spite of the import substitution policy, the country continued to run ever-increasing current account deficits. The ISI policy goals of restricting imports, encouraging local value-added and exports were clearly not being met. The chronically over-valued peso undermined ISI, the protected Mexican industry was not internationally competitive and therefore unable to generate sufficient export

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<sup>240</sup> Hansen, *Op. Cit.*, pp. 74–86.

<sup>241</sup> Story, *Op. Cit.*, p. 29. Figures from Secretaria de Programación y Presupuesto, "Características de la industria de transformación en México," (México D.F.: SPP, 1980), and cited by Story, p. 29.

<sup>242</sup> Richard Newfarmer and Willard Mueller, *Multinational Corporations in Brazil and México: Structural Sources of Economic and Non-economic Power*, Report to the Subcommittee on Multinational Corporations of the Committee on Foreign Relations, United States Senate, August 1975, p. 57. Cited by Story, *Op. Cit.*, p. 65.

<sup>243</sup> U.S. Department of Commerce, "Computer Equipment: Global Market Survey," (Washington D.C.: GPO, 1973), p. 76, and U.S. Department of Commerce, "Computers and Peripheral Equipment: México 2," (Washington D.C.: GPO, 1981), p. 8.

earnings to offset imports. Moreover, the transnationals, which were expected to lead in exports, were instead contributing to the balance of payments problems.<sup>244</sup>

It was in this economic and political milieu that Luís Echeverría assumed the presidential mantle. Echeverría undertook a major departure from the generally conservative economic policies of his predecessor and pursued a largely populist programme dubbed "Shared Development" which emphasized the goal of income redistribution over and against economic growth alone.

The new president was antagonistic toward private capital in general and foreign capital in particular. Private capital, in turn, was suspicious of Echeverría's populist rhetoric and his expansionary policies that enlarged the state's direct role in the economy.<sup>245</sup>

During the Echeverría *sexenio*, three laws designed to limit foreign investment and market dominance were enacted. First and most significant was the 1973 "Law to Promote Mexican Investment and Regulate Foreign Investment." This law solidified the government's "mexicanization" policy. It established majority Mexican ownership of joint ventures as the general rule and created the National Commission on Foreign Investment to enforce the provisions of the law and decide exceptions. The 1973 "Law on the Transfer of Technology" required the registration and review of all new contracts and licenses with foreign firms through a newly created Registry on Technology Transfer. This law also limited payments of royalties to foreign firms under licensing and contractual arrangements. Finally, the 1976 "Law on Patents and Trademarks" limited the use of patents and foreign trademarks in México in an attempt to lower non-price barriers to entry for Mexican firms in foreign-dominated industries.

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<sup>244</sup> See Story, *Op. Cit.*, p. 65 (table). In 1971, for example, foreign enterprises ran a current account deficit of 782.6 million dollars, which accounted for 84.3 percent of the country's total current account deficit.

<sup>245</sup> From 1970 to 1976 state majority shareholding companies grew thirteen-fold from 39 to 524.

Echeverria's policies had the effect of limiting foreign investment; however the TNCs continued to dominate strategic and dynamic sectors of the economy and ran ever-increasing balance of payments deficits.<sup>246</sup> Meanwhile, the rapidly expanding state bureaucracy exacerbated the external deficits.

In August and October 1976 Echeverria reacted to the worsening economic situation by devaluing the peso to one half of its previous level. This surprise action followed capital flight of staggering proportions. The president then publicly attacked the private sector and expropriated 100,000 hectares of farmland in northwestern México. These final actions of the Echeverria administration ensured the alienation of the private sector—foreign and domestic alike.

In sum, the Echeverria years were marked by a questioning of ISI policy, the enactment of controls on foreign investment, the alienation of the private sector, a greatly expanded state bureaucracy (with a concomitant increase in the state's use of foreign computer equipment and services which will be elaborated later), and growing external deficits and foreign debt.

With the economy in turmoil, Lopez Portillo came to power distancing himself from the policies of his predecessor (as Echeverria had done before), attempting to court the private sector with his so-called "Alliance for Production" policy. Lopez Portillo initially succeeded in gaining the trust of both foreign and domestic business; however, he ended his term accentuating the very things that characterized his predecessor's reign.

Lopez Portillo applied the 1973 Law on Foreign Investment more loosely than Echeverria, but still only 44 new enterprises were formed with majority foreign participation from 1973 to 1982. This compares with 1,987 new minority joint ventures and 498 mexicanizations during this period.<sup>247</sup>

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<sup>246</sup> Story, *Op. Cit.*, pp. 65–76.

<sup>247</sup> *Ibid.* p. 60.

The new administration liberalized import restraints, simplifying tariffs and removing import license requirements on some 5,600 products from 1976 to 1980.<sup>248</sup> The more liberal trade and investment policies of this administration, coupled with the discovery of large oil reserves that presaged a brighter economic outlook, encouraged foreign investors. Foreign direct investment grew rapidly from 1977 to 1980.

In 1979 Lopez Portillo's Minister of Resources and Industrial Promotion, José Andres de Oteyza unveiled the National Industrial Development Plan. It was under this plan that the computer programme would eventually be developed. The Industrial Development Plan established a coordinated set of ambitious goals and incentives to develop the economy to 1990. The plan encouraged investment in priority zones to redress the problem of geographic concentration of Mexican industry and population in the large urban centres, and it designated seventy priority industrial sectors to receive incentives to meet specified growth rates. The computer industry was included among these designated industries.

Lopez Portillo's administration exercised fiscal restraint until 1980–81. In these years however, profligate government spending, encouraged by the growing oil wealth and the highly ambitious economic development programme, fuelled inflation. The economy became more and more dependent upon oil exports while the overvalued peso combined with trade liberalization resulted in the rapid growth of manufactured imports. This in turn resulted in a growing external imbalance and increased foreign debt. The Mexican economy was thus increasingly vulnerable to external shock as a result of internal economic policy.

Three exogenous, interrelated "events" provided that unwanted shock: first was the rise of world interest rates in 1979; second was the 1980–81 recession in the world economy; and third was the 1981 decline of world oil prices. The combination

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<sup>248</sup> The number of restricted product categories decreased from 7,600 to 2,000 during this time. Import license coverage was correspondingly reduced from 80% of import value in 1977 to 24% in 1980. Banco de México, Dirección de Investigaciones Económicas cited in Review of Trade and Investment Liberalization Measures by México and Prospects for Future United States–Mexican Relations, Phase I. Washington, DC: US International Trade Commission, 1990.

served to increase fundamental costs and decrease vital revenues to the Mexican economy. In 1981 México faced a balance of payments deficit of 11.5 billion dollars.<sup>249</sup>

In order to decrease imports and increase the export of manufactured goods Lopez Portillo re-established import controls and raised tariff barriers in 1981. He also initiated a series of mini-devaluations. In May 1981 he reacted against the foreign controlled automobile sector, which had been running chronic trade deficits by strengthening export performance requirements for the industry.

The administration's policy reversal culminated in August and September of 1982 with a series of measures that appealed to economic nationalism in the country. At the beginning of August, Lopez Portillo instituted exchange controls freezing all dollar accounts and established two rates of exchange: a preferential rate for debt servicing and necessary imports, and a devalued free rate. In September the president shocked the private sector by nationalizing the remaining private banks. These policy initiatives reflected the opinions of the nationalists within the "economic cabinet" which included Andres de Oteyza of SEPAFIN, Carlos Tello Macias, former Minister of Programming and Budget (SPP), and José Ramon Lopez Portillo, the president's son and undersecretary at the SPP.<sup>250</sup>

Hence, Lopez Portillo ended by amplifying the legacy of the previous administration even though he had started out on a completely different tack. The economy was in severe recession, inflation was running at 100 percent, and the external debt was now 80 billion dollars.<sup>251</sup> Controls on imports were re-established and the alienation of the private sector was ensured by the banks nationalization, currency devaluations and exchange controls. Meanwhile, financed by oil revenues, the state bureaucracy had expanded its role in the economy.

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<sup>249</sup> World Economic Outlook. Washington (D.C.): International Monetary Fund, 1983.

<sup>250</sup> Story, Op. Cit., p. 148. Tello was not officially a member of the cabinet at this time but he continued a close friend of the president and informal adviser. He replaced Mancera as President of the Bank of México when Mancera resigned after the banks nationalization.

<sup>251</sup> World Economic Outlook. Washington (D.C.): International Monetary Fund, 1984.

Miguel De la Madrid Hurtado was President Lopez Portillo's Minister for Programming and Budget as from May 1979. He was "unveiled" as Lopez Portillo's successor in September 1981. De la Madrid came to power facing one of the worst economic crises in the country's history. As the two previous presidents had done, he wasted no time distancing himself from his predecessor's policies.

De la Madrid responded to the economic crisis by pledging the structural change of the economy. His "Immediate Programme for Economic Restructuring" included, among other measures, reduced growth in public spending, an increase in taxation, a "realistic" exchange rate policy, and the reordering of the federal bureaucracy for greater efficiency.

Dependence upon oil to finance industrial growth was no longer a viable option for the new administration; manufacturing would have to finance its own growth. De la Madrid needed to restore the confidence of the private sector in general, and foreign investors in particular, as they played a crucial role in his plan to restructure the Mexican economy.

The new president emphasized free market efficiency and international competitiveness in his restructuring programme. The 1983–88 National Development Plan signed by De la Madrid in May 1983 signalled the greater opening of the economy and further elucidated his approach:

"The Plan assigns priority importance to the modernization of the productive apparatus, with the purpose of promoting an efficient insertion of the industrial sector into the stream of international trade, and in a greater way, *to strengthen the country's bonds with the worldwide economy.*

"For that reason, the Plan considers that the recovery of the bases of growth and the structural re-orientation of national development demand *a more efficient link with the international economy, particularly in matters of industry and foreign trade, external financing, foreign investment, and technology transfer.*

"In this context the National Development Plan establishes a group of guidelines *to raise the contribution of foreign technology, administration and finance resources* that are required in the country's process of development. With this aim, the Plan points out that in the expansion and diversification of the national productive plant, foreign

resources will be utilized in complementary form, for which purpose, the technological, administrative and financial contribution of foreign investment will be oriented in a flexible manner to the priorities of economic development, in order to maximize its contribution."<sup>252</sup>

De la Madrid followed through on his pledges. He presented a 1983 federal budget that amounted to 8.5 percent of projected gross national product, down from 16.5 percent the previous year,<sup>253</sup> and pushed ahead with substantial tax increases. He relaxed exchange controls and allowed the market to further devalue the peso. At the beginning of 1983 the president relaxed the system of import licenses and reduced tariffs.

With regard to his pledge to restructure the federal bureaucracy, the most visible change De la Madrid made was to partition the Ministry of Resources and Industrial Promotion (SEPAFIN), linking the industrial promotion side of it with the Ministry of Trade to form the Ministry of Trade and Industrial Promotion (SECOFI). State-controlled industry was then placed under the jurisdiction of the new Ministry of Energy, Mines, and Public Enterprises (SEMIP). By creating a ministry dedicated to public enterprise the new administration hoped "to promote the goals of efficiency and productivity within the public sector."<sup>254</sup> In addition, the new administration's concern with foreign investment, exports and international competitiveness were reflected in the decision to link industrial promotion with the ministry concerned with controlling foreign trade policy.

More significant than the restructuring of the ministries were the new ministers themselves. The computer programme had been formulated in 1980–81 within the Bureau of Industries in SEPAFIN. The minister of SEPAFIN, José Andres de Oteyza, was a long-standing associate of President Lopez Portillo and a strong proponent of nationalist/expansionist policy. Architects of the computer programme

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<sup>252</sup> 1983–88 "Plan Nacional de Desarrollo," reproduced in *Inversiones Extranjeras: Marco Jurídico y su Aplicación*. (México D.F.: Comisión Nacional de Inversiones Extranjeras, 1984), p. 11. Translation and emphasis mine.

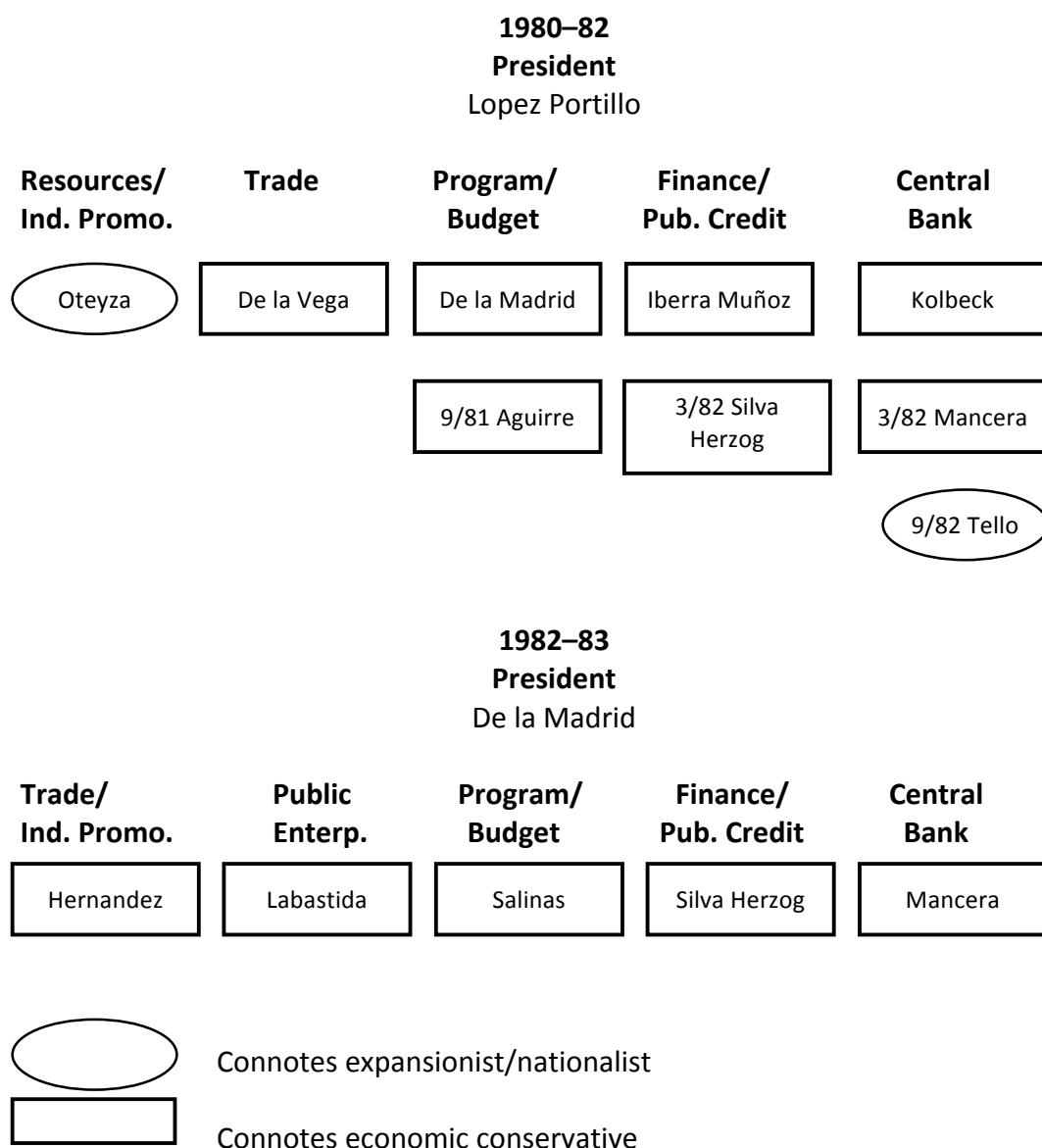
<sup>253</sup> Story, *Op. Cit.*

<sup>254</sup> *Ibid.*: 163.

reported that Oteyza's close relationship with the president provided them with necessary 'insulation' from political attack from other ministries.<sup>255</sup>

However, the nationalist actions of late 1982 were a political "last stand" not just for Lopez Portillo, but for Oteyza as well. De la Madrid's economic cabinet was conspicuously absent of any ministers with nationalist/expansionist tendencies (see Figure 6.1).

**FIGURE 6.1**  
**Changes in the Economic Cabinet**



<sup>255</sup> Author interviews, March 1987.



As Undersecretary of Trade in the Lopez Portillo administration, Hector Hernandez Cervantes negotiated the Protocol of Accession to GATT for México in 1979 and was thus identified with conservative, free market economics. It was now within his ministry that the computer programme would be administered. Salinas de Gortari was the main architect of the 1983–88 National Development Plan, which strongly emphasized the need for free market efficiency in the Mexican economy. Silva Herzog and Mancera were both part of Lopez Portillo's cabinet during the banks nationalization, but both strongly opposed it. Mancera, in fact, resigned over the issue. Thus, their cabinet appointments reflected De la Madrid's commitment to restoring business confidence.

As part of the re-organization of SEPAFIN and SECOM into SECOFI, De la Madrid established a new post: the Undersecretary of Foreign Investment and Technology Transfer to which he appointed Adolfo Hegewisch. In so doing, the president underlined his commitment to promoting these two objectives as per the Development Plan. The new undersecretary would also chair the National Commission on Foreign Investment, which decides all cases for foreign investment where majority foreign control is proposed.

On February 17, 1984 the National Commission on Foreign Investment, under its new leadership, issued its new "Guidelines for Foreign Investment and its Promotional Objectives." In describing the guidelines the Commission wrote:

"To summarize, the selective promotion policy will orient the inflow of foreign investment towards pre-selected activities that may generate a net gain in foreign exchange balance, incorporate and adapt technologies that will contribute to the national scientific and technological development and to the technologically complex, and high investment-per-man-hour activities. In these activities, direct foreign investment can positively contribute to the development objectives without displacing domestic investment."<sup>256</sup>

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<sup>256</sup> "Guidelines for Foreign Investment and its Promotional Objectives," February 17, 1984, quoted in National Commission of Foreign Investment, Foreign Investment: Legal Framework and its Application. (México D.F.: CNIE, 1986), p. 15.

The guidelines included a list of "priority industrial activities" in which direct foreign investment with majority foreign capital would be welcomed, while recognizing that these areas are exceptions to the 1973 Foreign Investment Law. Included in this list were consumer electronics, computers, their parts and software, electronic components, their parts and diverse materials, and professional electronics.<sup>257</sup>

The computer industry development programme was formulated in 1980–81, official approval sought in late 1981 and 1982, and implementation attempted thereafter. How did the political and economic situation in México in the 1970s and early 1980s influence policy formulation and implementation? Below is a summary.

(i) Worsening Economic Problems.

The rapid economic growth of the Mexican economy in the thirty years from 1940 has not been consistently matched. At the time of the formulation of the computer guidelines the economy was experiencing growth that was largely financed by oil exports and foreign debt. By the time official approval was sought and implementation attempted, however, the economy had plunged into crisis: the economy was in severe recession; inflation was 100 percent; manufactured imports soared; and foreign debt climbed to \$80 billion. Industrial growth from 1980–83 averaged –2.4 percent per year.<sup>258</sup>

While the growth of manufactured imports in general, and computer imports in particular—which grew 175 percent from 1979 to 1980<sup>259</sup>—argued in favour of the import restrictions contained in the computer decree, the unfavourable investment climate and the need for exports weighed heavily against the domestic private or public investment required to develop a Mexican computer industry.

(ii) Vacillating Trade and Investment Policy.

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<sup>257</sup> Ibid. pp. 17–18.

<sup>258</sup> Story, Op. Cit.

<sup>259</sup> SEPAFIN, "Development Programme for the Manufacturing of Electronic Computer Systems, their Main Modules and Peripheral Equipment," (México D.F.: SEPAFIN, 1981), p. 2.

Trade and investment policy in México vacillated wildly during the 1970s and 1980s with changes in administrations and economic fortunes. Echeverría actively discouraged foreign investment by initiating and strictly enforcing restrictive legislation. Further, he employed both tariff and non-tariff trade barriers in order to protect domestic industry; by 1976 import licenses were required for 7,600 products. López Portillo reversed his predecessor's restrictive policies in the first four years of his *sexenio* and foreign investment flourished. However, in 1981 import controls were re-established. The banks nationalization and foreign exchange controls of 1982 were arguably more effective in halting foreign investment in the country than Echeverría's legislation. Finally, De la Madrid reversed course once again. In 1983 the trade policy was liberalized and foreign investment, once again, encouraged.

The effect of the vacillating trade and investment policy was to confuse the private sector. The computer development programme relied on the private sector; no public investment was envisaged. It is no surprise therefore that local private capital reacted with limited, opportunistic investments while foreign capital took nominal positions in the market and adopted a "wait-and-see" attitude.

More concretely, the liberal trade and investment regime pursued by De la Madrid at the time when the programme was to be implemented ran directly counter to the restrictive guidelines outlined in the plan. This naturally added to the confusion and uncertainty surrounding the computer development programme. One government official described Adolfo Hegewisch – the person responsible for both foreign investment and the implementation of the computer programme – as “caught between the devil and the deep blue sea.”<sup>260</sup>

(iii) Lack of Private Sector Support.

As Dale Story argues persuasively, the Mexican private sector exercises considerable economic and ideological autonomy from the state. Moreover, the

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<sup>260</sup> Author interview with SECOFI official, March 1987.

Mexican private sector has had an adversarial relationship with the state.<sup>261</sup> For its part the Mexican state has antagonized the private sector, consistently under Echeverria and latterly under Lopez Portillo. This alienation and adversarial relationship has limited private sector support for nationalist policies in general and the computer development programme in particular. Proponents of the programme were never able to generate private sector support for the policy even when the programme received national media coverage in 1984–85.<sup>262</sup>

(iv) Growth of the State Bureaucracy.

The growth of the Mexican state bureaucracy and its involvement in the economy since 1970 has been astounding. Not only did this growth result in increased public sector deficits; it implied an ever-increasing state demand for computer equipment and services for use in both its normative and economic functions. For reasons that are explored in the next section, the state has not used its buying power to aid the development of the local industry. Rather, it has chosen to employ its virtual monopsony primarily to extract price concessions from the computer transnationals.

Thus, the growth of the state bureaucracy expanded the local informatics market and concentrated buying power. Both of these results could have influenced the development of the local industry positively, but were not employed to that end.

(v) Reordering of the Economic Cabinet.

Finally, the transition of administrations in 1982 resulted in the reordering of the ministry in which the guidelines were formulated and would be implemented. The reordering emphasized the new administration's goals of attracting foreign investment, and encouraging exports. Furthermore, the economic cabinet now

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<sup>261</sup> Story, *Op. Cit.*, see for example pp. 122–124. Story posits that the adversarial relationship owes in part to the entrepreneurs' concern about state–labour–peasantry axis that excludes them. This prospect was particularly ominous under Echeverria and arose again when Lopez Portillo nationalized the banks.

<sup>262</sup> The media coverage concerned IBM's proposed investment in the country. This is discussed in detail in the next chapter.

comprised ministers espousing free market efficiency; by 1983 the president and his closest advisers were ostensibly opposed to "nationalist/expansionist" policies. The national computer development programme thus was without a committed sponsor at cabinet level after the change of administrations.

## CHAPTER 7

### EVOLUTION OF MÉXICO'S COMPUTER POLICY

In addition to the challenges arising from the general political and economic situation in the country, the computer development programme faced several more immediate obstacles. These included: the historical market dominance of the computer transnationals; the lack of Mexican computer scientists and technicians; the Mexican state's reluctance to use its market monopsony to aid the development of an indigenous industry; private sector ambivalence toward the programme; and U.S. government pressure. These factors and their effect on the development and implementation of the computer programme are explored in this section.

#### TNC Market Dominance

Although at least seven major computer transnationals had established subsidiaries in México prior to 1970<sup>263</sup>, none of these companies actually produced computer equipment for the local market until 1978 when NCR began manufacturing minicomputers in México. Thus, in 1970 México was importing all of its data processing equipment. Moreover, just three computer transnationals controlled 85% of the Mexican market in 1971.<sup>264</sup> At this time the state owned 51% of the value of medium and large-size data processing equipment installed in the country.<sup>265</sup> The manufacturing of computer equipment in 1972 was limited to a Burroughs assembly plant for in-bond production whose products were entirely for export.

TNC market dominance continued throughout the decade of the seventies. In 1977, U.S. companies or their subsidiaries supplied 75% of the computers installed in

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<sup>263</sup> IBM and Burroughs had sales subsidiaries in 1927; NCR in 1936; Honeywell in 1947; CDC and Digital in the early 1960s; and Hewlett-Packard in 1966. Source: author interviews and company reports.

<sup>264</sup> U.S. Department of Commerce. "Computer Equipment: Global Market Survey," (Washington: GPO, 1973), p. 76.

<sup>265</sup> U.S. Department of Commerce. "Electronic Data Processing Equipment, Peripheral Devices, and Software," (Washington: GPO, 1970), p. 37.

México, representing 97% of the total value.<sup>266</sup> In 1978 over 98% of the Mexican market for computers and their peripherals was supplied by imports.<sup>267</sup>

By 1980 there were some Mexican companies supplying modems and terminals. However, the vast majority of Mexican companies involved in the sector were acting as distributors for foreign companies. Some of the TNCs involved in the microcomputer segment of the market such as Apple and Tandy, were by this time shipping some sub-assemblies (semi-knocked-down or SKD kits) which were put together by their distributors or directly by their customers in México. But any significant electronic assembly and testing efforts in México took place in plants set up specifically for export production (in-bond assembly plants or maquiladoras) by the TNCs.

Because of the lower sophistication of computer users in México relative to North America or Europe, the computer TNCs were able to employ the same strategies in México for fostering user-dependence, only for a longer period of time and with greater effect. The standard commercial procedure until 1977 was the leasing of computing equipment; 95% of the systems in operation at that time were rented.<sup>268</sup> This practice served to increase customer dependence on the manufacturers and permitted the suppliers to earn very high profits on fully-depreciated, older technology. With the arrival of minicomputers, large companies such as IBM, NCR, and UNIVAC continued renting their equipment while the newer companies (e.g., Digital, Hewlett-Packard) began to sell directly to the end-users. Technological change lowered the cost of computers, putting downward pressure on prices to the end-user. However, because of the continuing oligopolistic structure of the industry in México, prices remained much higher than in the U.S. or Europe as the market leader—IBM—continued to harvest older technology. Furthermore, market shares

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<sup>266</sup> U.S. Department of Commerce. "Computers and Peripheral Equipment: México," (Washington: GPO, 1981), p. 4.

<sup>267</sup> *Ibid.*, The United States alone, supplied 70 percent of the Mexican market.

<sup>268</sup> Jorge Valerdi & Associates, Computer Communications Marketing in México: A Study on Strategies, (Miami: LATCOM Inc., April 1982).

were maintained by means of sales and service strategies that were based on existing technical incompatibilities rather than price reductions. Thus, a typical mechanism for maintaining market share was to force the end-user to stay with one specific line of computer equipment because of equipment incompatibility to other systems, which might be cheaper.

From 1979 to 1981 liberal trade policies coupled with a grossly overvalued peso conspired to worsen severely the Mexican balance of trade in electronics. Any local suppliers operating on the margin of the market were squeezed out while imports supplied the entire market. Computer imports proceeded to jump 175% from 1979 to 1980.<sup>269</sup>

The proximity to the U.S. coupled with the lack of import restrictions resulted in great confusion in the Mexican marketplace. Within a few short years a plethora of diverse computer equipment was on offer in México. In 1979, 140 out of 235 computer models being sold in the world market could be found operating in México.<sup>270</sup> This meant that the market, which was already small, was further fragmented into even smaller user groups much less able to create and maintain their own software and technical support needs. The market was flooded with local distributors out for quick profits. These local distributors often disappeared as quickly as they appeared and there was very little after-sales support. Thus, the market acquired a very unfavourable image. The end result was a chaotic, confused, and dependent Mexican market.

The situation in 1980–81 was thus a dire one from the standpoint of those arguing for the development of a national computer industry. In 1980 six computer transnationals controlled 96.2 percent of the Mexican computer market, with IBM holding the dominant share of 44 percent.<sup>271</sup> In 1981, imports accounted for 230

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<sup>269</sup> SEPAFIN, *Op. Cit.*, p. 2.

<sup>270</sup> Montoya Martín Del Campo, *Op. Cit.*, (1986) p. 232.

<sup>271</sup> 1980 market shares: IBM 44 percent, Honeywell 12.1, Univac 11.7, Burroughs 10.9, CDC 9.1, NCR 8.4, and all others 3.8 percent. U.S. Department of Commerce, *Op. Cit.*, (1981), p. 8.



million of the total market of \$364 million, while exports totalled just \$4 million that year.<sup>272</sup>

TNC dominance was not only expressed in terms of its stranglehold on the market. Until 1976 the computer transnationals conditioned the development of informatics in México through their direct participation in the Import Committees of the Ministry of Industry and Commerce. In these committees, decisions were made in relation to the amount and origin of computer imports. TNCs had in this policy instrument a powerful mechanism to protect their own commercial interests and limit the possibilities for the development of a domestic Mexican computer industry.

This foreign intervention within the Mexican state bureaucracy was partially neutralized in 1977 when these decisions were placed under the control of the Ministry of Programming and Budget. On the other hand, the lack of alternative sources of locally produced equipment during these years created a situation in which the state was forced to establish certain commercial and industrial policies as well as policies pertaining to the use of informatics within public administration that necessarily favoured the activities of those foreign corporations.

#### Inadequate Scientific and Technical Training

Contributing to the lack of "local alternatives" was the situation regarding training of computer specialists in Mexican institutions of higher education. The training of specialists is vital to the development of indigenous technological capacity.

David O'Connor puts it well:

"The computer industry is essentially a knowledge-intensive industry wherein skilled, highly trained scientific, engineering and technical labor power is probably the single most important asset. Without such labor, even access to adequate financial resources and material inputs

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<sup>272</sup> Secretaria de Comercio y Fomento Industrial, Dirección de la Industria Electrónica, "Estadísticas sobre la Industria de Computadoras en México," mimeo. (México D.F.: SECOFI, 1987), p. 5. Total market size in 1981 from Infocom, The Market for Macro-computers and Minicomputers, (México D.F.: Infocom, May 1987). Infocom is a market research company specializing in the Mexican computer industry.

would not be a decisive advantage in a country's efforts to develop an indigenous industry."<sup>273</sup>

The Mexican state responded very slowly and inadequately to the need for an educational infrastructure capable of training personnel highly competent in the diverse areas of computer science and engineering. In particular, the courses offered reflected both the TNC dominance of the industry and an orientation to computer usage rather than design and production. And although the number of courses and student enrolment increased dramatically over the years, there was a high desertion rate, a relatively low level of academic qualification in the teaching faculties, and a scarcity of on-going basic research in the field.

The courses offered were organized on three fronts: the first two by the equipment vendors themselves, and the last by the state in the national education system.

Some of the first courses directly related to computers were organized by the transnational computer manufacturers in 1966–67. These courses emphasized the operation of equipment, basic principles of problem solving using computers (elementary programming), the fundamental elements of operating systems, and the management of information. These vendor courses were naturally self-serving; their goal was to educate and expand the local market and the sponsoring vendor's participation in it. Thus, the courses served to train specialists who could later fill roles in the marketing of technical equipment, and to train users to operate their equipment. Furthermore, the courses emphasized the peculiar characteristics of the sponsor vendor's equipment, thereby limiting the course participants' knowledge to that equipment.

Soon these informal short courses were not enough to supply the vendors' increasing demand for competent personnel. In the early 1970s these same transnational computer companies established "commercial trade schools." By 1978

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<sup>273</sup> David C. O'Connor, "The Computer Industry in the Third World: Policy Options and Constraints," *World Development*, 13.3 (1985) pp. 324–325.

there were sixty such schools offering courses in elementary coding, programming, and systems analysis. These schools required only a high school education of their students. Once again, the emphasis in these schools was on training another generation of computer salesmen, maintenance engineers, and users.

The first computer-related course established in the national education system was a postgraduate Masters programme in "systems engineering" at the National Polytechnic Institute (Instituto Politécnica Nacional or IPN) in 1962. The course at IPN was followed in 1967 by the Ibero-American University (UIA), which also established a programme at the Masters level. The first bachelors course was set up at the Technological Institute of Higher Studies of Monterrey (ITESM) in 1968 in "computer systems engineering." Others followed in 1974 as the idea gradually caught hold in the formal education sector. At the start of the 1980s there were 160 institutions of higher education offering more than 180 computer-related courses of study.<sup>274</sup>

However, TNC involvement in the training of computer specialists remained dominant. By as late as 1977, only 4 percent of all technical personnel in informatics received their training in Mexican colleges and universities. In contrast, 55 percent of computer science specialists were trained directly by the TNCs that were vending their imported equipment in the country. Of this training, 85 percent was carried out on site and was related primarily to operating and selling the equipment, rather than to design or production. In this same year 30 percent received training from private institutions and 10 percent from user companies, especially financial service bureaus.<sup>275</sup> The educational level of the personnel operating computer systems in the country captures the situation. In 1977, "more than 50 percent of systems analysts did not have a bachelor's degree and a large number were at high school level. Those with

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<sup>274</sup> Dr. Octavio Rascon Chávez, "La Educación en Computación en México," La Informática a Futuro en México: Memorias del Ciclo de Conferencias 1983, (México D.F.: SPP/INEGI & UNAM, 1984), p. 30.

<sup>275</sup> Secretaria de Programación y Presupuesto. Diagnostico de la Informática en México: 1980. (México D.F., SPP/INEGI, 1980).

university degrees were engineers without specific training in computers. Programmers were high school graduates without higher education."<sup>276</sup>

By 1980 the situation had not altered significantly. Although the universities had increased to 15 percent their participation in the training of technicians, 67 percent of the informatics personnel had been trained in courses given by the companies producing the equipment, and 23 percent by commercial enterprises.<sup>277</sup> Moreover, not one computer-related doctoral programme existed in the country by 1983.

The involvement of the TNCs in general and IBM in particular in the area of education is illustrated in Table 7.1 which lists the number of courses offered by equipment vendors in 1981–82.<sup>278</sup>

**TABLE 7.1**

**Courses Offered by Equipment Manufacturers 1981–82**

<b>Manufacturer</b>	<b>Number of Courses</b>
IBM	816
Honeywell	156
Sperry–Univac	155
Burroughs	73
Control Data	49
Hewlett Packard	47
Digital Equipment	41
NCR	32
MAI	26
Others	176
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<b>TOTAL</b>	<b>1,571</b>

Enrolment in computer-related programmes increased exponentially as Table 7.2 indicates.<sup>279</sup>

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<sup>276</sup> U.S. Department of Commerce. "Market Survey for Computers: México," (Virginia: National Technical Information Service, 1979), pp. 3, 30.

<sup>277</sup> SPP, *Op. Cit.*, (1980).

<sup>278</sup> Secretaria de Programación y Presupuesto, *Manual de Información Estadística en Informática 1983*, (México D.F.: SPP/INEGI, 1983), p. 13.

In these statistics one can see the early dominance of the technical schools that provided basic instruction in programming and computer operations. The rapid growth of bachelors programmes that replaced technical schools in popularity by the mid-seventies is also noticeable. Finally, the very small number of postgraduate students in computer-related courses is remarkable. In total, fewer than 1,000 postgraduates had enrolled in computer-related programmes by 1981. Nevertheless, total enrolment increased dramatically in the first half of the 1980s.

While the increasing numbers of students enrolling in computer-related courses is encouraging, the numbers actually graduating are abysmal. Of the 966 postgraduates admitted to study between 1965 and 1980, only 233 had graduated by 1984 - a completion rate of just 24 percent. Twenty-nine percent of the students for bachelors degrees in computer courses and only ten percent of technical students graduated during this same period. Thus, while some 68,000 students enrolled in some kind of computer course in those twenty years, only 7,000 graduated.<sup>280</sup>

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<sup>279</sup> Source: Secretaria de Programación y Presupuesto, Catalogo de Programas de Formación de Recursos Humanos en Informática 1983, (México D.F.: SPP/INEGI, 1984), pp. 21–22.

<sup>280</sup> Ibid.

TABLE 7.2

Admissions to Computer-Related Courses of Study				
Academic Year	Technical Qualif'n	Bachelors Degree	Postgrad Degree	Total
1965-66	86	0	0	86
1966-67	116	0	3	119
1967-68	134	0	7	141
1968-69	110	0	1	111
1969-70	112	136	1	249
1970-71	338	212	35	585
1971-72	454	361	13	828
1972-73	633	507	29	1169
1973-74	662	614	36	1312
1974-75	646	840	24	1510
1975-76	638	1879	47	2564
1976-77	633	2306	86	3025
1977-78	674	2417	105	3206
1978-79	719	2744	129	3592
1979-80	761	3765	204	4730
1980-81	975	4823	246	6044
1981-82	2245	5730	361	8336
1982-83	2835	8587	860	12282
1983-84	3947	12943	934	17824

The low completion rate is attributed to a variety of factors.<sup>281</sup> Ironically, the same economic forces that attracted students in computer sciences often drove them out of their course prematurely. The high demand for specialists in the marketplace combined with the chronic lack of financial resources for students—particularly postgraduates who often have family commitments—conspired to draw students out of academia and into industry where they could earn a salary. Another factor that contributed to the low completion rate was the lack of adequate resources at the institutions themselves. In particular, the availability of up-to-date computer equipment did not keep pace with the increasing numbers of students. Finally, the

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<sup>281</sup> These reasons were articulated by Dr Victor Guerra Ortiz in "Educación de Posgrado en Computación," *La Informática a Futuro en México: Memorias del Ciclo de Conferencias 1983*, (México D.F.: SPP/INEGI & UNAM, 1984), pp. 37-40.

lack of adequate preparation of the students prior to beginning their course contributed to the high desertion rate.

Whatever the reasons, the story is clear. While enrolment in computer courses was up, students often did not complete their course of study. The result was a growing number of inadequately trained personnel entering the workforce, who were often qualified only to sell, service, or operate equipment that was designed outside the country.

A corollary result was a lack of academic and research staff in the country's colleges and universities. A measure of the quality of coursework is the qualifications of the faculty and their level of commitment to teaching and research. The faculty statistics indicate generally low levels of academic qualification, with two-thirds of teaching faculty possessing a bachelors degree or less. Again due to economic pressures and the relatively low rate of pay that teachers in the public education system received, only 23 percent of the faculty were full-time academic staff while 64 percent taught on an hourly contract basis (the remainder were half-time staff).<sup>282</sup>

The situation was disastrous for research efforts as it was impossible to maintain continuity of research efforts if the team was always changing. Basic research in computer science was rare in the national education system. The limited financial and human resources that existed in academia were devoted primarily to applied research. As an indication, out of roughly 10,000 researchers in México at the end of 1983, only 200 worked in matters related to solid-state electronics, and out of those only 35 had some knowledge of microelectronics.<sup>283</sup>

What then was the outlook for the training of computer specialists in México? In addition to increasing student interest, the cause received impetus from the National Council on Science and Technology (CONACYT). CONACYT was established to promote scientific research and technological development, and to promote the

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<sup>282</sup> SPP/INEGI, *Op. Cit.*, (1984), p. 44.

<sup>283</sup> José Moreno, "Reflexiones en torno a una estrategia para el desarrollo de la microelectrónica en México", in *Información Científica y Tecnología*. No. 5, October 1983.

formation of human resources in these areas. The Council initiated a successful scholarship fund and developed and proposed policy guidelines for this area. Further, the cause received official encouragement from President De la Madrid. He increased CONACYT's budget tenfold from 1982 to 1985. However, the reality is that inadequate funding hurt the scholarship programme and CONACYT's policy proposals were shelved in the wake of changes in its leadership. Furthermore, the Council was never charged with relating technical and scientific research to industrial production.

The education of specialists is a long-term investment that continued to be eschewed, as scarce resources were committed to areas that promised a near-term return. Meanwhile, the assimilation of user technology and some production technology continued; while design technology and microelectronics remained the domains of the computer transnationals. Without a strong lead from the Mexican state to promote the training of computer specialists, scientific research, and the linkage of research to local industry, México remained dependent upon the purchase of foreign technology or the direct operation of electronics TNCs in its economy.

#### The Mexican State as Computer Consumer

A second area in which the Mexican state failed to give strong impetus to the development of a national computer industry was in its historical computer procurement policies.

The Mexican government was easily the dominant consumer of computer electronics in the country. This was due in part to its own extensive bureaucracy and its extensive direct involvement in the economy. Government expenditures on informatics totalled some 13.7 billion of the 19.8 billion pesos spent in México in 1982—roughly 70% of total expenditures. Of this 13.7 billion pesos, 4.25 billion was spent on informatics used directly by the government in its administrative and normative activities, 2.95 billion in the finance area (prior to the banks nationalization, most of this would have been in the private sector), 1.52 billion on health and social security, 380 million on public transportation, while the remaining 4.6 billion was



attributed to publicly-owned industrial enterprises (e.g., Pemex). In terms of installed base, the government possessed approximately 66% of computer capacity installed in the country.<sup>284</sup> In terms of value, the government spent most of its informatics budget on large computer systems—mainframes and minicomputers. As such, its primary suppliers were the large computer TNCs.

Because the government exercised such enormous purchasing power in the market, it is worth tracing the development of its computer needs and corresponding purchasing policies. In so doing one sees the government's increasing appetite for, and dependence upon, imported informatics equipment and services.

It should be remembered that this dependence was mutual; for each of the computer TNCs, the Mexican government was by far the largest customer, accounting for between 20% and 80% of sales for the mini and mainframe manufacturers.<sup>285</sup> And along with the increasing expenditures came an increasingly centralized control of government computer purchases. However, the government made little effort to use its monopsony actively to promote a national capability in computer electronics. Rather, it was content to use its purchasing power to acquire better products and services at lower prices.

During the Echeverria and Lopez Portillo administrations, the size and complexity of the Mexican state structure grew dramatically. The number of state-owned enterprises mushroomed from 272 in 1970 to 1,155 in 1982. In 1982 state-owned enterprises accounted for 4.4 percent of the labour force and received subsidies equivalent to almost 13 percent of GDP.<sup>286</sup> All this meant a huge growth in the quantity and complexity of administratively controlled activities as well as of those activities interconnected by means of general and sectoral policies. In 1975 the

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<sup>284</sup> All of these figures come from SPP/INEGI, *Op. Cit.*, 1983, p. 6.

<sup>285</sup> Figures based on company-furnished data received in personal interviews conducted from January to June 1987.

<sup>286</sup> Figures cited in Alberto Chong and Florencio López-de-Silanes, *Privatization in México*, Inter American Development Bank Research Department Working Papers, 2004, p. 8, come from Pedro Aspe, *Economic Transformation the Mexican Way*. (Cambridge, MA: MIT Press 1993).

Commission of Public Administration was formed inside the Office of the Presidency. This paved the way for the introduction of informatics into the activities of government.

The growth of the Mexican state structure culminated in the nationalization of the nation's banking industry in 1982. The need to modernize the bureaucratic organization of the state influenced the policy decisions taken with regard to informatics. As part of the Programme of Administrative Reform the law concerning the Federal Public Administration (PFA) authorized the Ministry of Planning and Budget (SPP) to take the necessary measures to institute a national information system. Within the SPP, the responsibility for this was given to the General Coordination of the National Information System. Included among this group's responsibilities were the establishment of general informatics policies for the federal public sector and the coordination of offices dependent on the PFA so as to negotiate the purchasing of equipment as a uniform group.

Within this Coordination Group, a Director's Office of Informatics Policy was set up in March 1977. The general objectives of this office were: "to assist the development of informatics personnel and technology, so as to make optimum use of the available material resources as well as those acquired by the country. The aim was to achieve greater productivity in public spending for this material, to support the administrative reform programmes of the federal government, to help other agencies in establishing a national information system, and to lessen technological dependence."<sup>287</sup>

On January 16, 1979 President Lopez Portillo issued an agreement authorizing the SPP to standardize and coordinate the information tasks within the PFA. From that moment the powers of the SPP were specifically defined as consisting of: (1) the diagnosis of informatics requirements in the public sector; (2) the promotion of the rational utilization of informatics resources; (3) the formulation of regulations and

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<sup>287</sup> Secretaria de Programación y Presupuesto. *Comunidad Informática*, No. 1, May–June 1978. pp. 11–15.

their enforcement in the acquisition and contracting of computer equipment; (4) the establishment of the Teleinformatic Internal System of the Federal Public Sector; and (5) the monitoring of the development of informatics activities in all areas of the PFA.<sup>288</sup> Interestingly, the next president, Miguel De la Madrid was to take charge of the SPP in May of that year.

In 1980 the National Coordination of the National Information System became known as the General Coordination of National Statistical, Geographical and Informatic Services. The idea was to integrate the national systems of statistical and geographic information, optimizing the use of electronic computer systems in the process.

In 1983 the Senate passed the Initiative for a Decree of Reforms and Additions to the Law of Statistical and Geographical Information proposed by President De la Madrid. The reforms referred to the establishment of the National Institute of Statistics, Geography, and Informatics (INEGI) as the agency through which the SPP would exercise its rights given by the law. The reforms gave INEGI greater resources and consolidated the power of the institute as the central coordinator and overseer of government informatics purchases and use.

INEGI's function with regard to computer purchasing remained basically the same from 1980 to 1990: to rationalize government spending in informatics through the establishment of technical, contractual, and procedural norms for all government purchases of informatics equipment and services. The primary motivation for this rationalization was the government's increasing complexity and felt need for informatics equipment and services. A secondary motive was the concern that individual government departments and enterprises could be unduly influenced by the large computer transnationals. Thus, the central government was to play a paternalistic role in overseeing government purchases. Moreover, INEGI had the de facto power to influence purchasing in that it controlled the government's informatics budget.

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<sup>288</sup> Secretaría de Programación y Presupuesto. *Política Informática Gubernamental*, (México: SPP, December 1979).

Prior to 1985 INEGI was not seen to interfere very much with government institutions' purchasing decisions; INEGI set guidelines and respected the choice of the end-user. From 1982 to 1985 INEGI overruled just four purchasing decisions of government entities. In the words of the Director General of Informatics Policy in INEGI at the time, "We blessed their [the government entities'] decisions. I always respected the choice of other people."<sup>289</sup>

As such, those in SECOFI responsible for implementing the policy saw INEGI's reticence to use its purchasing power to assist the development of the local industry as a missed opportunity, or worse. "Grijalva [Director General of Informatics Policy, INEGI] was an important obstacle to the policy."<sup>290</sup>

However, after a change in the leadership at INEGI in 1985,<sup>291</sup> the agency exercised increasing influence on the purchasing decisions of government entities. Upon receiving a written "project" from a government institution, INEGI would qualify the project and recommend a vendor. By law, the decision was to be based on the lowest priced bid that met the technical requirements of the project. Of course, "lowest price" in this context was not as clear-cut as it sounds. TNCs reported that intangibles such as the company's relationship with the government and personal feelings entered into the decision. If the individual institution disagreed with INEGI's recommendation long delays in the purchase ensued—delays the institution usually could ill-afford. Thus, there appeared to be a reversal of the procedure for vendor selection: whereas prior to 1985 INEGI "blessed" the recommendation of the government entity, post-1985 the recommendation would appear to come from INEGI itself.

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<sup>289</sup> Author interview with Pablo Grijalva, the Director General of Informatics Policy, INEGI (1982-85), April 1987.

<sup>290</sup> Author interview with Ricardo Zermeño, Director General, SECOFI, June 1987.

<sup>291</sup> In 1985, Jose Luis Soberanes replaced Luis Pablo Grijalva as Director General of Informatic Policy. Grijalva never really believed that México should try to develop a national computer industry. However, with Soberanes came Alberto Montoya Martín Del Campo as Director of Policy and Norms in Informatics. Montoya had argued strongly in his 1986 PhD dissertation for the Mexican state to take an active role in developing a national computer capability.

The ownership of the vendor was not a primary factor in the government's purchasing decision. By law, INEGI had been restricted from accepting a local vendor's bid if price and technological competence were not competitive. However, all other things being equal, the government would choose a local vendor over a foreign one. In the latter half of the 1980s INEGI facilitated the sale of local-vendor equipment to government entities on occasion, reflecting the institution's growing desire to use its power to aid the development of a local computer industry. One small Mexican manufacturer of IBM compatible micros made a sale of 360 units to Pemex with the help of INEGI. In the words of the company's representative, "INEGI is our business." (Considerations of ownership were only applicable in purchases of microcomputers and peripherals). Furthermore, if the firm was not a manufacturer of record in the country (i.e., not registered with SECOFI's industrial development programme, manufacturing some electronics equipment in México) it could not participate in government bids. This was the case of Control Data, which could not participate in government bids from December 1986 to April 1987 when the company did not have a registered local manufacturing operation. As a result the company experienced severe losses in the first quarter of 1987.

In conclusion, government purchasing power, though dramatically increased through volume and centralization, was not used directly or systematically to develop the local informatics industry. With the 1985 change of leadership in INEGI some efforts were made to coordinate government purchasing policy with the industrial development efforts of SECOFI. However, these efforts were limited by the lack of local alternative sources of computer technology in all but basic microcomputers and peripherals. Moreover, by the late 1980s, the president of INEGI, Pedro Aspe, was shifting back to the liberal procurement policies practiced prior to 1985.

To be sure, the government of México expanded its use of information technology commensurate with the increased size and complexity of the state bureaucracy. Information technology was and is a powerful tool for government in its

exercise of power and control over society.<sup>292</sup> It is patently in the government's self-interest to expand with the most up-to-date and cost-effective equipment and services available. So the government used its monopsony primarily to negotiate lower prices, while procuring an increasing volume of state-of-the-art computer equipment and services from the transnationals.

Thus, while SECOFI's computer industry guidelines grew ever more flexible, the government as a customer grew more monolithic and demanding. México continued to be primarily a consumer—not a producer—of computer electronics.

#### Lack of Private Sector Support

The discussion of the general political and economic context in the previous chapter noted the Mexican private sector's wariness of nationalist/expansionist policies. This general wariness certainly applied to the computer development programme. In addition to this, at least three more specific factors further inhibited private sector enthusiasm for the programme.

Firstly, the Mexican computer industry was thoroughly dominated by foreign transnationals at the time the programme was introduced. Mexican participation was limited to retail distribution under license (which would not be directly affected by the programme either favourably or adversely), and the assembly of imported semi-knocked-down microcomputer kits by a few small companies. Thus, there were no major industrial groups with a vested interest in a protected domestic computer industry.

Further, the policy initiative could not rely on the support of a critical mass of technology-minded elites in the private sector; such a critical mass did not exist in 1981–82. Brazil's academic institutions were producing increasing numbers of electronic engineers and computer scientists from the 1960s onward. These

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<sup>292</sup> Many authors have commented on the potential abuses of information technology by government. See for example, Armand Mattelart and Hector Schmucler, Communication and Information Technologies: Freedom of Choice for Latin America?, (Norwood, NJ: Ablex Publishing Corporation, 1985).

technicians had a personal interest in the development of a local computer industry in that country. By assuming governmental positions and forming formal and informal networks, they were able to influence policy substantially in this area. México's academic institutions, as noted above, were not active in this area until much later. As there were few qualified personnel to participate in a local industry, likewise there were few with a personal interest in the development of such an industry. The few that did exist had been trained largely by the computer transnationals to be users of their computer equipment, not developers and innovators.

The local private sector was, at best, ambivalent toward the policy initiative. Indeed, it may be argued that the private sector was in fact hostile to the programme on balance. Without significant Mexican presence in the computer industry, the private sector was primarily a user of computer technology developed, sold and serviced by foreign companies. The market had been educated by the computer transnationals since the introduction of computers in México. The market was interested generically in obtaining the best equipment at the lowest price. However, in 1981–82, the market was still not very sophisticated and was thus highly risk-averse. The computer development programme, while professing a commitment to international competitiveness, could be perceived as threatening current price and technology standards.

Two other factors served to inhibit the successful implementation of the computer development programme: the dynamics of the change of government administrations, and pressure from the U.S. government. The impact of these two factors is best illustrated within the historical context of the formulation of the guidelines and the quest for official recognition and approval of them.

## **Formulation of the 1981 Computer Industry Guidelines**

In 1979 José Andres de Oteyza unveiled the National Industrial Development Plan. One of the priority areas designated in the plan was computer electronics. At this time, however, no integrated development plan for the computer sector had been developed. It fell to Natán Warman, Undersecretary of Industrial Development under Oteyza, and Ernesto Marcos, the Director General of Industries, to devise a plan for computers. Adding impetus and urgency to the formal need to formulate guidelines for the industry were the soaring trade deficit in the sector and chaos at the low end of the local market.

Lacking the necessary technical expertise in the ministry, Warman and Marcos sought outside help to formulate policy. They commissioned Warman's brother, José Warman, who was then an electronic engineer teaching at the national university (UNAM). In early 1981 José Warman was joined by Ricardo Zermeño who had just finished doctoral studies in England on technology policy concerning the use of robotics in industry. By August 1981 a draft of the guidelines was complete.

Because the computer guidelines were first published under the National Industrial Development Plan, no new government decree was needed to implement them.<sup>293</sup> What was needed, however, was the agreement and cooperation of four government ministries if the policy was to be effective: namely, SEPAFIN, SPP, the Ministry of Trade (SECOM), and the Ministry of Finance and Public Credit (Hacienda). SPP was important because it controlled government computer purchases; SECOM, because it controlled foreign trade; and Finance, because it held the purse strings with respect to fiscal incentives incorporated in the development programme.

From within the Lopez Portillo administration there was neither strong support nor opposition to the proposed policy of developing Mexican capability in computer electronics at first. The lack of strong opinion owed in part to a lack of understanding;

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<sup>293</sup> For reasons discussed below, the Computer Decree was never published in México's Official Diary. However, because it was implemented under the 1979 Industrial Development Plan and fell under the policy for capital goods published on October 7, 1981, the plan could be implemented without formal approval.



there was a general ignorance within the government bureaucracy concerning the sector. However, Marcos and Warman benefitted from the close relationship that the Minister of SEPAFIN had with the president, which served to insulate them somewhat from political opposition from other ministries.

Outside SEPAFIN, the only enthusiastic support for the plan within the government came from the Director General of Informatics Policy within the SPP who was responsible for regulating computer purchases by the government. The Director General had been consulted in the drafting of the guidelines and was ideologically committed to the development of a Mexican computer industry. Unfortunately for the policy proponents, this Director General was replaced by one who was less enthusiastic about this programme in 1982.

SECOM initially opposed the guidelines because they contained severe import restrictions that ran counter to the current policy of freer borders. Between 1975 and 1979 SECOM had replaced much import licensing with a simpler tariff system. However, SECOM was forced to reverse the policy with the economy headed for severe crisis in 1981. With this reversal SECOM was no longer opposed to the programme. In fact the guidelines were welcomed as they served to facilitate the administrative aspects of import licensing, defining and rationalizing import permits in this sector of the economy. Thus, SECOM was at least pragmatically supportive of the program.

Initially, the Ministry of Finance under Silva Herzog offered neither aggressive support nor opposition, though Herzog's inclinations would be for free trade economics as demonstrated by his staying power during the changeover of administrations.

These four government ministries were to sign the policy programme and the policy was to be published in the Official Diary in November 1982 so that the guidelines would have official recognition and the force of law. However, the dynamics of the change of presidential administrations, pressure from the U.S.

government on behalf of U.S. computer transnationals, and the economic crisis conspired to inhibit approval and implementation of the programme.

Chapter 6 established that the 1982 cabinet changes had a negative effect on political support for the policy. Not only were the changes important in themselves, the process by which these changes were made also was significant.

By late 1981 several of the government ministers who were to approve the policy knew what their new posts would be in the next administration. The most significant of these, perhaps, was Hector Hernandez who was the Undersecretary of Trade (SECOM). In the new administration he was to become the Minister of Trade and Industrial Development in SECOFI—the new ministry which was to result from the merging of SEPAFIN and SECOM. Also of importance were Mauricio de María y Campos who at the time was Undersecretary of Finance, and Luís Bravo Aguilerra, Director General of Foreign Trade in SECOM. Bravo Aguilerra was to be promoted to the Undersecretary of Foreign Trade in the newly consolidated ministry. De María y Campos was to become Undersecretary of Industrial Development, also reporting to Hernandez. The computer policy would be administered under him in this ministry.

These ministerial changes, and these men's foreknowledge of them, made them reticent to commit themselves to a policy whose ramifications they did not fully understand. If there were going to be political problems with the program, the problems would be theirs. Further, Hernandez—as noted earlier—was identified ideologically with free market principles and didn't want to be constrained to implement a programme he didn't support. "Hernandez already knew he would become head of SECOFI. He wanted his hands free to be able to do what he wanted. He didn't want to be bound by this programme."<sup>294</sup> Thus, apart from the normal bureaucratic delays inherent in a change of administration, the political and institutional dynamics associated with such a transition inhibited the implementation of this new policy initiative.

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<sup>294</sup> Author interview with José Warman, Director, Office of Electronics, SECOFI, June 1987.

The U.S. government did not waste time in expressing its concern over the new policy initiative. In early 1982, Malcolm Baldrige, the U.S. Secretary of Commerce, sent a letter to Andres de Oteyza, the Minister of SEPAFIN, asking that the programme not be passed into law without first consulting the U.S. government.

Prior to this, in 1981, Presidents Reagan and Lopez Portillo had established a joint trade commission to improve cooperation and to resolve trade issues between México and the United States. Sector "working groups" were set up under the auspices of the commission at the initiative of the U.S. government shortly after the computer policy was formulated in late 1981. Sectors under discussion included textiles, automobiles, petrochemicals, pharmaceuticals, and electronics. However, electronics proved to be the topical area of concern at this time.<sup>295</sup>

These working parties took place at the undersecretary level and comprised U.S. government officials from the departments of state and commerce, and Mexican officials from SEPAFIN and SECOM.<sup>296</sup> The objectives of the sector working group on electronics included: (1) the examination of issues of concern regarding the computer industry in México and the United States; (2) the identification of areas in which cooperative efforts can better promote the growth and development of both countries' computer industries and the freer flow of trade and investment; and (3) the making of recommendations to the Commission.<sup>297</sup> In one meeting the U.S. presented its agenda including its own proposals for electronics policy in México. The U.S. proposals were six-fold: (1) immediate relaxation of local content requirements; (2) removal of export requirements; (3) relaxation of required R&D expenditures; (4) move toward open trade practices in computers; (5) access to the microcomputer market for U.S. exporters or U.S. firms in México; and (6) removal of mixed investment

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<sup>295</sup> Mark P. Jacobsen, "México's Computer Decree: The Problem of Performance Requirements and a U.S. Response", *Law and Policy in International Business*, 14. 4 (1983), pp. 1172–1173.

<sup>296</sup> This, of course, meant that Hector Hernandez would be present at some, if not all, of these working parties.

<sup>297</sup> Unclassified Telegram from the U.S. Embassy in México to the U.S. Department of Commerce, Washington D.C. (January 1982) quoted in Jacobsen, *Op. Cit.*, p. 1173.

requirements. In short, the U.S. proposals attacked every major guideline in the policy initiative. The thrust of the U.S. government's argument was that the "mutual interests" of México and the U.S. were best served when U.S. companies were allowed to supply high technology to México. "The United States believes that U.S. computers can significantly contribute to the development of México's industrial capacity, and assist in the creation of internationally competitive Mexican exports."<sup>298</sup>

Not surprisingly, the working group failed to reach substantive agreement. José Warman, the architect of the computer programme, attended the talks and noted, "The talks were not well set up. There was no definite attempt at substantive agreement on either side. I felt the talks as general pressure, but little more."<sup>299</sup> The resultant effect, however, was a group of reticent Mexican ministers, and a programme whose passage into law was forestalled indefinitely and whose implementation was considerably delayed.

The programme was authorized by Natán Warman in August 1981 and announced publicly in December of that year. Warman then worked with civil servants in the SPP to modify and improve the policy so that it could be published in the Official Diary in November 1982 with the signatures of all four government ministers. In June 1982 the SPP formally approved the policy and in September, Finance signed. However, Hector Hernandez of SECOM, for the reasons outlined above, did not commit himself to the policy and the programme was never published in the Official Diary. The failure of the policy to receive official status was to prove a stumbling block to its successful implementation, as seen further below.

With the change of administrations, SEPAFIN and SECOM were amalgamated into SECOFI under the leadership of Hector Hernandez. Despite Hernandez' reluctance concerning the industrial development programme for computers, José Warman and Ricardo Zermeño were appointed to administer the programme as best they could. Though Hernandez was not committed to the programme, Warman had earned the

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<sup>298</sup> "Discussion Paper on Implications of México's Computer Development Plan", mimeo.

<sup>299</sup> Author interview, June 1987.

respect of Hernandez, de María y Campos, and Bravo Aguilerra and so was appointed Director of Electronics Policy Coordination under de María y Campos in SECOFI.<sup>300</sup> “Warman was appointed because although there was disagreement about the policy, it was agreed it [referring to the Guidelines] was an impressive piece of work. Hector Hernandez kept an attitude of ‘least resistance’ and basically left Warman alone to do what he could.”<sup>301</sup>

Furthermore, this was a new and technically complex area of policy making and enforcement, and required the supervision of technically competent civil servants. Warman recognised this fact in a typically blunt fashion: “There was supine ignorance about electronics within the government [at that time].”<sup>302</sup> No one was better placed therefore to implement the policy than its authors, Warman and Zermeño.

As in the Brazilian case, the specialised nature of the industry provided an opportunity for a small cadre of elites to influence policy formulation and implementation. México may not have been the archetype of the “developmental state”, but at least with respect to the country’s computer policy in the early days, a meritocracy in policy responsibility applied, if only because no one else understood the industry.<sup>303</sup>

Before examining further the politics surrounding the electronics programme it’s helpful to look specifically at the decree itself. The next section will consider the objectives of the programme and summarize the guidelines and incentives for the development of a local computer electronics industry in México. There follows a discussion of the initial attempts at implementing the programme in the years 1983–

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<sup>300</sup> De María y Campos continued to provide cautious support for the policy during its implementation. Coming from the Finance Ministry, de María y Campos owed much of his political influence to Silva Herzog. When Silva Herzog left the ministry in 1987, de María y Campos' hand was weakened and the computer policy received still less support from above.

<sup>301</sup> Author interview with Ricardo Zermeño, Director, SECOFI (under Warman at the time referenced in the quote), May 1987.

<sup>302</sup> Author interview with José Warman, March 1987.

<sup>303</sup> Admittedly José Warman was Natán Warman’s brother, so one may argue that José Warman’s appointment was hardly meritocratic. However, the evidence suggests that it was. He earned the respect, even of his political opponents, and was appointed based on merit.

84, IBM's successful effort to obtain an exceptional ruling on investment in a microcomputer operation, and finally an evaluation of the impact of the policy on the industry relative to the programme's objectives.

### **The Computer Electronics Development Programme**

The "Development Programme for the Manufacture of Electronic Computer Systems, Their Main Modules and Peripheral Equipment" had four basic objectives:<sup>304</sup>

(i) to promote technological development relating the productive sector with centres for research and development in computer electronics; (ii) to produce computer equipment for the local market at price and technology levels comparable to the international market; (iii) to promote the export of data processing equipment while reducing imports; and (iv) to increase horizontal industrial integration through the development of Mexican component suppliers. In particular, the programme explicitly aimed to expand and consolidate the computer sector in order to supply 70 percent of the country's computer needs in five years.

Given that there was almost no local capacity for the design or manufacture of computers in México in 1981, these goals were highly ambitious. Warman and Zermeño were faced with a dilemma in trying to stimulate a national electronics industry. The electronics component manufacturers (e.g., Texas Instruments, and Motorola) did not want to manufacture in México, and the foreign computer equipment vendors would not manufacture where there were no components. However, the worldwide microcomputer explosion and the fact that microcomputers could be assembled using "public technology" (i.e. integrated circuits that were available on the international market) provided the policy-makers with an opportunity.

The policy strategy thus turned on the market for microcomputers – a market with lower technological and capital barriers to entry, and the market with the

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<sup>304</sup> SEPAFIN, *Op. Cit.*, pp. 1–6.

greatest potential growth in the medium-term. In minicomputers the policy was to emphasize exports, allowing some imports of finished products to complement local production. The policy thus allowed 100% foreign ownership in this segment, but encouraged the development of local component suppliers. The mainframe segment permitted more limited policy goals. The local market was too small, and the technology too advanced, to support local production. So mainframes could be imported and sold in México so long as the computer TNCs compensated imports with exports of other products manufactured locally.

Hence, the programme, recognizing the limitations of Mexican private capital, did not intend to exclude foreign investment in any area of the industry, as was the case in Brazil. Rather, the idea was to orient foreign investment in such a way that the necessary technological, managerial, and capital resources would be transferred and local capabilities would develop—quickly in microcomputers and peripherals, more gradually in minicomputers, and probably not at all in mainframes.

Following is a summary of the main requirements for investment in mini- and microcomputers and their peripherals as stated in the policy guidelines.<sup>305</sup>

1. In order for foreign companies legally to sell computer equipment in the Mexican market they must register a local manufacturing project with the government of México.
2. Foreign investors may maintain 100% equity in their Mexican minicomputer operations, but are restricted to 49% equity in microcomputer, peripheral, or component operations. The importation of minicomputers will be allowed on a selective basis; however fully-assembled microcomputers cannot be imported.
3. A weighted measurement, the GIN,<sup>306</sup> is used to determine the level of integration of locally produced components into the machines. Such integration should proceed according to the following schedule in Table 7.3:

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<sup>305</sup> *Ibid.*, Chapters III and IV, pp. 8–22.

<sup>306</sup> GIN is the Grado de Integración Nacional and is calculated below:  
$$\text{GIN} = [2(\text{CI}) + 2(\text{Ceb}) + 1.5(\text{S}) + \text{A}] / [0.7(\text{CI} + \text{CJ}) + \text{CebT} + \text{ST} + \text{A} + \text{CIM}]$$

**TABLE 7.3**  
**Local Integration: GIN Requirements %**

	1st year		2nd year		3rd year	
	Mini	Micro	Mini	Micro	Mini	Micro
<b>Recommended GIN%</b>	30	45	35	50	50	60
<b>Minimum GIN%</b>	25	35	25	40	35	45

4. Each company will have a foreign currency budget and will have to compensate a percentage of their imports with exports as follows in Table 7.4:

**TABLE 7.4**  
**Export to Import Ratio Requirements %**

	1st year	2nd year	3rd year	4th year
<b>Minis</b>	30%	60%	75%	100%
<b>Micros</b>	0%	25%	35%	45%
<b>Peripherals</b>	25%	35%	45%	70%

5. Price is to be kept within 10–15% of the list price in the United States, and quality is expected to be up to international standards.

6. Research and development expenditures required to finance government approved projects, as a percentage of total sales, are to be as follows in Table 7.5:

**TABLE 7.5**  
**R&D Expenditure Requirements (% of Sales)**

Minis	Micros	Peripherals & Components
5%	6%	3%

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Where: CI=the costs of the integrated circuits purchased in the country from companies which have been registered in the development programme; Ceb=the local cost of basic electronic components (when these components are purchased from a maquiladora, only 60% of their value is used in the formula); CebT=the total value of the basic electronics components purchased in the country; S=the value of sub-assemblies or modules purchased in the country (50% of their value is used if they are purchased from a company not inscribed in the programme); A=the local cost of non-electronic accessories required in production; ST=the total value of the sub-assemblies purchased in the country; CJ=the cost of integrated circuits acquired abroad; and CIM=the total value of inputs acquired abroad excluding integrated circuits.



7. Foreign companies will furnish technical training to its Mexican personnel with respect to design, research and development, production, and administration of computer manufacturing operations. Furthermore, foreign investors will provide access to the advances in research and development made in research centres located in their home countries.
8. Production plants should be located in the geographic areas specified by the National Plan for Industrial Development.

The programme envisaged flexible enforcement in that deficiencies in one area could be compensated for by increases in another. For instance, if a company was actively promoting exports of completed machines or of components and had a positive currency balance, local integration requirements might be relaxed. It seems the most important area of government flexibility concerned the trade-off between the integration of local components and the international competitiveness of the equipment. The government appeared not to want to integrate at all costs. Indeed, the proximity of the U.S. market meant that the government could not successfully pursue an industrial development policy that entailed a prolonged period of inferior technology and high prices. The constant threat of contraband equipment prevented the Mexican government from enforcing national integration that is uneconomical.

The programme established incentives as well as restrictions and controls for the production of computer equipment. The support furnished by the Mexican government included:

1. Incentives with respect to financing:
  - a. Preferential interest rates and grace periods in the financing obtained through government-approved financial institutions and funding agencies (e.g., FOMEX, FONEI);
  - b. Pre-investment studies financed by the government;
  - c. Fiscal credits up to 20% of the required investment to expand or install productive capacity.

2. Incentives with respect to the process of investment:
  - a. 30% discount in the consumption of energy products;
  - b. Fiscal credits of 15% for the purchase of computers and peripherals produced in México;
  - c. The elimination of import tariffs for equipment used for production;
  - d. Import quota preferences given to the producers of computer equipment (although computer distributors still maintain import quotas they will be gradually reduced);
  - e. Fiscal incentives to build laboratories destined for research and development activities;
  - f. The possibility of consuming products made in the in-bond assembly plants (maquiladoras);
  - g. Fiscal credits of 20% of the value of the new jobs generated by this new investment.
3. Incentives with respect to the market:
  - a. The protection of the local market through the establishment of yearly import quotas and previous import permits;
  - b. Import tariffs of 30% for microcomputers, 20% for mini-computers and mainframes, and 15% for spare parts;
  - c. Preferential treatment for participating companies for sales to the government;
  - d. Export incentives, in particular for exporting to the Latin American market without additional tax payments, through the Latin American Association of Free Trade.
4. Incentives with respect to institutional support:
  - a. Official support in negotiations with other state offices;
  - b. Support for establishing agreements for research and technical training.

Thus the programme had both a "carrot" and a "stick" to persuade companies to comply with the programme. The government's "stick" was the denial of permission to import. The policy's carrot consisted in the benefits of these incentives and the opportunity to participate in the small, but growing, Mexican market for computer electronics.

Despite the political ambivalence or even opposition of some in the Mexican government, Warman attempted rigorous implementation of these policy guidelines at the beginning of 1983 until July 1985 when IBM was allowed 100% ownership of a microcomputer manufacturing subsidiary in México, directly contradicting the policy guidelines. The next section explores the circumstances that led to this exceptional ruling and its significance for the nascent industry and the policy initiative itself.

### **The IBM Decision**

Some observers have pointed to the decision of the Mexican government in July 1985 to allow IBM 100% ownership of a local microcomputer manufacturing subsidiary as that which marked a major shift in government policy with regard to computers. In fact, the IBM decision only explicitly manifested a policy shift that began with the economic crisis and the change of administration two and half years earlier. As has already been shown, the incoming De la Madrid administration was pledged to opening the Mexican economy to foreign investment. Indeed, computer electronics was designated explicitly in the new administration's "Guidelines on Foreign Investment" as an area in which foreign investment would be welcomed.

Thus, well before the IBM decision the administration's attitude toward foreign investment in computer electronics was manifestly less restrictive than the 1981 policy guidelines. A representative in SECOFI's Office of Foreign Trade and Investment stated simply that the new administration thought that computers were not an area to be developed in the context of a reserved market in México; "We're too far behind."

Within the same ministry (SECOFI), Warman and Zermeño were pursuing a policy of restricted foreign ownership in microcomputers while the Undersecretary of

Foreign Investment and Technology Transfer, Adolfo Hegewisch, was promoting majority foreign ownership in computer electronics, specifically including microcomputers. As the promotion of foreign investment had the presidential seal of approval, it can be inferred that Hegewisch had a considerably stronger hand than Warman. Moreover, the 1981 guidelines lacked the force of law as they had never been published in the Official Diary, and they also lacked the committed support of anyone at cabinet level. After all, this policy had been formulated during the final tumultuous years of the now repudiated President Lopez Portillo. Hector Hernandez in particular, adopted the path of least resistance with regard to the computer policy, and as Undersecretary of Foreign Investment “was [after all] paid to promote foreign investment.”<sup>307</sup> This was a classic case of Mexican policy by “regulation” and “non-decision.”<sup>308</sup> Politically, Warman was on his own.

It was in this context in early 1984 that IBM began negotiating in earnest to establish a wholly-owned microcomputer operation in México. In March 1984 IBM presented its plan, which included an investment of \$6.6 million to expand its minicomputer plant in Guadalajara so that some 600,000 micros could be assembled there in the next five years. IBM would export roughly 90 percent of these micros, and eighty new jobs would be created.

IBM made a simultaneous offer to UNAM in the hopes of securing its long-term future in the Mexican market. IBM offered to donate \$4.5 million toward the establishment of infrastructure in the university to carry out long-term projects for research and education in electronics. The plan would also integrate several state universities and would involve the Ministry of Communications and Transport and the

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<sup>307</sup> Quote from José Warman in author interview, March 1987. Warman was under no illusions about the lack of policy support he would receive from above.

<sup>308</sup> Dale Story uses these terms to describe the Mexican government's habit of leaving effective policy decisions to the implementers.

Mexican telephone company, Telmex.<sup>309</sup> As it turned out, UNAM rejected IBM's overtures; however, the Mexican government found it more difficult to resist Big Blue.

Warman vigorously opposed IBM's insistence on 100% ownership, pointing to Apple and Hewlett–Packard who had already signed joint venture agreements with local capital and were registered with the programme.

It was at this juncture that Mexican private capital took its first political initiative with regard to the national computer policy.<sup>310</sup> On October 15, 1984 ANFABI—the National Association of Manufacturers of Informatics Goods—which at the time included Apple and H–P because they were minority partners in joint ventures, publicly demanded that the programme be made official by its publication in the Official Diary.<sup>311</sup> ANFABI argued from the programme's successes with regard to investments, production, employment, and exports.

Initially it appeared that Warman and ANFABI had been successful in stopping IBM's proposal. On January 18, 1985 the National Commission on Foreign Investment unanimously rejected IBM's proposal. A month later the Undersecretary of Industrial Development, Mauricio de María y Campos (Warman's superior) gave the reasons for the Commission's decision. He cited the facts that the proposed investment was small, entailed 100% ownership, and noted that the project would create a negative trade balance because it relied on imported components. Furthermore, the industry already had a good number of manufacturers.<sup>312</sup>

In March 1985 IBM agreed to modify its proposal and renegotiate. IBM based its argument for a wholly–owned subsidiary that was free to source components as it wished on the government's objective of a competitive industry that could generate

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<sup>309</sup> Miguel A. Rivera, "Negociaciones ocultas entre funcionarios de IBM y UNAM", *La Jornada*, México, December 13, 1984. p. 7.

<sup>310</sup> Though it seems remarkable on the surface that this was Mexican private capital's first political initiative, it must be remembered that only two years previously there were no significant Mexican computer manufacturers. ANFABI itself was a very new organisation.

<sup>311</sup> *Informatica*, No. 101, November 1984. p. 34.

<sup>312</sup> *The New York Times*. January 19, 1985, p. 1; *The Times*. (London) January 21, 1985; and *La Jornada*. (México) February 8, 1985, p. 9.

foreign exchange. IBM argued that it could only export products that were of the highest quality at a competitive price. IBM noted that insufficient component suppliers existed in México for the company to meet both the local integration commitments and a high level of exports. The company also was quick to point out that, in fact, the government's official policy was to promote foreign investment in microcomputers; not to restrict it. In so doing, IBM put its finger on source of the conflict existing within SECOFI concerning the development of a Mexican computer industry, and underlined the political and legal weakness of the 1981 programme. José Warman recognised IBM's tactics. "They play one government department [Industrial Development, Foreign Investment, Commerce] off against the other."<sup>313</sup>

In June 1985 Adolfo Hegewisch announced to the press that negotiations with IBM were advancing, but noted that the price of the computers in the domestic market was now the sticking point.<sup>314</sup>

ANFABI then took out full-page announcements in several leading México City newspapers.<sup>315</sup> The announcements demanded the continuation of the industrial development programme, highlighting the results of recent years. The announcements appeared on the same day that President De la Madrid returned from a tour of Western Europe.

De la Madrid returned to give an important speech in Guadalajara in July 1985. In this speech the Mexican president underlined his administration's commitment to the further liberalization of the Mexican economy and emphasized again the positive role for foreign investment in the Mexican economy. However, the TNCs and the U.S. government wanted more than words; they wanted action.

It is widely held that U.S. Secretary of State George Schultz brought pressure to bear on De la Madrid concerning the Mexican government's decision regarding IBM's

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<sup>313</sup> Author interview, March 1987. In a later interview, Warman also recognized that it was only a matter of time before IBM would get what it wanted. He noted ruefully, "Have the Marines ever been stopped by Decree?" (Author interview, June 1987.)

<sup>314</sup> La Jornada, June 16, 1985, p. 1.

<sup>315</sup> See for example, Excelsior, June 24, 1985, p. 16–A.

proposed investment in their face-to-face meeting on July 22, 1985. The exact nature of that pressure is known only to those two men. What is known is that the IBM decision was on the agenda and two days after their meeting, the Mexican government accepted IBM's proposal along with several other proposed foreign investment projects. Interestingly, the IBM decision never returned to the National Commission on Foreign Investment for consideration. Ricardo Zermeño explained:

“The National Commission on Foreign Investment had rejected the IBM proposal unanimously in December 1985. All eight ministers rejected it. Hegewisch was unable to lobby the eight ministers successfully so the decision was taken directly by Hegewisch with the backing of President De la Madrid. It didn't go back through the Commission.”<sup>316</sup>

It is likely this did not disconcert members of the Commission; more likely, they were relieved at not having to take the decision themselves.

Certainly México's need for new credit, and the sharp decline in oil prices made the government especially vulnerable to U.S. pressure at this time. Some observers have noted that the U.S. government conditioned the signing of a bilateral commercial treaty with México on the removal of the restrictions on foreign investment in the area of microcomputers.<sup>317</sup> Equally important, however, was De la Madrid's on-going desire to encourage foreign investment without alienating the trade unions, public sector bureaucracy, and nationalist forces in the country. To accomplish this the Mexican government needed to signal a greater opening to foreign investors while being seen to drive a very hard bargain with them. In the case of IBM, De la Madrid succeeded in both objectives.

On July 24, 1985, IBM's "modified proposal" was approved whereby IBM agreed to export 92% of the 603,000 personal computers the company would produce in the first five years of production. Proposed total investment in the operation was reported in the press as \$91 million, up dramatically from the original proposal of \$6.6

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<sup>316</sup> Author interview, May 1987.

<sup>317</sup> Montoya claims this in his PhD dissertation. Alberto Montoya, *Op. Cit.*, p. 257.

million. Indeed, it is difficult to see how the company was going to invest such a large sum in México, given the moderate nature of the plant modifications required to produce the microcomputers. IBM promised to set up a research and development centre for semiconductors and education in different areas of computer science. Even if these investments are included in the total—which they surely must be—total investment cannot possibly be \$91 million. In reality, IBM would spend \$6.6 million expanding its plant (as proposed originally), \$11 million on the semiconductor facility, and \$3 million on supplier development.<sup>318</sup>

The total investment figure was thus extremely exaggerated in the press. Once again, the rushed nature of the decision is partly to blame for this. Industry sources indicate that many in IBM were surprised by the announcement, implying that the government agreed to no specific proposal of IBM's, and released exaggerated figures prematurely in order to impress public opinion. Zermeño noted, “The numbers were manipulated and released in a hurry.”<sup>319</sup> Indeed, the press worldwide remarked on the concessions that the Mexican government had extracted in its negotiations with IBM.<sup>320</sup>

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<sup>318</sup> Figures from SECOFI, Dirección de la Industria Electrónica.

<sup>319</sup> Author interview with Ricardo Zermeño, June 1987.

<sup>320</sup> See for example The Times, July 30, 1985.



**TABLE 7.6**

**Comparison of IBM Proposals**

	<b>Original</b>	<b>Announced</b>	<b>Agreed/Actual</b>
Foreign ownership	100%	100%	100%
Production (5 yrs)	603,000	603,000	agreed 603,000/ '86 actual 3400* prod'n shifted to PS/2 in 1987
Exports (% of output)	92%	92%	export 2x import^/ no exports prior to 1988
Local content	35–50% after 4 yrs	51–82%	51–82%/ 25% in 1986^ fell in 1987 with PS/2 intro^
Market share limit	—	33%	agreed 33%/ 4% actual 1986*
Price differential	—	15%	agreed 15%/ 40–75% actual**
Investment (US\$ mil)	6.6	91	25–40
Plant	6.6	6.6	6.6^^
Semiconductor Fac'ty	—	}	11.0^^
Supplier Devt	—	}	3.0^^
Other R & D	—	}	9.0@

Sources:

Figures on original and announced proposals from David Gardner, "México Opens Door to IBM," *Financial Times*, July 25, 1985, p. 40–e.

\*Infocom, *The Mexican Market of Microcomputers*, (México D.F.: Infocom, 1987).

^Author interviews with IBM de México, May 1987.

\*\*Margaret Miller, "High Technology Transfer: The Mexican Computer Electronics Industry," unpublished BA Honours Thesis in Economics, Stanford University, June 1986; and author observations.

^^Author interviews with Office of Electronics Industry, SECOFI, June 1987.

@Author interviews revealed that IBM spends 5% of sales on local R&D, which in 1986 would have been \$8.8 million. It is perhaps generous to add this to the \$14 million committed to the semiconductor facility and supplier development.

Furthermore, IBM's actual performance in the first two years after the agreement nowhere approached the announced agreement. The company produced no micros in 1985, 3,400 in 1986, and then shifted production to its new Personal System/2 in March 1987 thereby slowing production just after it had started. Thus after eighteen months of its five-year agreement, IBM had produced barely 5,000 of the 603,000 promised microcomputers. With regard to exports, the company agreed to export twice the value of its imports into México. However, company officials admitted in interviews that there would be no exports of microcomputers until 1988.<sup>321</sup> Actual performance with respect to local content was much worse even than the company's original proposal. Moreover, when the company switched production to the PS/2 local content fell further. Finally, IBM did not keep to its commitment with respect to pricing. The PC was introduced at a price 75 percent greater than comparable U.S. prices. Competition drove the price down, but in 1987 prices were still some 40 percent above U.S. price.

Clearly then, the announced agreement was for the benefit of Mexican nationalists. De la Madrid had to be seen to drive a hard bargain with IBM. However, the reality is that the announced agreement was grossly exaggerated and IBM has no intention of complying. Moreover, the government would appear to have little intention of strictly enforcing the agreement.

The IBM decision had a significant impact on the computer industry in México. Immediately after the announcement of IBM's plans to enter the Mexican microcomputer market, several proposed investments in the industry were cancelled and others were considerably reduced. Warman himself acknowledged this fact: "I know of investments that were decided and agreed but then were backed away from after the [IBM] decision."<sup>322</sup> At least two factors were at work here: fear of IBM market dominance, and more significantly, uncertainty about the regulatory environment:

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<sup>321</sup> Author interview with IBM de México officials, May 1987.

<sup>322</sup> Author interview with José Warman, March 1987.

what was now the government's policy with respect to the industry? "The issue is not whether IBM is in or out. The issue is: do we have a policy?"<sup>323</sup>

After the IBM decision, Hewlett-Packard and Apple both moved to buy out their joint-venture partners. The "price" for 100% ownership in microcomputers, as it was with IBM, was greater exports. H-P and Apple committed to exporting twice the value of their imports in this product range.

H-P and Apple both indicated that the only compelling reason for the joint ventures in the first place was the government's insistence upon minority investment as a prerequisite for participation in the market. Industry observers understood the joint ventures as a rational strategy under the circumstances pertaining prior to the IBM decision: "H-P and Apple moved cautiously and took positions in the market via joint ventures. They didn't invest seriously; this was more of a wait-and-see attitude. If the policy sticks, they're in. If not, they'll have a head start in the market."<sup>324</sup>

However, the joint ventures were not working well in microcomputers. The local partners were interested, naturally, in profits from the venture. The TNCs, on the other hand, recognized that the market for micros was growing more competitive and less profitable, and were content to use micros as a "loss leader"—that is to lose money in this segment for the sake of other products (which were not part of the joint venture). This coupled with the need for quick decision-making in the dynamic microcomputer market encouraged the two companies to end the joint venture arrangements within a year after IBM's victory.

Unisys (the company formed from the merger of Burroughs and Sperry in 1986) maintained its joint venture in microcomputers for a number of reasons despite the shift in policy. Firstly, the joint venture company, Compubur, operated at the high end of the microcomputer market, assembling multi-user micros. The market for this equipment was less dynamic than for 16-bit micros at the time and therefore the need for rapid decision-making was not as acute. Further, the local partners,

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<sup>323</sup> Author interview with José Warman, March 1987.

<sup>324</sup> Author interview with Francisco Thions, President of Infocom, March 1987.

Banamex (24.9%) and CCI<sup>325</sup> (26.1%) provided considerable political support, financing opportunities and good local connections, leaving the day-to-day running of the company to Unisys (49%).

It is instructive at this point to contrast the approach IBM took in México with that taken in Brazil. In both cases, IBM openly tested the policy. In Brazil, IBM first ignored the minicomputer reserve and began manufacturing its own minicomputer in country while enlisting market support for the product. After losing this initial skirmish, IBM tested the policy successfully at the margins on two other occasions: receiving approval first to manufacture its small mainframe computer in country, and secondly, to establish a joint venture with Gerdau to provide data processing services on IBM equipment. In México, IBM again openly tested the policy by proposing a wholly owned microcomputer plant in direct contradiction of the policy guidelines allowing only minority foreign ownership. While initially rebuffed, IBM ultimately got what it wanted. In both the Brazilian and Mexican cases, IBM was prepared to offer greater investment and export commitments in exchange for production and supply chain autonomy.

The main difference in the two cases was IBM's recruitment of the US government to actively support the firm in fighting the policy in México. Understanding the gap that had opened between those who had written and were seeking to enforce the restrictive Mexican policy guidelines and the priorities of the Mexican president and his senior ministers and the vulnerability of the Mexican economy at the time, IBM's offer of increased investment and exports may have succeeded without American political pressure. The political pressure from its northern neighbour in all likelihood simply hastened the decision rather than altering it.

After the approval of IBM's proposal, José Warman's position as Director of Electronics Industrial Coordination became untenable. The policy he had formulated,

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<sup>325</sup> CCI is Controla Comercial e Industrial, a private group controlled by the President of CANIECE, the Mexican electronics and electrical communication trade association.

implemented and defended was no longer the policy in force. So Warman stepped down as Director at the end of 1985 and a year later started the Centre of Electronics and Informatics Technology (Centro de Tecnología Electrónica e Informática or CETEI). CETEI was co-funded by UNAM and the National Chamber of the Electronics and Electrical Communications Industries (CANIECE) and seeks to support the development of technology bringing together industry needs and university talent to pool and focus the technological resources in the country. Thus, Warman remained active in the sector, taking up one of the original objectives of the policy: the development of indigenous technological capability.

Ricardo Zermeño succeeded Warman in SECOFI, and remained the Director of Electronics Industrial Coordination until the change of presidential administrations. The policy guidelines were considerably weakened and evolved further following the IBM decision. As one TNC representative put it, "You drop one rule (the most debated one) and the others appear less rigid." The results can be seen either as greater flexibility, in that each company negotiates its own agreement with SECOFI, or greater confusion. Even the transnational computer firms that stood to gain from the policy shift expressed consternation. A Unisys official's comment was typical:

"Everyone has a different package now. We need to keep in close contact with government officials so there are no surprises. The previous dogmas have been diluted. There is no consistency in enforcement now. At least with Warman you had a consistent policy."<sup>326</sup>

Some were more scathing of the seemingly abrupt shift in policy: "You have to have patience to endure stupidity. The government should have warned the market that this [change in policy emphasis] was coming."<sup>327</sup>

Nevertheless, Zermeño was successful in imposing to a large extent the other major requirements stipulated in the guidelines, employing a less confrontational style than his predecessor.

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<sup>326</sup> Author interview with Unisys in México City, April 1987.

<sup>327</sup> Author interview with Jaime Nares, Director General, Tandem Computers, June 1987.

However, industry participants perceived a discontinuity in the way policy was enforced. For locally-owned manufacturers, export requirements were not pressed, while local content requirements were. With the transnationals, pressure was extremely strong to meet export commitments. In fact some TNCs reported purchasing non-electronic goods locally and exporting them to comply with their export commitments: "In 1985-86 we had to buy coffee and honey to export in order to meet export earnings requirements."<sup>328</sup>

The case of Apple Computer indicates the extent that the government of México was willing to go to improve the balance of trade in the industry. The case also reveals a remarkable naïveté on the part of this (at that time) young computer transnational in signing agreements with which it had no chance of complying. In a surprising turn of events, Apple was forced to shut down its Mexican operations in early 1988, unable to comply with the agreements the company had negotiated with Zermeño's office. Apple had been importing into México a value roughly two to three times what it exported up until 1987. The company then agreed to export twice the value of its imports as a precondition to attaining 100% ownership of the Mexican operation. Later that year, Apple obtained permission to import fully-assembled MacIntosh microcomputers from its automated U.S. plant. In return for the right to import these micros (contrary to the written guidelines) Apple agreed to export three times the value of these imports. In granting permission for the import of finished micros, the government again relaxed the requirements of the decree in order to obtain greater export commitments. When IBM shifted to the PS/2 product range in March 1987 the company also received permission to import two of the four micros in the range in exchange for the same export commitment: three-to-one. Unlike IBM and H-P, which could generate export earnings over a much broader product range, Apple's product line was limited to micros. Apple was thus simply unable to meet

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<sup>328</sup> Author interview with multi-national manager, April 1987.

these export commitments. After several warnings, the borders were closed to the company and the subsidiary was closed.

In effect, the policy emphasis shifted from the development of a local computer electronics industry to the development of México as an electronics export base. In this sense, the policy better reflected the priorities of the administration and also took better account of the country's limitations and competitive advantage in the sector. But from the standpoint of two of the four original policy objectives—the development of local technological capability and Mexican component suppliers—the policy shift had negative consequences as will be shown in the next chapter.

## CHAPTER 8

### IMPACT OF THE POLICY

Having described the general political and economic context and the evolution of México's computer policy, it is possible now to examine the impact of the policy guidelines in the 1980s. It should be remembered that while the policy was formulated during the period of the oil boom in México, initial attempts at its implementation were made in the context of the worst economic crisis in México's recent history.

This chapter begins with an overview of the Mexican computer industry and its market at the time. It takes a broad look at the Mexican computer industry in order to define terms, measure the dimensions of the market, and discuss competition in the industry. This will be followed by a more specific evaluation of the impact of the computer policy guidelines with respect to their original objectives.

#### Product Segments

Four product segments were addressed by the computer decree of 1981: mainframe computers, minicomputers, microcomputers, and peripheral equipment. In the original guidelines, the different computer segments were defined in terms of memory size, processing speed, and price.<sup>329</sup> However, because the technology developed so rapidly, many of the distinctions of 1981 were eclipsed, especially concerning the distinction between mini-computers and microcomputers.

In addition to these four product segments addressed by the policy, there are several other related industries that should be noted here because they are integral to the entire computer electronics complex. Further back in the industry chain is the main technological component of computers, which is an industry in its own right; namely, the microelectronics industry. Forward from the equipment industry is the large computer maintenance and services industry. Included here are all the data

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<sup>329</sup> SEPAFIN, *Op. Cit.*, pp. 23–30. Micros for example were defined as having a word length of 4 to 16 bits, central memory of not more than 64k bytes, and a selling price of between \$300 and \$20,000.



processing bureaux. Finally, there is the software industry, which together with microelectronics, was the dynamic heart of technological innovations in the field.

### Market Evolution

As noted earlier, the Mexican market was supplied almost entirely by imports from abroad until 1982. The mainframe market continued to be supplied solely through imports. A few manufacturers such as NCR began assembling minicomputers in the late 1970s with minimal local content. And by 1982 several more foreign-owned companies set up minicomputer assembly operations.

The first microcomputers were introduced in México in 1978 through a few distributors of Apple and Tandy, who imported finished product and subassemblies until 1982 when the borders were closed and SEPAFIN's policy went into effect. An aggregate total of 13,000 micros were imported in these four years: Apple importing 10,000 and Tandy 3,000. In 1982 when the government imposed import restrictions, these local distributors of Apple and Tandy equipment closed their operations, and the first breed of local vendors started assembly lines with minimal local content. Most of these local vendors established licensing or component purchase agreements<sup>330</sup> with foreign microcomputer manufacturers.

1984 saw the first major foreign vendors investing in Mexican microcomputer operations. Apple and Hewlett-Packard took minority positions in joint-ventures to manufacture microcomputers in México according to the computer decree. A year later Olivetti, Burroughs, NCR, AT&T, and Tandy followed them into the Mexican microcomputer industry. Finally, in 1986 IBM PCs and a host of Asian PC clones came in through local assembly lines. The entry of these foreign computer giants gave strong impetus to growth in the microcomputer market while the entry of the Asian clones exerted downward pressure on prices in the market.

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<sup>330</sup> These agreements were typical forms of "technology transfer" in the Mexican computer industry. In exchange for assistance in setting up the assembly and testing operations and exclusive local marketing rights, the national company would commit to purchasing certain essential components exclusively from the foreign technology provider.

## Market Size

In comparison with the total world market for computer equipment and services, the Mexican market was small. In every product segment, the Mexican market was substantially less than one percent of the total world market.

**TABLE 8.1**

### **1986 Computer Market Size (\$ Millions)**

	<b>México</b>	<b>World</b>
Mainframes and Minicomputers*	\$400	\$ 56,500
Microcomputers	111	24,125
Software, Maintenance, & Services	220	60,875
Peripherals	40	59,750
	=====	=====
<b>TOTAL</b>	<b>\$771</b>	<b>\$201,250</b>

\* Includes imports direct to users

Sources: Infocom estimates; Datamation

However, it is not the size of the market that primarily generated interest; it was the prospects for rapid growth.

## Market Growth

**TABLE 8.2**

### **Market Growth**

#### **Unit Shipments**

	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>CAGR %</b>
Mainframes		115	105	-8.7
Minicomputers		1,098	1,119	1.9
Microcomputers	13,921	36,061	51,336	92.0
Home Computers	4,700	36,685	40,820	192.3

**TABLE 8.2 (CONT'D)**

	<b>Market Growth</b>						
	<b>Revenues (\$ Millions)</b>						
	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>CAGR % 83-86</b>
Mainframes & Minis	364	262	244	302	378	349	12.7
Micros & Home Computers			20	65	117	111	77.0

Source: Infocom

These growth prospects were realized only at the low-end of the market. Growth in the mini and mainframe markets was more negatively affected by the economic crisis. Border restrictions severely curtailed sales of the large computers, which only recovered to their pre-crisis levels in 1987. The home computer market grew very rapidly; however, household incomes, limited distribution and high prices slowed future growth. Professional microcomputers were the most attractive segment of the market.

### Competition

**TABLE 8.3**  
**Total Revenues of Major Computer Manufacturers**  
**(\$ Millions)**

	<b>Ownership</b>	<b>1981</b>	<b>1986</b>	<b>Growth 81-86 CAGR %</b>
IBM	100% Foreign	178.4	175.8	- 0.3
Unisys	Foreign*	59.5	66.2	2.2
Hewlett-Packard	100% Foreign	11.0	43.7	31.8
NCR	Foreign*	42.0	36.3	- 2.9
CDC	100% Foreign	25.3	32.2	4.9
Honeywell	100% Foreign	25.4	23.4	- 1.6
Digital	100% Foreign	8.0	14.0	11.8
Apple	100% Foreign	2.0	14.0	47.6
Printaform**	Owner/Manager	—	13.8	NM
Sigma**	Owner/Manager	—	9.5	NM
Mexel**	Owner/Manager	—	8.8	NM

\*Unisys and NCR own 49% of microcomputer joint ventures; while their other operations are 100% owned. Unisys' 1981 sales equals Burroughs and Sperry/Univac combined sales.

\*\*Printaform licensed technology from Columbia, Sigma licensed from Commodore, and Mexel licensed from Televideo. NM=Not meaningful

Source: Infocom

Although the large computer transnationals suffered the consequences of the economic crisis and import restrictions of 1982–85, Table 8.3 confirms their continued dominance of the Mexican market. On the whole, the transnationals still controlled some 85 percent of the total Mexican computer market in value terms in 1986. As Table 8.4 illustrates, the TNCs had no Mexican rivals in minicomputers or mainframes.

While the transnationals in general controlled the Mexican computer market, IBM had the lion's share. Not surprisingly, IBM dominated the Mexican market much in the same way it dominated the world market. Although IBM lost market share after 1981 the company was still almost three times larger than its nearest competitor in the Mexican market in 1986.

**TABLE 8.4**

	<b>Share of Installed Base (December 1986)</b>			
	<b>Minicomputers</b>		<b>Mainframes</b>	
	<b>Number</b>	<b>Pct.</b>	<b>Number</b>	<b>Pct.</b>
IBM	2,014	37%	233	38%
Unisys	236	4%	195	32%
Hewlett–Packard	818	15%	—	—
NCR	960	18%	44	7%
CDC	48	1%	70	11%
Honeywell	356	7%	66	11%
Digital	465	9%	7	1%
Others*	555	10%	0	0%
	=====	=====	=====	=====
<b>TOTAL</b>	<b>5,452</b>	<b>100%</b>	<b>615</b>	<b>100%</b>

\*Others include Wang, Data General, MAI, Prime and Tandem. All these companies were 100% foreign-owned.

Source: Infocom

The rapid growth of the microcomputer sector and the policy guidelines had some effect on this table of leading computer companies. Of the transnationals, Hewlett–Packard and Apple experienced outstanding growth largely because of their successful early entries into the microcomputer market. Secondly, notice the emergence of several Mexican microcomputer manufacturers that licensed technology

from small foreign players. Clearly, by restricting imports of microcomputers, the policy guidelines helped create a space in the industry for these Mexican firms.

The microcomputer market warrants a closer look now, because it was the focus of the policy effort and the only area in which Mexican companies had any success. Table 8.5 describes the installed base of microcomputers in the country. Apple's enormous advantage here was due in part to its imports prior to 1982. IBM's position in the market was due almost entirely to direct imports—many of them illegal—prior to 1986 when its local operation commenced. Printaform's strong position in the market was a bright spot not only for the company but for the Mexican policy-makers as well. This company's success during this period is discussed further below.

**TABLE 8.5**  
**Microcomputers**  
**Share of Installed Base\* (December 1986)**

Apple	39,870 (10,000 of which were imported prior to 1982)
Printaform	18,700
IBM	15,000 (11,600 imported directly prior to 1986)
Mexel	9,500
Denki	8,000
H-P	7,300

\*Excludes installed base of 77,205 very low-priced home computers sold by Sigma under license from Commodore. Mexel and Denki licensed from Televideo and Corona respectively.

Source: Infocom

**TABLE 8.6**  
**Annual Market Sales of Microcomputers 1986**

	Revenues (\$ millions)	Share (%)
Apple*	14.0	12.6
Hewlett–Packard*	14.0	12.6
Printaform	13.8	12.5
IBM*	9.5	8.6
Sigma (Commodore)	9.5	8.6
Mexel (Televideo)	8.8	7.9
Denki (Corona)	5.3	4.8
Micrologica Aplicada (Onyx)	4.1	3.7
Infosistemas (AT&T)	3.7	3.3
Planta Industrial Digital (Altos)	3.6	3.3
18 others	24.4	22.0
	=====	=====
<b>TOTAL</b>	<b>110.7</b>	<b>100.0</b>

\* Denotes 100% foreign–owned. Revenues of Apple and H–P include sales of laser printers. Firm in brackets is foreign licensor.

Source: Infocom

While annual sales of microcomputers were led by Apple and Hewlett–Packard, the market continued to be a fragmented one with no company claiming a dominant position. As Table 8.7 indicates, the Mexican licensors had a majority of market sales. As a sign of things to come, however, that majority was already shrinking rapidly as the three major TNCs—Apple, H–P, and IBM—increased their share of the market after 1985.<sup>331</sup> The TNCs were not winning sales by selling more cheaply. Rather, their success was attributed to a perception of more up–to–date technology, better marketing and stronger brand recognition.

**TABLE 8.7**  
**Shares of Microcomputer Market (Revenues)**

	1985	1986	1987*
Mexican	66.9%	61.5%	56.0%
Foreign	33.1%	38.5%	44.0%

Source: Calculated from Infocom data. \*Company projections edited by Infocom.

<sup>331</sup> This trend was temporarily forestalled when Apple was forced out of the market in 1988.

### Observations Concerning the Mexican Microcomputer Market

Microcomputers were not a particularly profitable business in the early years of the sector's development due to the tremendous pressure on prices, the relative lack of brand loyalty on the part of consumers, and the rapid pace of change in the market. Nevertheless, large players like IBM and H-P perceived the vast potential of the market and committed to participating.

Because of the pressure on prices and the rapid pace of technological change, two factors were vital to long-term success in the business: (i) financial strength and (ii) large scale to exploit economies of scale in component purchasing and sustain investment in research and development. The local companies lacked the scale, financial resources and the technical expertise to build competitive advantage. They remained dependent upon their licensors (usually second- or third-tier international computer firms) for technology development. And in a prolonged price war such as was experienced in the late 1980s, only the largest companies with the deepest pockets would remain competitive. Clearly, IBM, H-P, and the other TNCs were most likely to dominate market sales. The local assemblers with a small capital base were extremely vulnerable.

The market manifested a significant division with the TNCs serving the medium and large business customers, while the local vendors competed for the small office and home markets. Government pressure on the locally-owned companies to increase their use of locally-produced components which tend to be lower-technology only reinforced this division in the market.

Among the Mexican companies, Printaform was the most successful. Printaform was a well-established family-owned firm selling a range of office equipment and supplies. With the help of Asian production engineers, Printaform set up an efficient production facility and the company built a leadership position in the market for low-priced IBM compatibles. Printaform's major market tended to be the small office and professional users.

Also successful among the Mexican firms was Mexel, which licensed technology from the U.S. company, Televideo. Mexel invested in basic component supply. In 1987 the company had 70% of the market for basic terminals and made power supplies as well. Mexel's long-term strategy was to supply the major international vendors.

In the on-going shakeout of the market, it was widely held that the survivors would be the major TNCs, Printaform, Mexel, and a handful of other players. Most of the locally-owned vendors would disappear altogether or be merged into larger groups. In this sense, it was believed that the same firms that dominated the U.S. market would increasingly dominate the Mexican computer market.

One final observation is the relative lack of IBM dominance in the Mexican computer market. To be sure, IBM was the dominant force here as elsewhere. However, its share of minicomputers and mainframes, at less than 40%, was significantly less than its 50% worldwide share of these markets at that time. Moreover, in large mainframes, Unisys outsold IBM in 1986 and was equal to Big Blue in terms of installed base. In microcomputers, IBM's late entry and high price meant sales far below expectations. The market clearly was not willing to pay significant price premiums for the IBM name. Several of those interviewed commented on the lack of popularity of IBM in México and attributed this to the company's "arrogance" and "lack of flexibility". It is also possible that the government via INEGI consciously sought to reduce IBM's dominance in the market by choosing an alternative vendor for government purchases whenever possible.

In microcomputers, IBM made what many regarded as a serious mistake when the company introduced its PC at prices well above the rest of the market. IBM was clearly relying on brand loyalty and reputation; however, by 1986 the market had already learned that it could do without IBM. As Francisco Thions, the president of industry analyst Infocom, noted: "The customer had time to lose the mystical concept that you had to go with large brand name vendors." And he asserted that local microcomputer assembler, Televideo, were selling products with better reliability and



service than IBM.<sup>332</sup> Thus, IBM's first year sales of micros were significantly below expectations (and production was well short of commitments to the government) and the company proceeded to reduce prices. Then, in 1987 the company discontinued the PC range when it announced the introduction of the Personal System/2 products. IBM was to manufacture two of the four computers in the PS/2 range and received permission to import the other two in exchange for increased exports. Alas, the PS/2, like its predecessor in México, was not particularly well received.

#### Industry Summary Conclusions

The Mexican computer market was small, but experienced rapid growth due to the dynamics of the microcomputer market. Minicomputer and mainframe sales were clearly sensitive to fluctuations in the economy (and consequent import restrictions) and were disappointing in the years since 1981 (with the exception of 1985). The industry at the time can best be described as a bi-lateral oligopoly wherein the few large transnationals and the government occupied dominant positions as sellers and buyer in the marketplace.

Microcomputers, on the other hand, continued to grow strongly in unit terms, though due to the price war in 1987 market growth slowed in value terms. Unlike mainframes and minicomputers, the micro segment was fragmented with no one company controlling the market; though the government remained the largest purchaser of micros. A great many Mexican firms entered this industry, but the outlook was one of consolidation and concentration with the majority of the Mexican firms dropping or selling out. The result was a market supplied by a few transnationals competing in the high value-added segment of the market, and a few Mexican firms competing for the commodity business at the low end of the market.

The 1981 policy guidelines effectively capitalized on the coming boom in the microcomputer market, but they came just a few years too late to have a clear, lasting impact. Certainly they gave impetus to growth in microcomputers by reducing

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<sup>332</sup> Author interview, March 1987.

confusion and chaos in the marketplace. Further, they created space for some small national companies to enter the industry. However, considering the computer industry as a whole, the inroads made by Mexican companies appear both small and temporary. They did not succeed in loosening the TNCs' dominant position in the industry or developing national capabilities.

The thesis turns now to a specific evaluation of the impact of the policy guidelines with respect to their four objectives. The four objectives were: to produce computer equipment at internationally competitive price and technology levels; to improve the balance of trade in the sector; to promote local technological development; and to promote the development of Mexican component suppliers. In addition, two other objectives were implicit in the guidelines: the creation of employment and the creation of national computer companies. The following review is therefore structured on the basis of these six objectives using specific restrictions and mandates in the programme as measuring rods wherever possible. Because the IBM decision marked a discontinuity in the implementation of the policy guidelines, the ensuing discussion will examine the years 1983–85 (prior to IBM's agreement) separately from the years 1985–87 when appropriate.

#### Levels and International Competitiveness of Supply

This objective can be viewed as the sum of three requirements: first, that the market is well supplied, and specifically that 70 percent of the local market be supplied with locally-made products by 1989; second, that technical quality is up to international standards; and third, that prices are within 15 percent of U.S. prices as stipulated by the guidelines.

The supply of computers was initially reduced as a result both of the programme and of the severe import controls, which were enacted just prior to the implementation of the programme. The market was initially severely constrained as it had previously been supplied almost entirely by imports. Imports fell from \$235

million in 1981 to just \$104 million in 1983. The value of actual production in 1983 was only \$20.3 million, falling well short of the original goal of \$131 million. However, this was a considerable improvement on 1981 output of locally-produced computer equipment, which was less than \$5 million. By 1985 total production had risen to \$93 million.<sup>333</sup>

While local production increased substantially, imports also increased. However, the percentage of the market supplied by imports declined markedly, from 98 percent in 1981 to 79 percent in 1985.<sup>334</sup> Thus, while imports continued to play a dominant role in the supply of the Mexican computer market, the policy initiated a favourable trend with respect to local supply. Nevertheless, the original goal of local products supplying 70 percent of the market by 1989 was unattainable.

Further with respect to supply, the market experienced very long delivery times. Again this was due partly to import restrictions on finished products, parts and components, and partly to the inadequacy of local suppliers.

Minicomputers and mainframes were sold primarily through the manufacturers' direct sales forces, though in some cases, value-added resellers or large distributors were used.

In contrast, 70 percent of microcomputers were sold through distributor networks that were nascent and fragmented. Infocom estimated that there were 800 distributors in the country in 1987. Of these, 650 were independent operators while the remaining 150 were part of larger multiple chains.

Poor distribution impeded the development of the market. Distributors were hurt by high levels of inflation and thus could not hold large inventories. This resulted in uncertainty and delays in supply and further encouraged the contraband market. Hence, although the chaotic market conditions of 1978–82 no longer prevailed, there

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<sup>333</sup> Ricardo Zermeño Gonzalez, *Op. Cit.*, 1984; and SECOFI, Dirección de la Industria Electrónica. "Estadísticas sobre la Industria de Computadoras en México", mimeo. 1987. p. 5.

<sup>334</sup> *Ibid.*, Tables 4 and 5.

remained considerable scope for rationalizing and improving distribution of microcomputers to the market.

The technical quality of the products in the Mexican market was regarded as fairly high. This was due not only to the predominance of imports; the locally-produced equipment was considered of high quality as well. One line of Unisys multi-user microcomputers manufactured in México was considered to be the most reliable made by the company worldwide.<sup>335</sup> Though there were some problems with the supply of faulty components locally, these were generally considered to be insignificant. This was partly because most of the components sourced locally were low-technology items (see Local Integration below).

International competitiveness, measured in price differentials, did not improve in the early stages of the programme. Prices remained 90 to 150 percent higher than U.S. prices following previous historical patterns.<sup>336</sup> The high prices were attributed to the local producers' lack of scale, technological dependence, and lack of experience.

After 1983 government regulation had some success in reducing prices of minicomputers and mainframes in México; however prices still remained 35-40 percent higher than U.S. prices in the late 1980s. In microcomputers, competition was a much greater factor in reducing prices than government regulation. Micros in México were, on average, 70 percent more expensive than in the U.S. in 1985. By 1988 they were generally within 15 percent of comparable U.S. prices, with the exception of newly-introduced models such as the Apple MacIntosh and the IBM PCs which were introduced into the country at a premium of 50-80 percent over the prevailing U.S. price.<sup>337</sup>

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<sup>335</sup> Author interviews with industry participants and users, January to June 1987.

<sup>336</sup> Zermeño, *Op. Cit.*, p. 14.

<sup>337</sup> Price data come from a variety of sources including author observations, Infocom and Margaret Miller, "High Technology Transfer: A Case Study of the Mexican Computer Electronics Industry." Stanford University Economics Departmental Honors Thesis, June 1986. pp. 48-49.

### Levels and Origins of Investment

The computer decree was designed to encourage investment in the Mexican computer industry, particularly by Mexican investors. The original guidelines specifically forbade majority foreign ownership in the microcomputer segment. Furthermore, foreign companies wishing to sell mainframes in the Mexican market (via imports) were required to register a local manufacturing operation with SECOFI.

When the policy was adopted all the major computer transnationals had been selling equipment and services in México for more than twenty years, except Apple, which began selling through Mexican distributors in 1978. As a direct result of the 1981 policy initiative, each of the major TNCs decided to invest in local production. However, local investments remained relatively small and contained, reflecting both the TNCs' desire to participate in the growing Mexican market, and TNC uncertainty about the Mexican economy. By far the largest fixed investments were made for export production.<sup>338</sup>

Mexican private capital also invested in the industry, participating primarily at the low end of the microcomputer market producing IBM-compatibles, and peripherals such as terminals and dot-matrix printers. However, none of the Mexican firms were backed by a major industrial or commercial group.

The programme succeeded in attracting a large number of investors in the local industry. In 1981, before the implementation of the programme, there were only four firms registered as manufacturers of computers in México. At year-end 1983 there were 58 such registered firms. Of these, 27 were registered to produce microcomputers, 11 for minis, and 20 for peripheral equipment. By 1986 there were 73 firms registered in the programme.<sup>339</sup> (See Table 8.8.)

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<sup>338</sup> IBM's \$6.6 million investment was explicitly geared for export production. Other TNC investments illustrate the point: Unisys invested \$2.2 million in Compubur, NCR invested \$500,000 in a microcomputer joint venture, and Control Data invested \$500,000 in the local production of multilayer boards in order to have access to the Mexican mainframe market.

<sup>339</sup> SECOFI, Dirección de la Industria Electrónica, "Estadísticas sobre la industria de computadoras en México," (México D.F.: SECOFI, 1987) mimeo. Table 1.

**TABLE 8.8**

**Firms Registered as Computer Manufacturers with SECOFI**

	<b>1981</b>	<b>1983</b>	<b>1986</b>
Microcomputers	2	27	32
Minicomputers	1	11	12
Peripherals	1	20	29
	===	===	===
<b>TOTAL</b>	<b>4</b>	<b>58</b>	<b>73</b>

Looking at the ownership of these registered firms, the encroachment of foreign ownership since 1983 is clear. In 1983, 25 of the 27 companies registered to produce micros were wholly Mexican-owned, while the remaining two had minority foreign partners. Five minicomputer manufacturers were 100% Mexican-owned, five were foreign-owned, and one was a joint venture with majority Mexican capital. Of the 20 peripherals producers, fifteen were financed entirely by Mexican capital, three were joint ventures with a Mexican majority, and two were joint ventures with a foreign company owning the majority share.<sup>340</sup> After the 1985 IBM decision, local ownership was no longer a part of *de facto* policy. Instead, the government used the ownership issue to bargain for commitments to increase exports. From 1986 onward, a foreign company wishing to operate a wholly-owned microcomputer subsidiary in México had to agree to export two times the value of its imports. Three TNCs committed to this: IBM, H-P, and Apple. Thus, in 1986 three of the 32 microcomputer manufacturers were wholly-owned subsidiaries of foreign companies, three were joint ventures with a majority of Mexican capital, and the remaining 26 were wholly Mexican-owned.<sup>341</sup> (See Table 8.9.)

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<sup>340</sup> Ricardo Zermeño Gonzalez, SECOFI, "La Política de Desarrollo a la Industria de Computadoras en México," (México D.F.: mimeo, 1984) Appendix Table 3.

<sup>341</sup> Author interviews with participating companies.

**TABLE 8.9**

**Origins of Capital  
Percent National Capital**

	-----1983-----			-----1986-----		
	100%	>50%	<50%	100%	>50%	<50%
Microcomputers	25	2	0	26	3	3
Minicomputers	5	1	5	na	na	na
Peripherals	15	3	2	na	na	na

na = information not available

Fixed investment increased by more than 50% from less than \$20 million in 1981 to \$31 million in 1983, and then more than doubled to \$68 million in 1985 thanks largely to the entry of Apple, Hewlett–Packard, and IBM in 1984 and 1985.<sup>342</sup> However, only \$9.6 million of the \$31 million in 1983 was invested in production; a fact that reveals the tendency of existing companies to devote the largest part of their resources to marketing and the inclination of the new investors to make the least risky investments (i.e., in selling and marketing products with licensed technology rather than in production and development capacity).

The government tried to enforce the requirement of local production, but was flexible about the nature and size of the investment and local operation. After 1986 however, some imports of finished microcomputers such as the Apple MacIntosh were allowed as "complementary product lines," contrary to the original restrictions. TNCs wishing to import finished micros had to compensate these imports by exporting three times their value. Again, this shift in *de facto* policy reflected both the desire to have up-to-date technology in México, and the growing emphasis on balancing foreign trade at the expense of local technology and supplier development.

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<sup>342</sup> SECOFI, *Op. Cit.*, 1987, Table 3.

## Balance of Trade

Not surprisingly, México experienced chronic balance of trade deficits in the area of electronics. These deficits worsened significantly in 1979–80 when computer imports increased from \$78.4 million to \$217.1 million, thus giving strong impetus to the development of a coherent policy concerning imports of computer equipment.

The balance of trade in computers improved dramatically from 1981 to 1983, due primarily to the vast reduction of imports. As noted above, imports fell from \$234.5 million in 1981 to \$104.2 million in 1983.<sup>343</sup> Not only were imports reduced, their content was modified by the programme. Prior to the programme, imports consisted almost entirely of finished computer products. In 1983 imports consisted much more of inputs for production.

Exports were also given impulse by the programme. Exports were less than \$4 million in 1981 and increased to \$25 million by 1983.<sup>344</sup> After 1983 it is in fact the sharp increase in exports that improves the trade balance as imports increased again after 1983. It should be noted that these exports came almost entirely from computer transnationals producing equipment in México under the terms of the programme (figures do not include exports from maquiladoras).

**TABLE 8.10**  
**Foreign Trade in Computers 1981–1989**  
**(\$ Current Millions)**

	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>
Exports	4	3	25	54	79	79	116	252
Imports	235	148	104	177	275	275	236	332
	===	===	===	===	===	===	===	===
Net	-231	-145	-79	-123	-196	-196	-120	-80
Exp/Imp	.02	.02	.24	.31	.29	.29	.49	.75

Source: SECOFI and IMC 1990. Figures rounded to the nearest \$1m.

Balance of trade became the central policy thrust in the late 1980s. Export commitments were actively enforced and pushed on the TNCs who, in some cases,

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<sup>343</sup> Ibid., p. 6. (Table 5).

<sup>344</sup> Ibid., p. 6. (Table 5)



took to exporting non–electronic items to generate foreign exchange. TNC exports grew as a result: from \$25 million in 1983 to over \$116 million in 1987.<sup>345</sup> The primary market for these exports was the United States.

Indeed, the computer transnationals unanimously agreed that México offered a good base for exports. Labour costs in México were lower than in the Far East and proximity to the United States facilitates managerial control and lowers transportation costs.

While the government pressured TNCs to export, it pushed locally–owned companies to improve their foreign currency balance primarily by increasing local content. Such a two–pronged strategy seemed to work as the export–import ratio improved from 24% in 1983 to 49% in 1987. However, the strategy destined the locally–owned companies to the low–end of the market as the local suppliers were unable to provide many high–technology components.

The rapid rise of imports was a worrying trend for policy–makers, however. Clearly improvements in the overall trade balance would be difficult to sustain unless the manufacturers incorporated a greater amount of Mexican–made parts and components in their equipment.

#### Investment in Research and Development

The programme required participating companies to spend three to six percent of their local sales on research and development. In the years just after the programme was enacted, levels of investment in local research and development in computer electronics were extremely disappointing, especially given the importance of these investments to the development of national capabilities in computer technology. The programme envisaged an investment in R&D on the order of \$18.5 million in 1983. The actual amount spent was just \$1.9 million, barely 10% of the amount projected.<sup>346</sup>

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<sup>345</sup> Ibid.

<sup>346</sup> Zermeño, Op. Cit., (1984) p. 22, (Table 4).

In addition to other problems stemming from the difficult economic situation existing during 1983, these figures demonstrated that the policies for the development of a national technological capacity encountered stubborn resistance from foreign TNCs, which maintained central R&D facilities in their home countries.

All of the companies interviewed insisted that they were spending the required 3–6% of sales on local research and development efforts. However, aggregate figures for the industry indicated that only \$10 million was spent on R&D in 1985—a fraction of 1% of industry sales.<sup>347</sup>

The division of responsibilities within SECOFI for monitoring R&D expenditures inhibited enforcement of this requirement. Zermeño's office was responsible for monitoring the level of expenditures while the Office of Foreign Investment and Technology Transfer monitored how the money was spent. There was little, if any, coordination between the two offices. Thus, while the requisite amount was spent, much of the so-called R&D investment was in fact dedicated to market development (e.g., customer education, donations of equipment to educational institutions, etc.)

Interestingly, the Office of Foreign Investment and Technology Transfer was headed by Undersecretary Adolfo Hegewisch who strongly supported foreign investment in the computer industry and approved the IBM decision against the wishes of the Office of the Electronics Industry. While Hegewisch's office was concerned to promote foreign investment in this sector, it was not as enthusiastic about ensuring investment in local research and development projects. Hegewisch's close relationship with President De la Madrid meant that any protests from the Office of Electronics Industry fell on deaf ears.

#### Levels of Local Integration

The computer decree required local content to increase from 25 to 35 percent in minicomputers, and from 35 to 45 percent in micros. Initially, actual figures were

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<sup>347</sup> SECOFI, *Op. Cit.*, (1987), Table 6; and Infocom. "The Mainframes and Minicomputers Markets", April 1987, México, 1987. p. 11.

somewhat lower than this. It was estimated that nationally manufactured components accounted for 20% of the direct cost of the finished products and 30% of the cost of the parts used in their production.<sup>348</sup>

At first the levels of local integration improved, however, and there were other encouraging signs. Other branches of the electronics industry (i.e. passive components) began to sell the majority of their products to the producers of professional electronic equipment. This was a significant change from previous historical patterns, when most of these passive components were being purchased by the consumer electronics industry. Further, several of the transnationals established international purchasing offices whereby they could export parts and components manufactured by "qualified suppliers" to subsidiaries in other countries. Hewlett-Packard and IBM both established such offices. Indeed, it was in the interest of these two companies in particular to encourage exports of this type given their commitments to the Mexican government in this regard. Further, in-bond assembly plants (maquiladoras) established by computer TNCs to produce electronic components were allowed to sell a portion of their production in the internal market in addition to supplying the export market, which was their original role.

Though formal levels of local content were increasing, it was generally admitted that supplier development was very disappointing indeed. Locally-sourced components tended to be low-technology commodity items such as harnesses, cables, and low-resolution terminals. Computer manufacturers, both foreign and Mexican alike, complained of long lead times and low quality from local suppliers.

The slow development of component suppliers was partly due to the economic crisis, the high levels of fixed investment required, and uncertainty about the persistence of the industrial development policy, which was crucial to the survival of most local suppliers. However, it also can be attributed in part to the common practice of component purchase agreements as a form of technology licensing. In

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<sup>348</sup> Zermeño, *Op. Cit.*, (1984), p. 15.

these agreements the national company agreed to purchase certain vital components exclusively from the foreign technology provider in exchange for assistance in setting up assembly and testing operations and exclusive marketing rights in México. These arrangements clearly inhibited improvements in the sector's balance of trade.

Indeed the government shifted its emphasis with regard to local integration, due partly to the failure of supplier development and partly to the strong emphasis on exports. The government moved to emphasize local *process* rather than local *content*. That is, the Office of Electronics Industry in SECOFI was concerned that manufacturing processes take place on Mexican soil even if the components used were not made in the country. However, given that the import of finished microcomputers was allowed after 1986, local integration, whether measured by local content or process, did not improve. The percent of national integration in the production of computers almost halved from 10.5% in 1983 to 5.8% in 1987.<sup>349</sup>

The existence of a strong contraband market meant that the government was unable to require local integration that was fundamentally uneconomical. Nevertheless, it is arguable that the government should have placed more emphasis on the local production of components as the most basic way of developing a technology base in electronics and as a way of improving the balance of payments. Given the high risk involved, however, the government of México would have had to commit its own resources to such a project rather than relying solely on local private investors.

### Creation of Employment

The number of new jobs created in the industry was impressive. Total employment in the industry grew from less than 1,600 in 1981 to 5,160 in 1985. Furthermore, direct employment—that is, employment in production and development grew from less than 30 to 2,657.

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<sup>349</sup> Arturo Borja, El estado y el desarrollo industrial, Centro de Investigación y Docencia Económicas, México D.F. 1995.

**TABLE 8.11**

**Employment in the Mexican Computer Industry**

	<b>1981</b>	<b>1983</b>	<b>1985</b>
Direct Employment	<30	1,162	2,657
Indirect Employment	<1,570	1,609	2,503
	=====	=====	=====
<b>TOTAL EMPLOYMENT</b>	<b>&lt;1,600</b>	<b>2,771</b>	<b>5,160</b>

Of the 2,771 jobs in the industry in 1983, only 400 were in the areas of assembly and testing, 762 were in development and engineering, and 1,609 were in sales, administration, and other activities.<sup>350</sup>

The growth in employment naturally came from the growth in the microcomputer sector. Of an estimated 2,500 employees in this sector, 1,500 were involved in manufacturing, 625 in sales and marketing, and 375 in administration.<sup>351</sup>

In summary, the primary success of the computer industrial development programme was limited, with only the improved balance of trade objective clearly met. Balance of trade in the sector improved as the programme restricted imports and enforced export commitments from TNCs. And the programme helped to generate professional/technical employment opportunities in the sector. In addition, the programme established some order in a chaotic market, facilitated the market entry of national players, and prompted initial technology transfer through domestic/foreign joint ventures and licensing agreements. As a result, computer production expanded to meet local market needs, but prices remained significantly higher than international standards.

The policy thus succeeded in areas where required investment was small—the market presence of national companies licensing technology, assembling, and selling micros—and failed where the stakes were higher—component supplier development

<sup>350</sup> Zermeño, *Op. Cit.*, (1984), p. 22. (Table 4)

<sup>351</sup> Infocom, *Op. Cit.*, (Microcomputers).

and investment in basic research and development. The fact that the government was unable to sustain the policy as it was originally formulated undermined the confidence of the already skittish Mexican investor that a long-term investment in technology would pay off. Thus, Mexican firms remained technologically dependent and were increasingly losing ground to the wholly-owned TNCs in the microcomputer market.

In the context of a macro-economic policy of trade liberalization, the challenge for the proponents of the programme was to maintain some bargaining power vis-à-vis the foreign computer companies. Day to day policy still rested with the Office of the Electronics Industry in SECOFI. There was little support from above for industrial development programmes; but there was support for export initiatives. Zermeño made good use of even the weakened programme to force hefty export commitments from the TNCs. Policy strategy moved increasingly to a system of differential tariffs whereby components destined as inputs to manufacture could be imported at very low duty, while SKD kits carried higher tariffs, and finished products higher tariffs still.

### **Summary and Conclusions from the Mexican Case**

Following is a summary of the salient characteristics of the process that led to the formulation of a nationalist computer industry development programme, and the subsequent implementation of a substantially watered-down version of the original initiative.

Firstly, the dynamic and vital nature of the computer electronics industry provided a general motivation for the development of a coherent industrial policy for the sector. However, the specific impetus for the policy initiative was a concern for the rapidly deteriorating balance of trade in computers.

The rapid growth and change in the industry provided the policy-makers some leverage with which to develop a domestic computer industry. In particular, the advent and rapid growth of the microcomputer, along with its lower capital and technological barriers to entry, gave the government of México a point of entry into the broader computer electronics complex. The primary technology associated with

microcomputers—the integrated circuit or chip—was readily accessible from a great number of firms the world over on a commodity basis. Further, the large number of small microcomputer manufacturers, particularly in the United States, comprised a large "pool" of potential sources of product and process technology available to the Mexican industry. Indeed, all of the successful Mexican microcomputer vendors purchased technology from these rather smaller players in the U.S. industry who were not interested in setting up production facilities in México themselves. Thus, competitive fragmentation at the low end of the computer market provided the Mexican state policymakers with enhanced bargaining leverage.

The original guidelines, in their opening paragraphs, noted the relatively small size of the Mexican computer market. Yet they emphasized the potential size of the market and México's attractiveness as a base from which to export to the United States and the rest of Latin America.<sup>352</sup> Indeed the Mexican market for microcomputers largely fulfilled its growth prospects despite the difficult economic climate in the country in the 1980s. The private Mexican investors focused their investment in this segment of the industry. However, the transnationals were lured more by the potential for an attractive export platform than by the potential for growth in the local market.

Next, the academic/technical elites were able to influence computer policy in large part because of the complexity inherent in the sector. Lacking the specific technical competence within the government bureaucracy, José Warman and Ricardo Zermeño were brought in from the outside and given substantial scope to formulate policy within the broad guidelines of the ambitious National Industrial Development Plan. In this respect, the opportunity for competent and committed elites to influence high technology policy may be a general one.<sup>353</sup> It certainly applied to both México

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<sup>352</sup> SEPAFIN, *Op. Cit.*, pp. 1–2.

<sup>353</sup> Again, one might argue that José Warman's entree into the government bureaucracy was not a general one as he was hired as a consultant by his brother Natán. However, Zermeño and Montoya in INEGI are examples of real "outsiders" who attained positions of influence.

and Brazil. In that sense, national computer policy was managed by people who embodied important aspects of the developmental state ideal: meritocratic competence and civil society embeddedness.

In México, the lack of specific policy direction from the highest levels of government expanded the opportunity from influencing policy content to implementing policy. However, Warman and Zermeño were unable to develop a broad political consensus for their policy objectives, either within the government bureaucracy or in the private sector. They were initially more successful at striking favourable bargains with computer TNCs than they were inside their own state apparatus.

The policy opportunity was limited by a number of factors. First there was the historical domination of the local computer industry by the transnationals. Related to this TNC dominance was the lack of Mexican technological capability. Specialist training was largely carried out by the computer TNCs themselves; training that was geared to developing competent users, sales and maintenance personnel—not researchers and designers. The Mexican national education system was unable to attract and maintain a critical mass of academic research staff and most of the students who were attracted to the various courses did not finish them. Furthermore, the training and research that was going on was not closely integrated with the needs of industrial production. This chronic gap in specialist training in the national education system had two salient results. One is the desperate shortage of skilled Mexican computer scientists capable of generating and sustaining a national technology base. The second is a shortage of academic elites with a personal interest in the development of a national computer industry with its consequent opportunities for basic and applied research. Hence, while academic elites were able to influence policy formulation and implementation, they were too few in number and too dispersed to form a strong, coherent lobby for a nationalist computer policy.

Even had there been such a strong lobby, it is not clear that the lobby would have been effective in México. The sphere of effective political influence was fairly



wide at the implementation stage, so long as the exercise of this influence did not conflict with the objectives of the presidency. Contrasting the government's treatment of Apple and IBM sheds some light on this. Zermeño's office put considerable pressure on Apple to comply with its export commitments and ultimately closed the borders to the company forcing its exit from the Mexican market. In this case, Zermeño's office successfully exercised power and influence. However, in the case of IBM, the influence of the same office was limited. Here, Warman and Zermeño opposed an investment that promised to deliver substantial exports and send a favourable signal to foreign investors and the country's international creditors. Thus, where there was a conflict of fundamental objectives, the sphere of effective political influence narrowed to the president and his closest advisers. After 1982, the proponents of the programme no longer had a sponsor inside this sphere.

In a number of ways, the policy suffered simply from bad timing. While the development of the international computer industry provided an opportunity for successful policy in this area in the late 1970s and early 1980s, conditions in México after that time limited the opportunity. In particular, the change of government administrations and the severe economic crisis conspired against the policy and its effective implementation. The policy was formulated at the end of the expansionist oil-rich years of the Lopez Portillo administration. Approval for the policy was sought during the tumultuous final months of Lopez Portillo's presidency when government ministers and civil servants were concerned with their positions in (and outside) the incoming government. Implementation of the policy was attempted in a climate of economic crisis. De la Madrid purged his cabinet of nationalist/expansionist influence and pursued a broadly free-market economic policy that favoured foreign investment, emphasized industrial efficiency, promoted manufactured exports, and limited government spending. Clearly a policy that aimed to protect a nascent domestic computer industry was not compatible with the macro objectives of the new administration.

Furthermore, the U.S. computer industry, via the U.S. Department of Commerce added its voice of concern about the policy to those within the new Mexican administration at this sensitive time.

In this context, Warman and Zermeño were able to generate little ideological enthusiasm for their nationalist programme. Thus, while the nationalist elites successfully influenced the country's computer policy in both its formulation and implementation, their influence was ultimately limited by their inability to generate committed political support: (i) at the cabinet level after the change of administrations; (ii) from INEGI, which failed to offer consistent support through government procurement and purchasing power; and (iii) from large private industrialists who were (rightly) unconvinced of the government's commitment to the programme and were more concerned with product quality and price than with the development of indigenous capability in computers.

The IBM decision simply manifested the fundamental weakness of political support for the programme at the time. The decision serves as a salient reminder that (a) the state is not a monolithic negotiator; and (b) the bargains struck inside the state itself (the bargaining game-within-the-game) often prove decisive. One must therefore be cautious in a discussion of relative bargaining power and bargaining gains and losses. The state is a more diverse and complex actor than the TNC in the bargaining game. This complexity can work in favour of the state, making it difficult for the TNC to appreciate fully the politics in the government bureaucracy. However, the diversity can work in favour of the TNC to the extent the company is able to play the objectives of one part of the state against those of another. IBM did this successfully by applying pressure from the moment the policy was written, and then enlisting the support of the U.S. government for the company's strategic aims.

There was a shift of dependency, as the government capitalized initially on the characteristics of the microcomputer market. There was some import substitution in micros, with most assembly and testing transferred inside the country. And private local capital staked out a position at the low end of the market. However, the shift fell

well short of the technology development objectives envisaged by the programme in 1981. Even in micros, the industry remained dependent upon foreign technology in components, particularly semiconductors. And the TNCs' position in the mini and mainframe markets was never threatened.

Inasmuch as the objectives of the policy were subsequently narrowed to improving balance of trade in the sector and ensuring an efficient supply to the local market, the policy had greater success. However, these trade balance gains are vulnerable as long as the country would fail to develop local component suppliers.

In sum, the combination of several exogenous factors<sup>354</sup> created an opportunity for México to alter its position with respect to the international computer industry: the growing importance of the industry; the dynamic growth of the microcomputer segment; the accessibility of microcomputer technology; and México's local market potential and attractiveness as an export base to the U.S. and Latin America. However, several important factors limited the extent to which the country would capitalize on the opportunity: the historical dominance of the Mexican market by the computer TNCs; the lack of a critical mass of computer scientists and engineers; the change of administration and loss of nationalist support for the policy at cabinet level; the economic crisis, which limited the scope for direct government investment in the industry and conditioned the de facto objectives of the programme, narrowing them primarily to balance of trade considerations; the mounting pressure from the TNCs led by IBM with the active support of the U.S. government.

The interaction of these factors that opened up and subsequently limited opportunities for the development of a national computer industry should not be viewed mechanically, however. A strongly committed and united Mexican state could have overcome the obstacles encountered by offering a strong lead to private industry. This lead could have been given through a proactive procurement policy and direct investment in the industry, perhaps in components. The government's failure to

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<sup>354</sup> By "exogenous factors," the author means those things outside the country's influence. The fact that México didn't create the opportunity for itself is important. Policy in this area has continued to be reactive to external forces and conditions.

provide such a lead can be attributed to the short-term outlook of the leadership (e.g., in the failure of the education system), the self-interested nature of the state bureaucracy (in its procurement policy that failed to give consistent support to the nascent Mexican industry), and/or simply to the interaction of changing priorities and limited resources. As a result, proponents of a national computer industry in México were unable to generate the political will within the state bureaucracy to overcome the obstacles they encountered.

## CHAPTER 9

### AFTERWORD:

#### SUMMARY OF DEVELOPMENTS IN THE MEXICAN CASE SINCE 1990

This chapter summarizes the key developments in the Mexican case since 1990 when President Salinas eliminated the important elements of the computer development program enacted eight years earlier. The pattern for state policy and the future development of the industry was set in the 1990s and changed little after that, so this chapter will look most closely at the years immediately following the shift in policy. It begins by reviewing the shift in policy itself before moving on to describe the evolution of the informatics industry in México. This chapter concludes with observations about the legacy of the market reserve policy and its implications for host country – TNC bargaining.

#### **Policy Development: Big Bang Liberalization**

The Computer Electronics Development Program formulated in 1981 set out four basic objectives: (i) to promote technology development, linking in-country production with R&D centers; (ii) to produce internationally competitive computer equipment for the local market; (iii) to promote exports while reducing imports; and (iv) to promote the development of Mexican component suppliers. Foreign capital was limited to minority interest in microcomputers, peripherals and component operations. Local content requirements were set. Companies registered with the program were given preferential treatment for government procurement contracts, but they had to invest a percentage of their sales to fund the creation of research centers and training programs. Import quotas and tariffs were established to ensure priority was given to national production.

As demonstrated in the original case material, by the late 1980s the policy's actual objectives diverged from those outlined in the written policy. In practice, the policy emphasis had already shifted away from promoting the development of an integrated local informatics industry to the development of a competitive electronics export base.

Following his disputed election victory in 1988, President Salinas de Gotari accelerated the structural reforms and liberalization initiated by his predecessor Miguel de la Madrid. Beginning in 1990, Salinas lifted most restrictions on trade and foreign investment as part of the liberalization program. The government slashed average import tariffs from 29% to 10% and eliminated import licenses on all but 5% of products coming into the country.<sup>355</sup> Salinas privatized Telmex, two national airlines and the four largest banks. In fact, he oversaw a huge privatization program, selling, closing or merging 75% of the 1,155 parastatals in the country.<sup>356</sup> Tax reforms were enacted and public spending cut to address the deficit.

Restrictions on foreign investment were lifted under a new Foreign Investment Law in 1993 and trade barriers were further lowered under a new Foreign Trade Law. As a result, investor confidence soared. Foreign investment inflows grew fourfold in two years, from \$3 billion in 1989 to \$12.2 billion in 1991. Salinas then successfully anchored the liberalization policies with the adoption of the North American Free Trade in January 1994.

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<sup>355</sup> Knecht, Peter, series ed. Background Notes: México 1991. (Washington D.C.: United States Department of State, Bureau of Public Affairs, Office of Public Communication, 1991).

<sup>356</sup> Ibid.

In the context of these sweeping liberal market reforms, Salinas took specific steps to open the Mexican computer market. In 1990 import permits and quotas were eliminated entirely. Initially, import tariffs that were largely consistent with the original program remained in force: 20% maximum import tariff for finished products, 15% for parts and 5% for components with high-technology content. The import tariffs were reduced later in the decade. PCs attracted a 12% import duty under NAFTA in 1994 until the tariffs were eliminated altogether in 1998. R&D investment requirements were dropped and all companies were given access to government procurement contracts.

While lip service was paid to industry promotion at various times throughout the 1990s, the market was open and the industry was largely left to its own devices. Ernesto Zedillo was elected president at the end of 1994 and called for the development and exploitation of information technology as a national goal. He adopted a "Plan for the Development of Informatics" that sought to promote IT use, human resource development, R&D, the development of a local IT industry to exploit niche opportunities, improvement of the telecom infrastructure, and the creation of a legal framework to protect intellectual property. The Plan had little impact, however. The new informatics plan contained no new funding and assigned no pilot agency to ensure coordination among institutions that would be involved in its implementation.

The result was various ad hoc attempts to support the development of local suppliers to the large foreign electronics companies. SECOFI with the support of two development banks - Banco Nacional de Comercio Exterior and Nacional Financiera

provided capital to local suppliers.<sup>357</sup> In Jalisco – the center of México’s information technology cluster – a separate organization was created in early 1998 named Electronics Industry Production Chain (CADELEC). CADELEC sought to promote the development of local suppliers to the large electronics companies operating in that state. However, efforts were uncoordinated, funding was limited, and an overarching strategy was completely absent.<sup>358</sup>

### **Industry Development: Rapid Adjustments**

How did the Mexican computer industry develop following the Big Bang liberalization of 1990 and the subsequent adoption of NAFTA in 1994? Interpreting the results is complicated by the peso crisis and recession of 1994-95, but a survey of the industry over the whole decade provides a clear picture.

Continuing its general direction of travel since the IBM decision in 1985, México’s computer industry developed into an export platform for the US market, dominated by large, foreign TNCs. Production focused on assembly activities using imported high-tech components. Subsequently, NAFTA encouraged foreign producers to supply their Mexican assembly plants from México rather than import parts and semi-finished inputs from Asia. As a result, México has seen rapid growth in the production of circuit boards, cables, connectors and other parts, with the exception of semiconductors and disk drives.

While the consumer electronics industry clustered near the U.S. border, the computer industry’s primary locus is Jalisco (Guadalajara) where IBM established its

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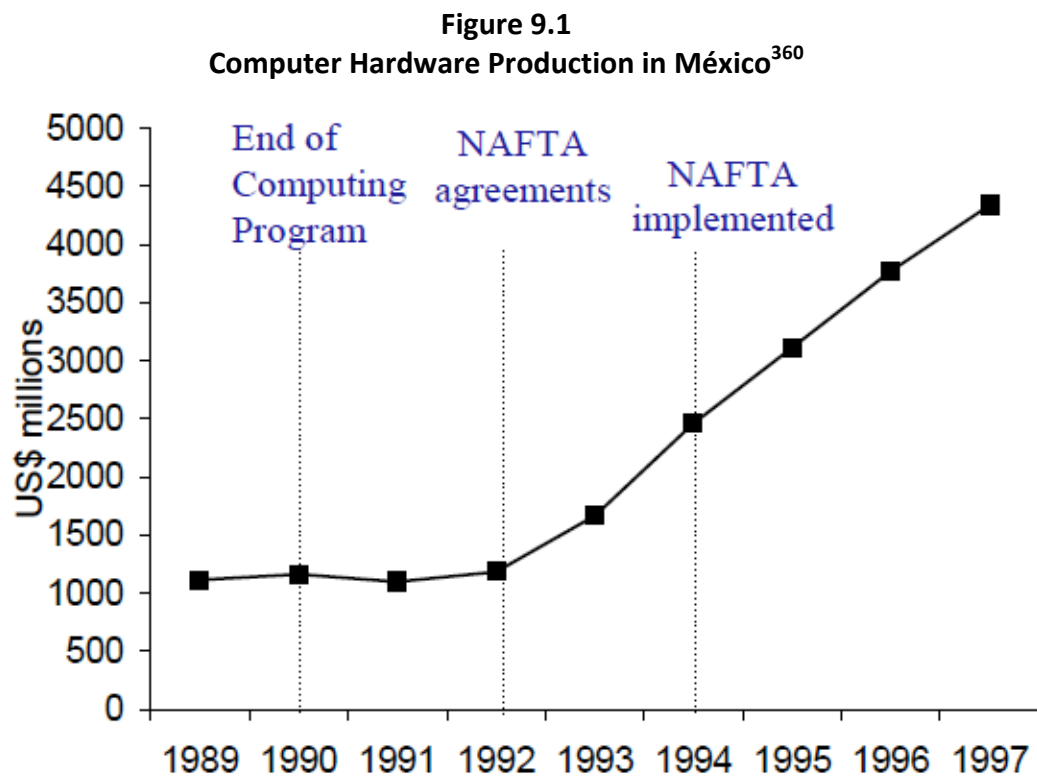
<sup>357</sup> In a sense, NAFTA generalized some of the principles of the maquiladora program throughout the country.

<sup>358</sup> Jason Dedrick, Kenneth L. Kraemer and Juan Palacios, Impacts of Liberalization and Economic Integration on México’s Computer Sector, Center for Research on Information Technology and Organizations, University of California, Irvine, CA, January 2001.



production facility. This region produces two-thirds of the nation's computer output and was home to 120 companies employing 50,000 employees in the late 1990s.<sup>359</sup>

Figure 9.1 below shows that computer production in México remained flat during the transition period of 1989-91. It then expanded rapidly from \$916 million in 1991 to \$2.9 billion in 1997, excluding maquiladora production. If maquiladoras are included, production of computer hardware exceeded \$4.5 billion in 1997.



Sales of personal computers – the part of the market that had been hitherto reserved for local majority-owned firms – amounted to 250,000 units in 1990. After the market was opened, sales grew at about 20% per year up to 1994 to roughly

<sup>359</sup> IBM alone accounted for 10,000 of these employees at the time. Dedrick, Kraemer, Palacios and Tigre *Op. Cit.* (2001), p. 1208.

<sup>360</sup> Source: Reed Electronics Research, Yearbook of World Electronics Data, cited in Dedrick, Kraemer and Palacios, *Op. Cit.* (2001), p. 33.

500,000 units. After a dip in 1995 resulting from the peso crisis, annual sales accelerated to nearly 1.4 million units by the end of the decade.<sup>361</sup>

The top PC producers were all foreign. By 1998, Compaq was largest with a 21% share of the market. IBM was second with a 13% share. Acer was third and HP fourth with 11% and 10% shares of the market respectively. Printaform, one of the few national success stories under the Computer Development Policy of the 1980s clung to a 0.4% share of the market in 1998. After liberalization the company survived primarily by producing office equipment.

Lanix, a private Mexican company established in 1990, produced its first PC in 1995. By 1998 Lanix held nearly 3% of the market. Lanix has continued to grow and diversify its product range, manufacturing under its own brand as well as under private label contracts, and is now easily the largest Mexican consumer electronics manufacturer. In 2005, the company had more than 11,000 employees and was exporting to other markets in Latin America.

Post 1990, with lower tariffs and expanded production, prices fell. As a result, the 3,000 assemblers of so-called white box PC clones and components were the biggest losers during the 1990s. Their market share plummeted from an estimated 70% in the late 1980s to 21% in 1998.

In 1998, 91% of packaged software was imported while customized software and services were largely developed in México.<sup>362</sup> Softek, a Mexican firm founded in 1982, became the largest player in this segment with 2,000 employees and \$50 million

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<sup>361</sup> IDC data, cited in Dedrick, Kraemer, and Palacios, *Op. Cit.*, (2001): 19.

<sup>362</sup> US Department of Commerce, 1998.

in sales in 1997. The company developed a very successful “near-shore” data processing service with increasingly global reach.

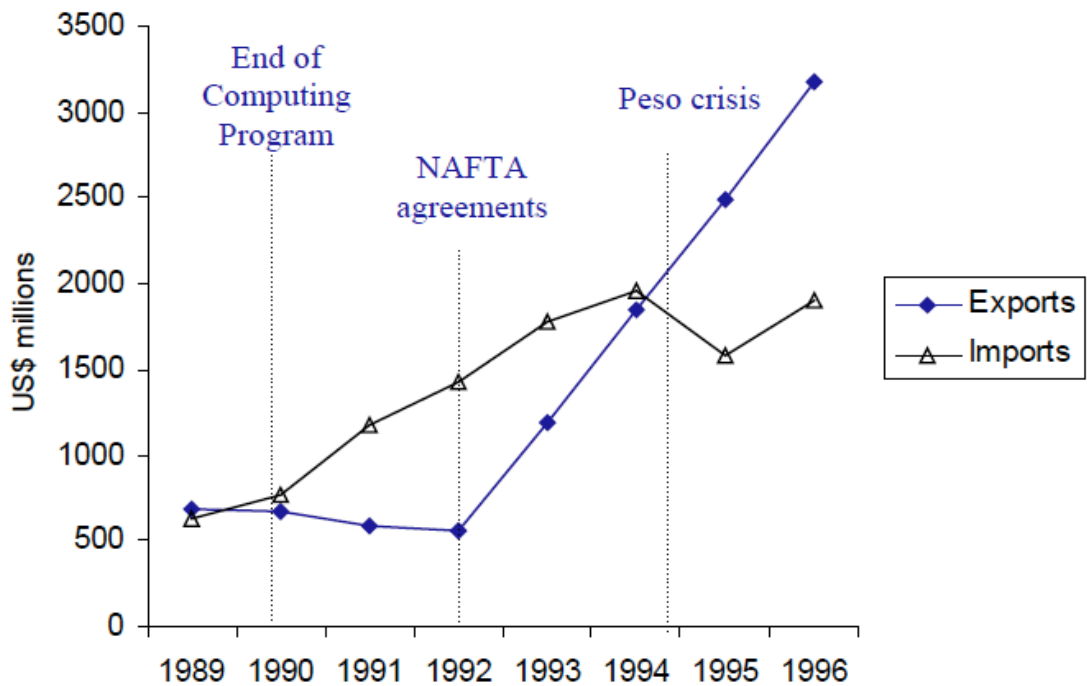
After the government opened up the informatics market, new foreign players entered and imports grew rapidly. The peso crisis and recession of 1995/6 halted the growth in imports, albeit temporarily. What is more striking is the development of exports. Exports actually declined steadily from 1989 to 1992, while imports grew sharply. This seems natural considering that this period saw a large number of new foreign entrants establishing and then ramping up production facilities in México post liberalization. Once production was established, exports began to grow and received a big boost from the NAFTA accords and the peso devaluation (see Figure 9.2). According to SECOFI, PC exports increased from \$553 million in 1990 to \$3.8 billion in 1997.<sup>363</sup>

Since 1990, IBM diversified production at its plant in Guadalajara. By removing concerns about export quotas or local content requirements, liberalization allowed IBM de México to play its natural role in the company’s global production and supply chain network. In the 1990s, IBM diversified production in México to include desktop and laptop PCs, PC servers and disk drives. Employment expanded to an estimated 8,000 workers in 1998. The company has invested in the development of México-based suppliers (local and foreign-owned). In 1998, the company was reported to be sourcing components from 25 México-based suppliers among the 200 companies supplying IBM de México.

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<sup>363</sup> "Estadísticas sobre la Industria de Computadoras en México." Secretaria de Comercio y Fomento Industrial, Dirección de la Industria Electrónica. México D.F.: SECOFI, 1998.

**Figure 9.2**  
**México's Trade in Computer Hardware**<sup>364</sup>



In 1999 IBM took the decision to expand its manufacturing facility in Jalisco to include tape and disk drives that were previously made in California.<sup>365</sup> The expansion was reported to create 2,750 jobs. In the late 1990s IBM employed a team of 150 software engineers focused on its AS/400 product line and acquired TecnoSys, a customized applications software firm, to expand IBM's service to customers in México.

The development of Hewlett Packard's operations in México followed along similar lines. In 1989, HP's Mexican operations assumed global responsibility for line impact printers. In 1992, HP México began doing final assembly and distribution of personal computers for Latin American markets. On the heels of NAFTA, HP México

<sup>364</sup> Source: Reed Electronics Research, Yearbook of World Electronics Data, Dedrick, Kraemer and Palacios, *Op. Cit.* (2001): 32.

<sup>365</sup> "IBM Begins Layoffs at Disk Drive Operation in San Jose, Calif." *San Jose Mercury News*, June 25, 1999.

diversified production as a regional manufacturing center. By 1998, HP's Mexican operations took prime regional responsibility for the company's rapidly growing and very profitable range of printers. The company's Mexican operations weren't confined to production, however. At this time the company had 35-strong engineering team that had generated 15 patents and seven products for five different printer platforms.

In summary, since liberalization and the adoption of NAFTA, México has become an integral part of the global supply chains of large informatics TNCs with a focus on furnishing the US and Latin American markets. Correspondingly, exports have expanded rapidly resulting in a positive balance of trade in the sector. Computer production in the country has expanded rapidly with competitive technology and price levels. However, most of the local players that began operations under the 1981 Computer Development Plan have been squeezed out; the market is concentrated in the hands of the large TNCs. In fact, the one player that seems to have thrived (Lanix) only began *after* the policy had been abandoned. An impressive industry cluster has developed around Guadalajara, expanding employment of technicians and managers in the process, but the industry remains reliant on imports of high-tech components.

### **Concluding Observations**

To borrow Evans' nomenclature and apply it to the Mexican case, the state played the role of midwife with respect to the national computer industry from 1981-86 (to be generous with the timescale), with some modest success. Operating with only half-hearted support from above, the policy implementers can be credited with the growth in the number of companies manufacturing microcomputers, minicomputers and peripherals in México. Under the policy guidelines, two-thirds of

those companies were financed with Mexican capital, while the remaining third were joint ventures that were majority Mexican-owned.

The Mexican state never attempted anything resembling “husbandry” after playing the midwife role for those few years. The result wasn’t a stillborn national industry, but the local players were competitively fragile. They were largely assembling and selling outdated technology at prices that were 50-75% higher than the international standard.

In addition to being economically vulnerable, the national industry was politically exposed. As has been explained in previous chapters, the IBM decision and the results that followed seem well explained by classic bargaining theory. In this case, longer hindsight only confirms what was apparent in the late 1980s. Apart from establishing some order in a chaotic market, assisting the balance of trade and generating employment, policy successes were limited to modest and temporary bargaining wins with IBM, HP and Apple.

Few Mexican players survived market liberalization. As in the case of Brazil, the state cannot take credit for those few exceptional local players that thrived in the competitive marketplace. The success of Lanix and Softek owes more to the entrepreneurial talent of the founders and managers than to anything the state did or didn’t do.

México’s location next to the world’s largest IT market and its membership of NAFTA provide rare advantages. The rapid and sustained increase in exports and corresponding balance of trade surplus in the sector reflect those advantages. Nevertheless, the government has not sought to fully capitalize on the position. There has been no proactive, coordinated, funded national strategy to develop

infrastructure, human capital or the technology base to support the national informatics industry. The industry has developed largely according to its own global commercial logic. Production has indeed expanded enormously in México, accelerated by the general industry practice of global sourcing and regional production to keep up with ever-shorter product cycles.

The Mexican state's free market policies helped the country participate in the global computer industry. But the hands off approach has not been sufficient to fully capitalize on the unique position the country has as a result of the industry dynamics and the country's proximity to the US.

## **CHAPTER 10**

### **SUMMARY AND CONCLUSIONS**

The central objective of this research project is to explain the policy initiatives followed and the factors that explain different policy outcomes in the two cases considered, thereby deepening our understanding of host country – TNC bargaining, emphasising country-specific factors. The thesis thus addresses itself to four tasks in order: (i) to describe the Mexican and Brazilian experience with the international computer industry during the 1970s and 1980s; (ii) to evaluate the results of Mexican and Brazilian government policy in this sector in light of the policies' objectives; (iii) to explain the relative success or failure of the policy initiatives; and (iv) to draw relevant implications for theories of host country – TNC bargaining. The preceding chapters have addressed the first three 'tasks' in detail, analysing the cases sequentially. The purpose of this concluding chapter is to address the fourth objective, considering the implications for host country – TNC bargaining.

This chapter begins with a side-by-side summary of the two cases, focusing on the market reserve policy (objectives, content, support and duration), the role of the state, the response of domestic and foreign capital, and finally, the impact of the policy while in place and its lasting legacy. Preceding chapters have discussed these points in detail but it is a helpful reminder to see the main features of the two cases side by side. The chapter then reprises the primary tenets of the bargaining model before drawing implications for host country – TNC bargaining from the two cases studied. In light of the extraordinary difficulty of directing the development of such a hyper-dynamic globalised sector, the chapter concludes by suggesting a potentially more effective – and practical – catalytic role that developmental states might play to achieve their objectives.



**Table 10.1**  
**Summary Comparison of Cases**

	<b>Brazil</b>	<b>México</b>
<b>Reserve Policy Objectives</b>	<p>Control the process of informatization in the country.</p> <p>Develop Brazilian capability to ensure design, development and production in Brazil.</p> <p>Create professional jobs in the sector.</p> <p>Limit market share of TNCs to ensure a leading position for national companies.</p> <p>Achieve favourable balance of trade.</p> <p>Create opening for the development of parts and components industry.</p>	<p>Promote national technological development linking producers with R&amp;D centres.</p> <p>Produce computers for the local market that are internationally competitive in price and technology.</p> <p>Develop Mexican component suppliers (horizontal integration).</p> <p>Promote national computer manufacturers.</p> <p>Create employment.</p>
<b>Policy Content</b>	<p>Began by reserving minicomputers to national players, allowing single round of technology licensing.</p> <p>Later, extended the reserve to superminis, microcomputers &amp; software.</p> <p>Established import restrictions and quotas.</p> <p>Fiscal incentives for investment in R&amp;D, training and components (microelectronics).</p>	<p>Mainframes and minicomputers open to 100% foreign ownership.</p> <p>Foreign capital limited to minority interest in microcomputers, peripherals and component operations.</p> <p>Local content requirements.</p> <p>Registered companies given preference for government procurement.</p> <p>Required investment in designated R&amp;D centres and technical training.</p> <p>Import quotas and tariffs set.</p>
<b>Policy Support</b>	<p>Broad and deep support for the policy until the late 1980s: military concerned with national security, sector technocrats concerned with professional opportunity, large domestic capital groups, especially banks, attracted by the market opportunity.</p> <p>Policy became a national priority.</p>	<p>Support limited to the sector technocrats who drafted the policy and were charged with its implementation and beneficiaries of the policy.</p> <p>Political support undermined by change of administration and financial crisis.</p> <p>No interest from large domestic industrial groups.</p>
<b>Policy Duration</b>	<p>16 years: 1977 to 1992, though in practice the policy began to be eroded in the late 1980s so was in full force for c. 14 years.</p>	<p>4 years: 1982 to 1985 (post-IBM decision), though a few tenets of the policy remained in force longer.</p>

<p style="text-align: center;"><b>Role of the State</b></p>	<p>Regulator via CAPRE and SEI, managing scope of the reserve, technology licensing, import quotas, etc. Direct participant via ownership of Cobra. Creator and manager of “greenhouse conditions” for local capital. Large domestic buyer with ambiguous purchasing practices.</p>	<p>Regulator via SECOFI, seeking to enforce policy restrictions and offering incentives (e.g., financing, fiscal credits, etc.) Largest domestic buyer seeking best products at best price.</p>
<p style="text-align: center;"><b>Response of Domestic Capital</b></p>	<p>Domestic capital was reticent at first to participate in state flagship, Cobra. Large domestic finance and industrial groups were enticed into the market over time. Late 1980s, leading domestic players entered into licensing agreements and JVs with the TNCs, trading protection from the state for access to finance and technology. Large users of informatics, concerned about inflated prices and outdated technology arrayed against the reserve.</p>	<p>Few large domestic groups were enticed to invest (exceptions: Banamex and CCI). A number entered into majority JV partnerships with large TNCs (H-P, Burroughs, Apple). More licensed technology from second-tier foreign players. Local investment primarily focused at the low end of the market: IBM clone assembly, dot matrix printers, etc. Contraband supply flourished.</p>
<p style="text-align: center;"><b>Response of Foreign Capital</b></p>	<p>Defiance and failed pre-emptive strikes (IBM). Initial failed attempt to enlist US government support to overturn policy (Data General). Expand share in mainframes. Regularly test the policy at the margins (superminis, data processing). TNCs with in-country operations were ambivalent about US government-initiated trade dispute.</p>	<p>With the exception of IBM, the leading TNCs entered into minority JVs. Second-tier players licensed technology to micro and peripheral manufacturers. IBM resisted and enlisted the support of the US government. IBM granted permission for 100% ownership in micros and peripherals in exchange for commitment to large investment and export programme. Most other TNCs dissolved their JVs shortly thereafter while agreeing to aggressive export targets.</p>

<p style="text-align: center;"><b>Policy Impact</b></p>	<p>Attracted large number of domestic firms into the industry.  Expanded professional employment in the sector.  Limited TNC market shares.  Failed to simulate sustained R&amp;D investment.  Eroded balance of trade.  Remained dependent on foreign high-tech components.  Locally produced equipment was not internationally competitive, except in bank automation.  Contraband market grew.</p>	<p>Local supply remained uncompetitive in price and technology, even though the policy exerted some initial downward pressure on price.  Improved sector's balance of trade.  Expanded professional employment in the sector.  Failed to stimulate investment in R&amp;D.  Initial improvement in local content could not be sustained.  Development of local suppliers limited to low end of the market (cables, low res terminals, etc.)  Helped extract concessions from IBM and TNCs for investment levels and export targets.  Contraband trade flourished.</p>
<p style="text-align: center;"><b>Post-1990 Policy</b></p>	<p>Liberalisation, shifting emphasis from local ownership to local production.  Emphasis on improving quality and lowering price of local supply through competition.  Maintained mix of tariffs and taxes to incentivise local production.  Continued R&amp;D investment requirements.  Dismantled central administration of policy.</p>	<p>Rapid liberalisation; <i>laissez faire</i> approach to the industry.  Encourage exports and internationally competitive equipment for the local market.  Some lip service to R&amp;D and component supply promotion but no funding to back it up.  Dismantled central administration of policy.</p>
<p style="text-align: center;"><b>Reserve's Legacy</b></p>	<p>Initial wave of local/TNC JVs gradually gave way to foreign majority ownership.  A number of internationally competitive Brazilian players (e.g., Itautec, PROCOMP, Sistema, Rima).  Large cadre of professionals.  Poor balance of trade driven by dependency on imported components.  Dependence shifted from hardware to components.</p>	<p>Few of the entrants under the Reserve survived.  The very few Mexican success stories developed without help from the policy.  México has developed as export base controlled by TNCs with globally integrated sourcing.  Strong balance of trade as a result.  Key lasting success is the growth of professionals working in the industry.</p>

As explained in the introductory chapter, the bargaining construct rests on four basic assumptions: (i) relations between host countries and TNCs are characterised both by divergent and mutual interests; (ii) there is the possibility of shared, non-zero-sum gains; (iii) the actual distribution of benefits depends on the relative bargaining power of each; and (iv) there is a shift over time in relative bargaining power in favour of the host countries (the “obsolescing bargain”). From the standpoint of the host country, the state’s effective bargaining “power” – and therefore the expected distribution of benefits – is thought to depend on six factors:

- (i) Host country ability to monitor investor and industry behaviour;
- (ii) The cost of duplicating or forgoing what the investor offers;
- (iii) Competition within the industry;
- (iv) The vulnerability of the foreign assets and earnings to adverse treatment by the host country;
- (v) The ability of the host country to discount the international political tension caused by investment disputes;
- (vi) The degree of uncertainty with regard to the investment project.<sup>366</sup>

The implications for host country – TNC bargaining arising from the experience of México and Brazil with the international computer industry can now be explored by examining two key questions: (a) do these six factors offer adequate explanatory power and insight into the cases studied; and (b) does the obsolescing bargain seem to apply in the dynamic, globalised high-tech world of informatics?

### **Underrated Factors**

This analysis of the experience of México and Brazil with the international computer industry firstly reveals a bargaining landscape that is in practice much more dynamic than the traditional bargaining model, with its six bargaining “chips” suggests.

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<sup>366</sup> Bergsten, Horst, Moran. *Op. Cit.*, (1978): 369-370.

While the importance of these six factors to the two cases is beyond question<sup>367</sup>, three fundamental and critically important factors are underestimated in the construct above: the hyper-dynamism of the global computer industry which opened and closed windows of opportunity to re-strike the bargain while presenting enormous challenges for the states in question to adapt policy initiatives to the changing realities in the international industry; country-specific differences, including the states' ability to build and maintain coalitions of support for the policy and country situational factors; and the importance of firm level strategy and capability which better explain the enduring success that a few national players have enjoyed. A comprehensive understanding of the experience of México and Brazil with the international computer industry must take good account of these three factors.

In exploring the different policy choices and outcomes in the two cases, the thesis has focused on the complex and ongoing interplay between market and political forces. Both sector-specific policy and private investment decisions act as endogenous variables in these cases of TNC-country bargaining. The preceding chapters have explored a number of mutual adjustments ("bargains") that have occurred in each case: (i) the adjustment of top political authorities to their supporters; (ii) state officials to each other (including top authorities); and (iii) state officials and market agents (both investors and consumers, foreign and domestic) to each other. The most important exogenous variables are the competitive dynamics of the international informatics industry, the macro goals of the host country regime, the industry's importance to these macro goals, the industry's complexity, and a number of other country-specific factors such as the historical endowment of a technological base, the

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<sup>367</sup> As stated in the Introduction, the aim of this thesis is not to prove or disprove the bargaining model, or to offer an alternative theoretical construct re: host country – TNC relations over investments. Rather, it is to enrich our understanding by highlighting factors that these theoretical constructs underestimate. For that reason, in what follows the author has not offered a systematic assessment of the six factors in relation to computer bargaining in México and Brazil. Instead, this concluding chapter focuses on the factors that best explain the results in the two cases studied.

potential market size, and geographic proximity to export markets. The most impressive feature of these various factors is their dynamism.

By comparing the two cases in this way, this study has sought to avoid the stagnationist error into which 'snapshots' of TNC-country bargaining fall. This research project has detailed the distinctive country-specific factors that have shaped policy courses and outcomes, which have been often neglected in studies of this kind.

Without doubt, the dynamism of the computer electronics industry shaped and constrained opportunities for México and Brazil to alter their position with respect to the international industry. Before moving on to compare country-specific factors, it is imperative to understand more clearly the industry specifics that opened and closed windows of opportunity in the bargaining "game" during the period under study.

#### **Underrated Factors: Industry Dynamism and Windows of Opportunity**

The computer industry would appear to be one in which foreign capital holds the whip hand. The industry is characterised by: rapidly-changing high technology; on-going product innovation; economies of scale in component purchasing, production, and research and development; high capital requirements; and increasing global integration. Indeed, during the period under study, a truly globalized industry emerged with common international technology standards effectively set and maintained by a few large companies like IBM, Microsoft and Intel. This industry, in short, is one in which the TNCs would seem to hold all the bargaining chips in a very fast-paced and dynamic game.

However, an appreciation of the characteristics of the international computer electronics industry is vital to any clear understanding of real bargaining power between developing nation hosts and computer TNCs. The dynamic, global nature of the industry provided both opportunities and risks to host countries and transnational computer companies in the bargaining process.

(i) Diffusion of computer technology.

"Technology is itself a body of knowledge about certain classes of events and activities. It is not merely the application of knowledge brought from another sphere. It is a knowledge of techniques, methods, and designs that work, and that work in certain ways and with certain consequences, even when one cannot explain exactly why."<sup>368</sup>

The two most obvious types of "technology" related to the computer industry are product design technology, which includes basic and applied research and development related both to hardware, software, and microelectronics, and process or manufacturing technology. Employing Rosenberg's definition above, two other "technologies" (or capabilities) that a successful computer firm must possess are: managerial competence, including capabilities in international component sourcing, access to credit, human resource development, and strategic planning; and marketing and support service 'technologies' which include the abilities of the firm to differentiate its product from those of its competitors, to successfully access and manage distribution channels, and to provide support services to vendors and end-users. These capabilities are vital in the technologically complex computer industry where customers often base their purchase decision upon their confidence in the firm and its brand promise more than a detailed knowledge of the product itself.

Both Brazil and México tried to gain these four 'technologies' by promoting local investment in the computer industry and restricting and orientating foreign capital in such a way that local capabilities had room to develop, while foreign capabilities are transferred to local companies. The diffusion of product and process technologies in the international computer industry aided both countries in their quest.

Much computer product technology is proprietary, especially in the larger more advanced computer systems. However, at the lower end of the market, most of

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<sup>368</sup> Nathan Rosenberg, Inside the Black Box: Technology and Economics, (Cambridge: Cambridge University Press, 1982): 143.

the technology is embodied in the integrated circuits (ICs or chips) and the operating system (basic software). Because companies that were not involved in the manufacture of end-user equipment were the ones to develop chips for microcomputers,<sup>369</sup> these technology-intensive chips became available on the international market. As the market for micros experienced dynamic growth, and the process technology associated with semiconductor manufacturing became more advanced, standard chips became relatively cheap international commodities. Competition in microelectronics intensified as Japanese and European firms entered the fray. Indeed, Japan overtook the U.S. in supply of ICs to the world market during the period under study. Thus the primary technology associated with micros became readily accessible the world over.

Although the computer industry can rightly be described as oligopolistic in that market concentration was high in the sector, the industry has remained very entrepreneurial, with new entrants carving out positions in the global market and small players thriving in sub-sectors. There are many hundreds of companies that operate at the margins of the market and possess technology know-how comparable to the giant computer transnationals. These companies are potential sources of product and process technology for a less developed economy. Brazil successfully tapped companies of this sort in Ferranti and Sycor before landing the larger computer TNCs in licensing agreements. Likewise, Mexican companies licensed microcomputer technology from the likes of Columbia (subsequently bankrupt) and Televideo.

In sum, increasing diffusion of computer technology served to open the window for Brazilian and Mexican players to gain a foothold in the computer industry.

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<sup>369</sup> Intel was the first to introduce the microprocessor, which can be programmed to carry out information processing and control functions in 1971. Those that followed include Texas Instruments, Motorola, Zilog, and a host of other U.S., Japanese, and European companies. IBM purchased shares of Intel and has very strong capabilities in microelectronics; however, this has in no way limited the international market for microprocessors. Interestingly, IBM purchased chips from Intel for the first generation of its personal computer; but used more of its own chips in the second generation.



(ii) Rapid and progressive advances in processing power.

The revolution in semiconductor technology that occurred since the transistor was integrated with other components into a silicon base served to dramatically reduce manufacturing costs, enlarge information storage capacities, and increase efficiency in computing. Moore's law has proved uncannily accurate over the past few decades: the number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years.<sup>370</sup> Processes of large scale and very large scale integration (LSI and VLSI) and tools such as computer-aided design (CAD) have further propelled the field of microelectronics, driving costs ever downward and computing power ever upward.

Thus, computing power has become embodied in ever-smaller equipment: first came the minicomputer in 1965, then the microcomputer in the late 1970s. Concurrently, computing power has become progressively less expensive. The price per information 'bit' of storage fell from 1 cent per bit in 1970 to nearly 0.001 cent in 1984. A 32-bit microprocessor with the power of a mainframe computer could execute one million or more instructions per second and in the mid-1980s cost only \$20.<sup>371</sup>

These twin effects in turn contributed to the explosion of the market for computer electronics. The early 1980s witnessed the advent of the "home computer" in the U.S., Japan, and Europe, thus including virtually every household in the addressable market for computer equipment and software. While the markets of México and Brazil remained much more limited, many more professionals and businesses could, by then, be included in the market. This rapid expansion, discussed below, provided an opportunity for México and Brazil to profitably develop capability in this new area.

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<sup>370</sup> Intel's co-founder Gordon Moore first described this trend in a 1965 paper reproduced in Electronics Magazine, November 11, 2006, p. 4. It has since become accepted wisdom in the industry.

<sup>371</sup> Atul Wad, "Microelectronics: Implications and Strategies for the Third World," Third World Quarterly, (October 1982): 629; Business Week, July 30, 1984: 56.

However, direct participation in microelectronics remained out of reach for México and Brazil. Microelectronics design and manufacture is problematic both in economic and technical terms. The design and process technologies are complex and costly. Experienced integrated circuit designers are scarce and expensive. And production is extremely capital intensive. Hence, microelectronics has remained a globally concentrated industry.

(iii) Explosive growth of the microcomputer market.

Advances in microelectronics made it possible to create a computer that was compact, affordable, and thus accessible by several new markets: small businesses, professionals, and home users.

With the entry of IBM into the microcomputer market in 1981, the product was effectively legitimised in the eyes of all segments of the business market. Large businesses began purchasing microcomputers by the hundreds and the micro market exploded.

Interestingly, IBM entered the market with a product that was largely assembled with parts and components produced by sub-contractors. Having previously neglected this lower end of the market for computer equipment and seeing now its great potential, IBM needed to enter the market quickly. Further, the company understood that the appeal of its PC would be directly proportional to the quantity and quality of applications software available to the end user. Hence, IBM opted for an operating system based on an "open architecture" so that anyone could write applications software for the PC.

These events and choices all had an important effect on the structure of the international microcomputer (later dubbed the "PC") industry. IBM's PC quickly took the lion's share of the microcomputer market, becoming the effective industry standard by 1983. The microcomputer industry, so fragmented at first, was beginning to mirror the rest of the computer market, at least for a season. However, the industry standard bearer comprised non–proprietary design and components. Technological barriers to entry remained low. Hence, copies or "clones" of the IBM

PC, which could run the plethora of software developed for the IBM, began to proliferate, driving prices down still further.

The relatively 'low-tech' nature of the microcomputer industry provided an important opportunity for México and Brazil to develop indigenous microcomputer assembly operations.

(iv) Rapid rate of technological innovation.

While the foregoing factors provided opportunities for México and Brazil to enter the computer industry, the continued dynamism of the industry posed a threat to their efforts. As the international industry raced ahead, the financial and technological gaps re-opened.

As markets became increasingly competitive, the largest computer TNCs increasingly employed proprietary technology in their equipment in order to differentiate their product and protect market share. IBM did this with its subsequent range of personal computers, Personal System 2. DEC did this when it introduced a new range of superminicomputers—VAXII. In these machines DEC employed extremely powerful chips that it developed internally.

Brazilian and Mexican state and industry actors discovered that the effort to keep up with technological change was at least as great as the effort to catch up with foreign technology in the first place.

(v) Global industry standards

During the hyper-dynamic decade of the 1980s in computers, a globalized industry developed based on de facto international technology standards based on IBM's hardware platform, MS-DOS (and later Microsoft's Windows) and UNIX operating systems, and Intel's chip. Thus,

..."thousands of companies are doing research, designing and manufacturing products, and developing software for a few standard technology platforms, particularly the IBM/Wintel PC."<sup>372</sup>

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<sup>372</sup> Dedrick et al. Op. Cit., (2001), p. 1201.

Thus, from the late 1980s onward it was very difficult and exceedingly expensive to maintain local or national computer technology that varied from the *de facto* international standards. The investment required to maintain separate standards was untenable, particularly considering that export markets would effectively be closed or at least very limited in size; the rest of the world was rapidly adopting and benefiting from the global supply chain.

Brazil's market – even when combined with the other MERCOSUR markets – was nowhere near large enough to sustain alternative technology standards. Meanwhile, México was in a position to benefit from the trend toward globally integrated supply chains and its proximity to the U.S. market.

(vi) Blurring industry boundaries

Traditional boundaries between computers, consumer electronics and telecommunications were blurring in the 1980s. This fact multiplied complexity for host country policymakers, whose job was already difficult enough. Neither Brazil nor México coordinated policy well across industrial sectors such as consumer electronics and telecommunications. Because of the growing confluence of basic technology (i.e. microelectronics) in these industries, the countries risked an unsustainable contradiction of policy across the industries. Moreover, without domestic capabilities in microelectronics – already very problematic as noted above – they found it difficult to reap economies of scale. Their respective domestic markets were too small to provide economies of scale in any one product; however, the basic technology and early production and testing procedures were common across such diverse product groups as PABX telecommunication systems and microcomputers.

(vii) Increasing cooperation among firms in the industry.

The computer industry is characterized by rapid technological change, technological complexity, and a growing confluence of computer and telecommunications technologies blurring the distinction between the transformation and transportation of information. All of these factors contribute to the high degree of risk associated with investment in this industry.

Firms responded to increasing complexity by entering into cooperative agreements with other firms in order to share the investment risk. These cooperative agreements have assumed a variety of forms including: total or partial acquisition of equity; joint venture; OEM agreements; joint technology development; licensing and cross–licensing agreements; and co–marketing agreements.<sup>373</sup>

While Mexican and Brazilian firms faced the risks inherent in the industry, the increasing willingness on the part of international computer firms to cooperate in a variety of ways increased negotiating flexibility with foreign capital.

In sum, careful consideration of the dynamics of the international industry reveals a variety of factors that served in some cases to open the window of opportunity for host country policymakers and domestic capital, and in others to close it. Even highly skilful, competent state actors with strong political support would find it incredibly difficult to keep adapting policy to the ever-changing bargaining landscape. While the global hyper-dynamism of the industry created opportunities to strike and re-strike a favourable bargain, states are neither rapid decision-makers nor nimble organisational actors. This is indeed one of the important conclusions of this study: host state policy speed and adaptability are more important than prescience or bargaining shrewdness. Speed and adaptability may also be more rare.

### **Underrated Factors: Country-Specific Differences**

While bargaining terms were constantly shifting due to the dynamics of the computer industry, country– and state-specific factors influenced the host country’s ability to exploit opportunities when they arose. The factors that relate México and Brazil to international capital generally and to the computer industry in specific are compared below. The comparison reveals the importance of state leadership as

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<sup>373</sup> Ohmae documents these international computer consortia in his book *Triad Power*. Ohmae, Ken’ichi. *Triad Power: the Coming Shape of Global Competition*. (New York: Free Press, 1985): 136-137.

investor, consumer, regulator and coalition-builder to policy effectiveness. It also reveals the importance of several other country-specific factors including differences in the size and geographic location of the host countries, and the macro-economic conditions at the time of the policy initiatives.

### State Leadership

The Mexican state largely confined its role vis-à-vis the computer industry to that of a consumer. At no time did the state invest directly in the industry. Without a national computer "flagship" company supported by government investment, the country lacked a focus around which to galvanise support for an industrial development policy in this area. It must be remembered, however, that at the time of the formulation and introduction of the industrial development programme México was entering the worst recession in decades. The government thus never contemplated committing public funds in any way other than through fiscal incentives. Moreover, support for the programme was not ideological or even developmental, but was rather more pragmatic. Several influential members of the state apparatus, especially in the Ministry of Commerce (SECOM) and Finance (Hacienda), supported the 1981 program primarily because it would help to reduce a burgeoning import bill in computers. Support for the policy within the state was thus motivated more by considerations of 'damage control' with the external market than by a positive investment mentality.

While the government was unwilling to invest directly in the industry, it nevertheless played an influential role in the development of the industry. Most obviously, the state intervened with the 1981 industrial development guidelines, seeking to create conditions by which domestic capital could invest in the sector and develop successful businesses supplying the local market. Policy makers had initial success enticing transnationals to invest in minority JV positions with local capital. However, with little political support and subsequent bargaining losses with IBM, the state was ultimately able to do little more than extract concessions related to investment levels and export targets.

Less obvious but equally important was the government's role as the number one buyer of computer equipment and services. One way or another, the Mexican government continued to account for more than two-thirds of the national market. As an effective monopsony, the government possessed a great deal of potential leverage over the computer transnationals. However, this potential leverage was not initially employed to further the industrial development efforts. Until 1985-86, the government agency responsible for overseeing all purchases of computer equipment and services by the state and its affiliated enterprises (INEGI) was concerned only with acquiring the best products at the best prices. Given the strategic nature of information technology for exercising and expanding control in a complex environment, it is not surprising that the Mexican government would want state-of-the-art equipment. There was little cooperation or coordination with the government entity (SECOFI) that was attempting to persuade the transnationals to invest in the country as opposed to merely supplying it.

With a change of personnel in INEGI in 1985 the state adopted a harder line with the TNCs and began to employ its monopsony to help the Mexican investors. However, subsequent changes in the leadership of INEGI spelled another about-face with the government using its market power merely to extract price concessions from the computer TNCs.

Unlike México, the Brazilian state took a direct ownership interest in the national computer industry, even some years prior to the formulation of an industrial development policy. Via the national development bank (BNDES), and with the strong support of the military, which was concerned about technological dependence and its implications for national security, the government financed a flagship company to develop and produce a minicomputer. Cobra was launched in 1974 with a product developed with technology licensed from the British military contractor, Ferranti, which had produced computers for vessels purchased by the Brazilian Navy.

A mark of the state's commitment to the development of a national computer company, if not industry, was the fact that it continued to supply Cobra with investment capital even though it was a commercial disaster.

Cobra was not the only significant direct state involvement in the industry. SERPRO, the state agency responsible for data processing branched out from a purely service role to a limited manufacturer of specialized types of computer equipment for its own use. Out of the agency sprang several entrepreneurial Brazilian computer manufacturers with a strong interest in the implementation of a market reserve in computers. Thus, Cobra—the national flagship—became a focus of nationalistic support for an industrial development policy, and both Cobra and SERPRO served as training grounds and launching pads for Brazilian engineers and entrepreneurs wanting to capitalize on government protection for the industry.

In broader terms it is important to remember that the Brazilian state had a history of protecting and its partitioning national market. Historically concessionist, a market reserve in computers was not a new departure for Brazil; the Brazilian state was used to playing that role.

It should be noted also that the Brazilian state, like its Mexican counterpart, is far from monolithic and internally consistent. Like México, the Brazilian state is a large consumer of computer equipment and services. In its role as consumer, the Brazilian state had strict nationalist guidelines with respect to the acquisition of computer equipment after CAPRE developed them in 1974. However, in practice, the rigour with which these guidelines applied varied enormously. The military is a salient case. Strong proponents of the nationalistic policy of market reserve on the grounds of national security, the military nevertheless continued to acquire state-of-the-art informatics equipment and technology from abroad, often in conflict with the state's own restrictions.



### Coalition-Building: The Creation of Privileged Investors

Given the perceived lack of broad government commitment to extending protection to Mexican investors in the computer industry, Mexican investors were attracted to the industry only on a relatively small scale.

Initially, the industrial development programme envisaged joint ventures between foreign and local capital in the microcomputer sector, with local capital holding the majority share. Two such arrangements were hailed as policy successes in 1984 when Apple Computer and Hewlett–Packard entered into joint ventures with local partners. However, after IBM entered the microcomputer business with a wholly–owned subsidiary in 1985, first H–P and then Apple moved to buy out their Mexican partners who were only too willing to sell. The only significant surviving joint venture was that between Unisys, Banamex, and a private Mexican investment group.

Interestingly, the largest capital groups that chose to participate in the Mexican computer industry committed funds in conjunction with the TNCs (e.g., Banamex' investment in Compubur, Unisys' microcomputer venture). Meanwhile, the balance of the "national effort" in computers rested with a number of entrepreneurially–orientated, mostly opportunistic investors producing mainly IBM clones.

Without the active participation of a critical mass of major Mexican capital groups, the local industry lacked an effective political constituency willing to fight for nationalist policy. Mexican capital with an interest in the industry did form an association (AMFABI) whose aim was promote the interests of Mexican computer manufacturers. AMFABI achieved a high profile during the government's negotiations with IBM as it lobbied vigorously against the acceptance of IBM's microcomputer proposal. Unable to generate much support in government, nor broader national support for its cause, AMFABI failed to stop IBM's proposed 100% microcomputer operation and ended up politically isolated.

It is a testimony to the tenacity of the pro–reservist lobby in Brazil and the longevity of the market reserve that a number of very important local capital groups invested in the industry. The country's two largest private banks, Bradesco and Banco

Itau, and one of the largest industrial firms, Docas de Santos, played a strategic role in the growth and development of the country's three largest private national computer companies: SID Informatica, Itautec, and Elebra respectively. As a result, domestic private capital with a vested interest in the market reserve policy became an important driver of the industry's development.

In contrast to AMFABI, its Brazilian counterpart—ABICOMP—was an effective political force in support of the market reserve. Leadership of ABICOMP revolved between members of the technocratic elite who helped formulate the policy in the days of CAPRE. ABICOMP was instrumental in fostering support in Congress for the legislation that codified the national informatics policy in 1984 prior to the departure of General Figueiredo's military regime.

Although private Brazilian capital had a vested interest in the industry, this was not enough to ensure the continuance of the restrictive policy regulations. Private capital, like the state, is not a monolith; it is a heterogeneous group whose members often have conflicting interests. There were the engineering pioneers who started computer companies under the market reserve (e.g., Edson Fregni of Scopus) and whose business success depended upon the continued restrictions on foreign capital. Then there were the very large investors such as Matias Machline of Sharp and Olavo Setubal of Banco Itau who wielded a great deal of personal political influence. Their businesses too were dependent in part upon the market reserve; however, they showed an increasing interest in dealing with foreign capital directly to establish technology agreements or procure further finance.

Once formal joint ventures and/or alliances between domestic and foreign capital were established, the state was left with a dilemma. The “privileged” firms had traded the protection of the state for access to international finance and technology. ABICOMP was eventually expanded to include the TNCs producing equipment in Brazil. Lines between foreign and domestic capital were blurred; it was no longer clear which players the state should now “privilege.” The alliances themselves had changed the bargaining equation.

Given the increasing importance of computer technology to all aspects of the national and international economies, it became even more difficult for Brazilian and Mexican industries to profitably participate in the international economy if their governments restricted the markets for computer equipment and services. The cause of broader economic prosperity - in contrast to the prosperity of domestic players in the informatics sector alone - was seized by Brazilian industrialists who were growing increasingly weary of paying high prices for computer equipment that was not up to international standards. These large users of computer equipment and services perceived that their ability to successfully compete in international markets was impaired by a local computer industry that was still trying to catch up to the international market. They became increasingly vociferous in their opposition to the market reserve and included Gerdau (which tested the policy guidelines by entering into an agreement with IBM in 1986 to form GSI—a data processing bureau), Embraer, and the entire automobile industry *en bloc*.

FIESP, the most powerful industrial association in the country at the time (which also appointed a member on the National Council of Informatics—CONIN), became the institutional focus for the national and foreign industrialists who were disgruntled with the restrictive policy. On December 22, 1986 FIESP presented a paper to CONIN attacking SEI's restrictions on technological joint ventures in the industry. At the time, most of the people interviewed thought it highly unlikely that SEI would openly yield to such pressure. However, large informatics users and manufacturers alike remarked on SEI's increasing "flexibility." Indeed, subsequent events validated this view; SEI could no longer develop and implement policy without accounting for the wishes of Brazilian industry as a whole.

Proponents for a national computer development policy in México were never able to generate a national interest in their cause. This failure is partly to do with the nature of the industry, the general lack of public debate in the country, and a nationalism that is rather more culturally defined than developmentally orientated.

Computer technology, unlike oil, is not a national resource, nor is it perceived to be in any sense 'locally-owned.' Popular mobilisation was not possible in the case of computers in México because of the very nature of the industry itself. Treatment of the issue in the national press and media was sparse and often misleading. IBM's negotiations with the Mexican government received considerable attention in the press, but when the agreement was reached, impossibly overinflated figures concerning IBM's proposed investment were reported unquestioningly in the leading dailies.

Brazil had rather more success than México in generating a broader base of support for the national informatics policy. Cries of 'the oil is ours!' were replaced by 'the computers are ours!'. This is partly due to the fact that Brazil had developed a critical mass of technocratic elite with an interest in the development of a national computer industry. However, the fact that these technicians and engineers led the cry for the market reserve was not due solely to self-interest. The country had a long history of national developmentalism. Brazil persisted over a long period of time and against long odds to develop their alcohol fuels, off-shore oil, hydroelectric and nuclear power industries to name but a few examples.

#### Coalition-Building in Government

It was unfortunate timing for the formulators of Mexican computer policy that attempts to formally initiate the guidelines coincided with the change of administrations in the Mexican government. The two strongest proponents of the policy guidelines, Natán Warman—Undersecretary of Industrial Development—and Ernesto Marcos—Director General of Industries—were to lose their posts in the subsequent administration. Moreover, the structure of the ministry under which the policy was to be implemented was set to change. The ministries of trade and industrial development were to be merged under common leadership. And by late 1981 several of the government ministers who were meant to formally approve the policy knew what their new posts would be in the next administration. These ministerial changes, and these men's foreknowledge of them, made them reticent to

commit themselves to a policy whose ramifications they did not fully understand. Thus, apart from the normal bureaucratic delays inherent in a change of administration, the political and institutional dynamics associated with such a transition inhibited the implementation of the new policy initiative in computers.

Pressure from the U.S. government against the new policy played a role at this juncture as well. In early 1982 the U.S. Secretary of Commerce sent a letter to his counterpart in México expressing American concern about the policy. While this pressure did not result in a repudiation of the policy initiative, it did increase the reticence of the Mexican ministers and indefinitely forestalled the program's passage into law.

President De la Madrid inherited a country in deep economic crisis in 1982–83. In the aftermath of the prolific spending of the oil boom, it was apparent to the new administration that manufacturing would have to finance its own growth. Lopez Portillo's nationalization of the banking industry in 1982 had shaken the confidence of foreign investors. De la Madrid needed foreign capital to invest in manufacturing more than ever. Thus, in the 1983–88 National Development Plan, the new president signalled the greater opening of the Mexican economy. The Plan aimed to “raise the contribution of foreign technology, administration, and finance resources that are required in the country's process of development.” The official fate of the restrictive computer industry development was thus sealed. It was within the context of a political and economic landscape that had shifted dramatically that implementation of the new policy was attempted.

In Brazil, it was the military that ultimately ensured the consistency with which the market reserve policy was applied from its inception in 1976 to its passage to law in 1984. The return to civilian rule in 1985 did pose some problems for the pro-reservists, however.

The codification into Brazilian Law of the National Informatics Policy was a great triumph for the pro-reservist lobby. It was perceived as absolutely critical to the

assured continuance of the market reserve. Yet the legislation itself was a two-edged sword.

The transition from military rule to civilian government affected the informatics policy in three important ways: (i) the policy and its implementers (SEI) were no longer insulated from political pressure as they had been inside the National Security Council; (ii) the codification removed some of SEI's discretionary power and made it easier for the TNCs to exploit loopholes in the law; (iii) effective control over the policy shifted from SEI to Congress, a much more politically diffuse and malleable entity.

Changes in party politics in Brazil also posed difficulties for the policy. By 1987 leftists in the majority PMDB were losing ground to more conservative voices in the party and in government. Several strong nationalist proponents of the 1984 law no longer had seats in Congress. Support for the national informatics policy was eroding in the late 1980s.

Interestingly, U.S. pressure on the Brazilian government to relax its market reserve was more public and at the same time much less effective than U.S. pressure on México was, even though President Sarney, like his Mexican counterpart, was not ideologically committed to the market reserve. The American government's public threats of trade retaliation (some of which were carried out in November 1987) were in large part a response to domestic congressional pressure on the Reagan administration to tackle the enormous balance of payments problem in the United States. To ease domestic pressure in the U.S., the Reagan administration issued strong public warnings to the Brazilian government and entered bilateral negotiations. The public nature of the U.S. pressure combined with the broad support for a nationalist policy in Brazil prevented Sarney from emasculating the market reserve to any great extent.

It was domestic economic crises that provided a greater impetus for liberalisation. After a decade of extraordinary growth, the market for informatics equipment and services slowed in 1987 when Brazil plunged into economic crisis. As a result, many of the smaller Brazilian computer firms went out of business, while most

of the larger ones incurred severe losses. The remaining firms were without capital to fund new product development, or even to purchase spare parts and supplies from abroad. In order to survive, many of the Brazilian firms began to look for joint-venture partners based outside of Brazil. The economic crisis thereby increased the bargaining power of foreign capital and worked to encourage the ultimate approval of a greater number of joint-ventures and alliances between foreign and domestic players in the industry.

The foregoing review of the two cases studied once again reveals the importance of the bargaining “game-within-the-game”. While the state-state bargaining played a part, the intra-state bargains were more decisive in determining the ultimate policy that could be implemented and the bargaining power that could be applied by the state in relation to both foreign and domestic capital.

#### Host Country – TNC Mutual Adjustments

North American computer transnationals saw México as an extremely attractive and appropriate base for exports to the U.S., Latin America, and indeed, to the rest of the world. Low labour costs (even lower than in the four Asian countries which have become synonymous with electronics manufacturing and export: Singapore, Korea, Hong Kong, and Taiwan), the ease of managerial oversight (it takes no longer to fly from New York to México City than to Los Angeles), and the proximity to the largest national market for computer equipment—implying low transportation costs and faster delivery—were cited as the most important reasons to set up production-for-export facilities in México.<sup>374</sup>

Clearly, the potential of the Mexican computer market, though much smaller than Brazil's, was attractive to foreign capital. But México's potential as an export platform was a far bigger draw. Witness IBM's agreement with the Mexican

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<sup>374</sup> The thesis does not mean to neglect the importance of the 'maquiladora' or in-bond manufacturing and assembly industries situated primarily along the U.S.–Mexican border. Electronics accounted for 50% of the output of these plants in the 1980s. Many of the computer TNCs with other operations in México have an interest in a maquiladora operation, but with few exceptions they are limited to component assembly and test rather than final equipment assembly.

government. As part of its global manufacturing strategy, IBM established its fourth microcomputer assembly plant in Guadalajara, promising the Mexican government that it would export 92% of this plant's output.

While México was attractive as an export platform, Brazil was attractive to foreign capital primarily because of its internal market. As an export platform, Brazil was less attractive. Distance from the major world markets and headquarters of computer transnationals coupled with rising labour costs that were not competitive with México or Asia, combined to limit Brazil's attraction as a platform from which to launch computer products to the worldwide market.

However, with a population twice as large as México's and a computer market three to four times as large, Brazil's domestic market offered considerably greater potential than México's. As a country that could lure the foreign investor based on its domestic market potential Brazil had relatively greater bargaining leverage than México whose primary lure was as an export base. There were a great many viable worldwide manufacturing sites; but there weren't very many national markets that were worth US\$ 3 billion and growing at 20-30% annually.

From the perspective of TNC rationality, the longevity and consistency of policy counts for much. In periods of uncertainty and transition, TNC managers will take actions that provide a hedge against future events and preserve a number of attractive or viable strategic options.<sup>375</sup> In México, some of the computer TNCs made tentative investments after the introduction of the guidelines (e.g., Apple and H-P) in order to get a foothold in the local market in case the government persevered with the policy. The original guidelines never had a chance to take firm hold in the industry without the backing of the president's office. Hence, IBM's victory is hardly surprising. And when it came, the other computer TNCs were quick to follow IBM's lead and alter the nature of their local ventures.

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<sup>375</sup> Business scholars call this "maximizing option value."



In Brazil, after failed initial attempts to pre-empt the policy and its impact, the computer TNCs also adopted a wait-and-see attitude. In the 1977 round of minicomputer licensing, none of the major computer TNCs participated. Their reasoning: why sell proprietary technology in a market that you may wish to enter at some later date? Seven years later it appeared that 'later date' might never come. In the new round of superminicomputer licensing most of the major computer transnationals sold technology to Brazilian licensors.

### *The Case of IBM: A Closer Look*

A closer look at IBM's *de facto* leadership in bargaining with México and Brazil is instructive at this point. This discussion of IBM's responses to the policy initiatives in Brazil and México reveals the importance of country specific factors to bargaining approaches and outcomes. That's why it makes sense to summarise these here. However, this account of IBM links directly to the second 'underrated factor' considered in the next section below: firm-level strategy and management, which applies equally to local capital and to the transnational firms like IBM.

In the 1970s IBM was the runaway global leader among information technology firms. Big Blue led not only in market share, but also as a political force due to the company's importance as a large investor and the primary supplier of essential equipment and services to government agencies and the military. As a relatively mature company with a broad international reach, IBM was also the most sophisticated multinational actor among the computer firms at the time, many of which were less than a decade old.<sup>376</sup> As we have seen, the other computer TNCs therefore tended to follow and benefit from IBM's broad bargaining plough.

IBM's strategic rationale with respect to emerging markets was very clear up to the early 1980s when it evolved in a couple of important respects. The company

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<sup>376</sup> This discussion of IBM's position and strategic operating rationale relies on Rex Malik, *And Tomorrow... the World? Inside IBM*. London: Millington, 1975; author interviews and familiarity with IBM and the international computer industry through his consulting experience in the early 1980s.

maintained strictly proprietary, centralised research & development and production, exporting equipment to international markets. IBM hired and trained local sales, marketing and basic technical/data processing staff in the markets served by the company. National subsidiaries tended to be sales and service operations; strategic decision-making was centralised in the company's New York headquarters. IBM supplied government agencies and large corporations with mainframe computers and related technical support and data processing services, typically on a lease basis. The company harvested its large, central investment in R&D by leasing older, second and third generation equipment to customers in emerging or secondary markets like Brazil and México. Customers faced very high switching costs as IBM's mainframes ran on proprietary operating systems that were incompatible with those of the competition. The company was understandably fiercely protective of its proprietary technology (hardware and operating systems), so would not consider licensing or alliance relationships that may jeopardise the company's centralised control over the "crown jewels."

By the mid-1980s, the development of the global information technology industry – particularly the growth of microelectronics and independent software vendors – forced two important changes on Big Blue's operating logic. First, the company would no longer control all the technology elements in its products. It had to shift to managing a global supply chain network. (For example, Microsoft designed the operating software that controlled IBM's first PC, launched in 1981. And later, IBM began to source the chips used to power its PCs from Intel). Second, the company began to strike licensing and alliance arrangements to remain competitive, as players in the industry became increasingly specialised.

IBM's actions (and reactions) with respect to the computer policy initiatives in Brazil and México can now be seen in the context of the company's overall operating rationale described above. Apart from the obvious motivation to defend and advance its market position, the company responded in both cases by seeking to (a) leverage its market leadership position; (b) protect proprietary technology; (c) preserve autonomy

in production and, later, in global supply chain management; (d) bargain with local investment and export commitments. Interestingly, IBM actively enlisted the political support of the United States government only with respect to México, not Brazil. Data General's early failed attempt to do so with respect to Brazil may have dissuaded IBM in that case.

In Brazil, IBM attempted to circumvent the market reserve in minicomputers by manufacturing its System 32 machines in its Sumare plant just prior to the government's 'competition' for concessions to manufacture minicomputers in the country. IBM then proceeded to collect some 400 statements of interest from local business in the 'new' (to Brazil) product. By going straight to the market with an attractive new minicomputer system entailing considerable investment on the part of the company, IBM had launched a "pre-emptive strike" against the market reserve, leveraging its market leading position. It is unclear whether IBM had mistaken Brazil's policy for traditional import substitution (in which case, their commitment to local manufacture would have been sufficient to secure their position in the market). It is clear that IBM had mistaken the commitment of CAPRE's 'technicians' to the market reserve and the level of political support they had generated, particularly from the military. IBM's bold attempt failed, and the company was forced to export the minicomputers it had manufactured and ordered to cease production. IBM may have been the most sophisticated of the computer TNCs, but at this juncture the company proved to be relatively naïve about host country politics.

Unsurprisingly, IBM chose not to participate in either the first (1977) or second (1984) minicomputer technology licensing competitions – to do so would have jeopardised the company's control over proprietary technology and production autonomy. Instead the company pursued a strategy of consistently testing the government's policy and resolve at the margins of policy, particularly at transition points. Within a year of the transition from CAPRE to SEI, IBM tested the policy by (again) proposing to manufacture its small, 4331 mainframe computer in Brazil. This time the company was successful by making a commitment to export three machines

for every two sold in the country. The company tested the regulatory environment again in 1986 – in the midst of the 301 trade dispute with the US government – successfully proposing a data processing services joint venture with the large Brazilian group Gerdau. While the JV was an apparent departure from the norm for IBM, it must be remembered that this arrangement involved transferring IBM data services staff to Gerdau; the equipment used was still proprietary to IBM. Throughout this period the company maintained a dominant market share in the country, continuing to supply large corporations, government agencies and the military with its expensive proprietary mainframe computers.

IBM applied the same corporate logic in México, though the company's bargaining counterpart was not as unified in its objectives as Brazil was at the outset. While managers at IBM de México did not claim to apply learning from the company's experience in Brazil, there is little doubt that company executives in New York had learned some useful lessons from 1977 to 1981. In a departure from its tactics in Brazil, IBM enjoined the U.S. Department of Commerce in early 1982— just after the policy guidelines were written— to apply pressure against the enforcement of the new policy. Later IBM approached the Mexican government with a proposal to invest in a wholly-owned microcomputer manufacturing plant whose production would be aimed primarily at the export market. Foreign ownership of such an operation directly contradicted the policy guidelines.

The Mexican government succeeded in getting IBM to modify its original proposal, promising greater investment and exports – the two bargaining chips that IBM was consistently prepared to play. Two days after a visit from U.S. Secretary of State George Schultz, IBM was allowed to establish a microcomputer subsidiary in México, despite the policy restrictions and the protestations of a rather weak band of Mexican investors in the industry.

At first blush, the main difference between the approaches IBM took in México and Brazil is the company's move to enlist the support of its "home" country at the outset. However, it is critical not to mistake this as the prime reason for the different

bargaining and policy outcomes. In the case of México, IBM was negotiating with a government that was more economically vulnerable and politically amenable to its proposal. Proponents of the Mexican market reserve had not been successful in winning allies committed to their cause within the new administration. Indeed, those enforcing the policy were swimming increasingly upstream against the flow of the new administration's 'economic restructuring.' De la Madrid's primary objective was the very thing IBM was happy to promise without sacrificing its commitment to protecting technology and production autonomy: exports. This confluence of country-specific factors and IBM's strategic interests resulted in a "win-win" bargain, even if it was perceived as "win-lose" to the Office of Electronics Policy and the local capital invested in the sector.

The other major computer TNCs adopted a wait-and-see attitude with regard to the policy initiatives of both countries. As noted above, in Brazil these companies refused to participate in the first round of licensing in 1977, hoping the Brazilian government would soon see the error of its ways. When it became apparent that an about-face would not be forthcoming, these companies changed strategy along with IBM, and actively sought to diffuse their technology in the country. IBM did this by publicly emphasizing the interconnectability of IBM-compatible national products with IBM mainframes. Other TNCs such as DEC, H-P, and Data General all licensed superminicomputer technology in 1984, diffusing their technology and educating the market in the operating environments of their systems. In so doing, the TNCs were both admitting a temporary bargaining setback and at the same time preparing for the time when the market reserve would be abolished—which happened in the early 1990s. In so doing, these companies could then address a market that was familiar with their systems when the reserve was relaxed.

Having learned from their experience in Brazil, some of the TNCs took tentative positions in the Mexican market with small investments and nominal compliance shortly after the imposition of the new policy guidelines there. However, when IBM

prevailed over the ownership restrictions, two important TNCs quickly followed, buying out their joint-venture partners.

In each case, the large TNCs were most inclined to contribute to exports and local supplier development where this was economically viable. Like IBM, these companies were most reticent to relinquish or share control of technology development. Fortunately for both countries, there were many smaller companies that were willing to license their technology in exchange for royalty payments or exclusive component purchase contracts. In both cases, the host country state had success, at least for a time, in shaping and directing the investment decisions of leading transnationals in the computer industry.

The foregoing discussion of IBM and the other computer TNCs reveals a critical but oft-neglected fact in the study of TNC – host state relations. Just as writers in international political economy have been rightly urging a more detailed and nuanced analysis of “the state” and its constituent actors<sup>377</sup>; serious scholarship must do the same with respect to the transnational (and domestic) firms whose strategies, organisational models, and managerial competence vary from one another and vary over time. The firms’ overarching market and financial goals may be easy to characterise, but their responses to policy initiatives will be better understood – and anticipated – if their individual corporate history, competitive strategy and managerial experience are subject to more detailed investigation. Whereas the units of analysis in this study have been two states and an industry, each has required considerable “unpacking” to understand the bargaining outcomes experienced.

Thus, while industry and market factors created and constrained viable policy choices for each of the host countries, country-specific factors conditioned the policies adopted, TNC responses to them, and the results documented. Attempts to prioritise the explanatory power of industry factors over country-specific factors are

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<sup>377</sup> Evans’ Embedded Autonomy is a good example of this. Evans, Op. Cit., (1995).

confounded by the two cases studied. The evolution of policy and the national industry, and the resulting bargaining gains and losses can only be understood by analysing the on-going interplay between industry and host country specific factors.

### **Underrated Factors: Firm-Level Strategy and Management**

The bargain model focuses on relations between the host country state and foreign capital, contending that host countries can harness foreign investment and direct it to the country's advantage. This study of the experience of México and Brazil with the international computer industry confirms the theory, even if gains are not always as predictable and enduring as the host country (and the model's proponents) might prefer.

The model seeks to explain realised gains based on the relative bargaining power of the host country state and foreign capital. But the actual results documented in the cases studied cannot be fully understood without reference to (a) the intra-state bargaining "game-within-the-game" discussed at length immediately above; and (b) the firm-level strategic choices and the management capability of local capital.<sup>378</sup> Discussion of the latter is conspicuously absent from discussions of dependency and bargain theory.

Policymakers in Brazil and México employed a variety of instruments to create the space and the conditions for local capital to invest and then flourish in certain parts of the informatics industry. The policies successfully enticed local private sector actors to enter the protected markets. Indeed, a number of domestic groups established market positions and grew. In general, those that adopted opportunistic strategies based on the protection of government policy alone did not fare well in the longer term, however.

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<sup>378</sup> The discussion of IBM above showed how TNC firm-level strategy and competence influenced responses to the computer initiatives in the two countries studied. Attention is now turned to firm-level strategy and competence of local capital, which equally cannot be considered as a homogenous bloc.

The most notable example of this in México is Printaform. Printaform licensed technology from Columbia under the Computer Development Policy in 1981, and grew revenues approaching \$14 million by 1986. Twelve years later, Printaform survived primarily by producing and selling office equipment. The company's share of the domestic PC market was reduced to 0.4%. In contrast, the Mexican leader in PCs and consumer electronics is Lanix – a private company established in 1990, well after the Mexican market reserve was dismantled. In fact, Lanix didn't produce its first PC until 1995; ten years after the IBM decision spelled the end of the Computer Development Policy in México. The other big Mexican success story in the industry is Softek. Although Softek was founded in 1982 at the beginning of the market reserve in microcomputers, the company focused on computer services and customised software – subsectors that were not included in the policy. The success of these two companies owes to the competitive strategy choices (where to play and how to win) and the entrepreneurial capabilities of their founders and managers, not to the policies of their host country governments or the computer TNC reactions to those policies.

Brazil's policy created greater space for local capital for a longer period of time. Unlike in México, a number of large finance and industrial groups invested in the reserved sector. Interviews with these players revealed a variety of strategies. Elebra tended to pursue a more opportunistic strategy, focused on commercialising foreign technology from DEC wherever possible. Players like Itautec and Scopus on the other hand, actively pursued the development of proprietary technology. Among the domestic players interviewed, Itautec was pursuing the most focused strategy, building a strong position in banking software and automation.

While relatively few Brazilian players succeeded in the marketplace after the reserve was dismantled, Itau Group is the most notable exception. With Itautec, this banking group entered the informatics sector in 1979, sensing an opportunity afforded by the market reserve enacted two years earlier. Over time the Group built a formidable array of information technology and electronics businesses: Itaucom (semiconductors); SESA (telecommunications); Philco (consumer electronics, purchased



from Ford in 1987). Itautec invested heavily in R&D, successfully negotiated with IBM to become one of two worldwide manufacturers for IBM communication controllers, and leveraged the Group's banking knowledge and presence to establish an internationally competitive position in banking software and automation that survives today. As evidence of this, Itautec began exporting ATMs to the US and Europe in 2001.

Thus, the expected and actual share of bargaining gains between host countries and foreign capital cannot be well understood without taking account of differences in the strategic choices, and the entrepreneurial and management talent of local capital. Power relationships, structural conditions and policy instruments alone do not explain the sustained market success of players like Itautec amidst the failure of so many other firms. Host country policy may entice local capital to enter, but local capital's sustained success will depend more on the quality of the firm's strategy and management than on the level or skill of state sponsorship.

### **The Obsolescing Bargain**

The fourth tenet of the bargaining model is the presumed shift over time in relative bargaining power in favour of host countries, known as "the obsolescing bargain". As noted in the introductory chapter, this shift of power to host countries is most readily seen in extractive industries with very high initial capital costs and technology diffusion.

Traditional bargain theorists such as Kindelberger, Horst, Moran and Kobrin have expressed doubts that bargain power will shift to host countries over time in technology-intensive industries. The most they were prepared to allow is a very slow shift in bargaining power.<sup>379</sup> In more recent analysis, Tarzi asserts that the probability of obsolescence in high technology industries is "extremely low."<sup>380</sup>

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<sup>379</sup> Bergsten, Horst, & Moran, *Op. Cit.*, (1978).

<sup>380</sup> Tarzi, *Op. Cit.* (1992).

However, Adler and Grieco argued that the obsolescing bargain did indeed apply to the computer industry in Brazil and India respectively.<sup>381</sup> Does experience of México and Brazil with the international computer industry provide evidence for the obsolescing bargain as these two authors have asserted? The short answer is no.

Both countries can claim some bargaining successes as previously documented, though the ambitions, longevity and achievements of the Mexican policy were more limited than Brazil's. Brazil's policy remained in force with broad, strong political support for more than a decade. If the obsolescing bargain were to apply to one of the two cases, it would apply to Brazil. When Adler published his analysis of the Brazilian case in the summer of 1986, Brazil had successfully enticed a large number of domestic players into the industry – including some major finance and industrial groups, developed a large cadre of computer professionals, developed indigenous commercial technology, and limited the scope of TNC operations and their market shares in the country. Adler's optimism about a shift of bargaining power in favour of Brazil at that time is understandable.

However, just a year later these bargaining gains looked much less secure. The failure of the Cruzado Plans, the subsequent economic recession, and a price war in computers exerted severe pressure on the Brazilian players. Most were not producing internationally competitive products so the export market was off limits. They were short on capital and state-of-the-art technology. Meanwhile, global technology advances continued unabated; Moore's Law waited for no one.

Political support for the policy was also wavering. Major Brazilian industrial users of informatics were lobbying against the reserve, concerned that the protective shield the state maintained around the domestic computer players hampered their own competitiveness. In short order, TNCs began to regain lost ground. New technology licensing agreements between major Brazilian players and foreign capital were authorised. Texas Instrument's investment plans for a new microelectronics

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<sup>381</sup> Adler, *Op. Cit.*, (1987); Grieco, *Op. Cit.* (1984).

plant was approved after that sector was “reserved” for three Brazilian firms. Thus, it was already clear in the autumn of 1987 that the bargaining gains of the first decade of the market reserve were in jeopardy.

With the benefit of longer hindsight, one sees many of the important bargaining gains lost. Technology licensing gave way to joint ventures, which eventually became controlled by foreign capital. Brazil continued to depend on imported high-tech components. And few Brazilian players have succeeded in the market absent the protective rubric of the reserve.

The obsolescing bargain clearly does not apply in the cases of México and Brazil. The real problem with the obsolescing bargain as framed is that it posits a progressive, one-directional shift in bargaining power over time to host countries. In dynamic, global, technology-intensive industries windows of opportunity are always opening and shutting. There are periodic opportunities for the host country and foreign capital to re-strike the bargain. This study shows that both México and Brazil were able to achieve some bargaining gains in the computer industry and they were vulnerable to a shift in the opposite direction.

### **Concluding Observations**

The cases underline the fundamental trade-off, at least in the short and medium terms, between objectives of technology transfer and international competitiveness. Brazil has pursued the former to the detriment of the latter, while México placed greater emphasis on international competitiveness and exports, to a large extent forfeiting indigenous technological development. Both countries had to balance one against the other, recognizing the difficulty of having both at the same time. The dilemma for the host country can be couched in the question: Is it better to be a dependent consumer of state-of-the-art informatics equipment and services, or an autonomous producer of inferior information technology? To answer the question

one must take good account of the increasing dependence of the economy as a whole on information technology. This pervasive dependence raised the stakes in the bargaining game. Interestingly, proponents and opponents of the market reserve in both countries based their arguments on the pervasive influence of information technology. Those favouring the market reserve argue that national economic development can only be self-directed if there is a truly national informatics industry and capability. Proponents of a more liberal approach argue that the competitiveness of the entire economy is jeopardized without access to the latest productivity-enhancing information technology.

This study also reveals the resilience, resourcefulness, and determination of the market in pursuing goods and services that it needs and wants. Where the market is knowledgeable about international standards of price and technology, it is difficult to sustain a policy that restricts the market's access to such products and services. The existence of significant and growing contraband markets in both countries in the 1980s testifies to this fact. Further evidence of the market's determination is its increasingly vociferous opposition to the market reserve in Brazil. It is also difficult to prevent copying of technology in such a case simply by legislating against it. The potential profits from supplying latent market demand are too great an incentive for opportunist investors. Illegal imports and product copying have undermined both indigenous technology development and balance of trade in the sector. As such, the cases studied provide empirical support for the state-to-market power shift that Strange contends. Power over outcomes was indeed "exercised impersonally by

markets and often unintentionally by those who buy and sell and deal in the markets.”<sup>382</sup>

My final observation concerns a role and more flexible mechanism the state could have used but did not: the role of lead venture capital investor. This is a role that seems well suited to the creation of effective “greenhouses” for local capital in very dynamic industries like informatics – the host country state functions that Evans described as “midwifery” and “husbandry.”<sup>383</sup> It is a flexible mechanism that would help states overcome the impossible challenge of anticipating the evolution of a hyper-dynamic industry and determining which policy mechanisms to apply exactly when in order to deliver intended outcomes. It provides adaptability where sufficient prescience and shrewdness are impossible to guarantee outcomes.

The Brazilian state invested capital in a single company, Cobra. However, the state could have invested in a venture capital fund, run by (say) a proven Silicon Valley venture capital manager, with a well-defined mandate to develop a national computer industry over a 10-year period. Such a mechanism is inherently more adaptable to changing opportunities and challenges than the mechanisms employed by the Brazilian or Mexican states. The idea can be elaborated a little further with respect to Brazil.

Once the policy objectives shifted from developing Brazilian-owned informatics companies supplying a protected domestic market, to developing an internationally competitive informatics industry cluster in Brazil, lessons from the successful US high-technology cluster model are relevant and applicable.

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<sup>382</sup> Strange, *Op. Cit.*, (1996) pp. 12-13.

<sup>383</sup> Evans, *Op. Cit.*, (1995).

High-tech companies start up in Silicon Valley, Boston and the like attracted by the existence of an eco-system that includes:

- ◆ Top class universities with strong science and technology R&D.
- ◆ Flagship companies that attract and ultimately spawn smaller companies in their own industry sectors forming the clusters. Cisco, Apple, Google and Oracle have attracted others to co-locate in Silicon Valley. Likewise Genentech, Amgen and Abbot have done the same in various locations to create biotechnology clusters.
- ◆ Hi-technology support services companies.
- ◆ Clusters of venture capital and investment firms with investment capital, networks and expertise in the industry cluster.
- ◆ Cities with good infrastructure and access to international airports.

In the past, clusters grew up around leading US universities like Stanford and MIT. Today, high-tech start-ups are located where the venture capital firms are based. Technology and talent have tended to follow the money and expertise, most often to the Silicon Valley.

If the government of Brazil (or México, for that matter) had been prepared to commit capital to develop the sector, it could have invited a variety of international venture capital firms to match government funds.<sup>384</sup> The government could have then set conditions for the mandate, for example:

- ◆ Venture capital firms must locate in Brazil and raise matching funds from private institutions.

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<sup>384</sup> This approach was adopted on a relatively small scale in Malaysia with the biotechnology industry, for example.

- ◆ Funds can only be invested in companies located in a specific region of the country where there is a developing ecosystem and where an agreed percentage of activities must occur (in the case of Brazil in São Paulo state, and in the case of México in Jalisco).
- ◆ Funds will be agnostic about the country of origin of the technology. The advantage of inviting international VCs is that they will bring in foreign investors (for the match funding) as well as technologies. A US venture capital firm based in Brazil can persuade a US-based company to locate in Brazil in order to receive funding. While this approach would have been incompatible with the original policy objectives in Brazil circa 1977, it could have accelerated internationally competitive local production when the policy shifted from protection to promotion in 1990.
- ◆ Venture capital managers seldom invest alone and often syndicate deals with other VC firms. So the leverage from the government's seed capital can be considerable, on the order of five to ten times.

Midwifery and husbandry are seemingly attractive and important functions for a developmental state to play. But the hyper dynamism of the informatics industry makes these roles exceedingly difficult for the state to play well, even if local and international politics are supportive. And the stakes are high – informatics is not just a collection of standard industrial codes; it is a cluster of industries that have a critical impact on the productivity and therefore competitiveness of the national economy.

Thus, states must make realistic assumptions about what role they can play to encourage the development of competitive high-tech industries. Perhaps adopting the role of a catalytic investor – not in an individual flagship company but in a fund or

funds that are better geared to fuelling the growth of an internationally competitive industry cluster – is a role that will help states to transition from midwife to husband and yield more lasting success.

### **Main Contributions of the Thesis**

This final section summarises the main empirical and conceptual contributions the thesis makes to the understanding of the relations between host country states and TNCs in a highly dynamic industry sector in developing countries.

#### Empirical Contributions

The research findings are supported by extensive empirical research that draws from primary sources, including interviews with decision makers in the state bureaucracies, and in local and transnational firms. Based on ninety-six field interviews and numerous secondary sources, the research project documents in rich detail the development of computer policies in the 1970s and 1980s, together with the responses of foreign TNCs and domestic capital to the evolving policy and market environments. The thesis is distinctive in its thorough interdisciplinary historical documentation and exploration of (a) domestic and international politics at both macro and sectorial levels; (b) industry structure development and competitive dynamics; (c) market response and influence; and (d) firm level strategy, success and failure. As such, the case studies integrate and synthesise perspectives from history, politics, economics and business.



As noted in the introduction, the Brazilian case has received more attention since the fieldwork for this thesis was conducted.<sup>385</sup> However, this analysis of policy impact and emphasis on the dynamic interplay between market and political forces is distinctive. By contrast, the Mexican case has continued to be relatively neglected.<sup>386</sup> The case material alone on México therefore adds to the body of knowledge about the market reserve experiment in that country in the early 1980s.

The thesis also adds to the body of literature that *compares* the experiences of developing economies with the international informatics industry.<sup>387</sup> The cases of México and Brazil have not been compared systematically with a view to drawing lessons for TNC – host country bargaining.<sup>388</sup> In fact, the two cases are rarely discussed together. Yet the two cases are interesting comparators, not just because they offer a test and potential refinement of bargain theory in high technology industries. Both cases developed in a period of national history characterised by growing democratisation and transition to free market economies – economic policies that have largely endured to this day. This comparative case study documented at this particular time in history therefore offers a distinctive and relevant perspective.

### Conceptual Contributions

The distinctive contributions the thesis makes to conceptual scholarship on the relations between developing country states and transnational firms in globalising high

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<sup>385</sup> Evans, *Op. Cit.* (1995); Evans, Frischtak and Tigre, *Op. Cit.* (1992); Schoonmaker, *Op. Cit.* (1995); and Schoonmaker, *Op. Cit.* (2002).

<sup>386</sup> Montoya Martín Del Campo, *Op. Cit.* (1992); Borja, *Op. Cit.* (1995).

<sup>387</sup> Brazil's experience with the international informatics industry has been compared at some level to India and Korea in the mid and late 1990s in Evans, *Op. Cit.* (1995); and Evans, Frischtak and Tigre, *Op. Cit.*, (1992).

<sup>388</sup> A summary comparison of the impact of liberalization on the computer industries in México and Brazil has been documented in Dedrick, Jason, Kraemer, Palacios and Tigre *Op. Cit.* (2001), but there is little discussion of host country politics or host country – TNC bargaining in the article.

technology industries are fourfold. The thesis: (i) demonstrates the inapplicability of the obsolescing bargain in the cases studied, instead detailing a more dynamic bargaining environment where industry and country-specific factors open and close windows of opportunity for both host country and transnational firms; (ii) highlights the trade-offs between the objectives of technology transfer and international economic competitiveness; (iii) illustrates the importance of firm-level strategy and managerial competence to explain industrial success, whatever the policy environment; and finally (iv) demonstrates the inadequacy of the standard host state “toolkit” and identifies an alternative role that developmental host country states can play in knowledge-intensive globalised industries, despite the challenges that such hyper-dynamic industries present.

*Inapplicability of the obsolescing bargain.* Vernon’s original articulation of the obsolescing bargain theory forty years ago was based largely on the experience of foreign investment in extractive industries.<sup>389</sup> Stephen Kobrin (along with other traditional bargain theorists like Kindelberger, Horst and Moran) subsequently argued that manufacturing and export-oriented foreign investors were less vulnerable to host country treatment arising from an obsolescing bargain.<sup>390</sup> Malesky noted more recently that foreign investors learn and direct their investments into countries where they are less susceptible to an obsolescing bargain post investment.<sup>391</sup> However, Adler and Grieco argued that the obsolescing bargain did indeed apply to the computer

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<sup>389</sup> Vernon, *Op. Cit.*, (1971); (1980).

<sup>390</sup> Kobrin, *Op. Cit.*, (1987).

<sup>391</sup> Malesky, *Op. Cit.*, (2005) p. 8.

industry in Brazil and India respectively. These papers were published in 1984 and 1987 without the benefit of sufficient longitudinal perspective.<sup>392</sup>

While this study is not offered as a rigorous testing of theoretical models, the detailed examination of the dynamics of state – TNC interactions over a multi-decade period of time provides conclusive proof that the obsolescing bargain does not apply in these cases. While both México and Brazil achieved some bargaining gains in the computer industry, they were both vulnerable to a shift in the opposite direction. This study of the on-going interplay of political, industry and market forces revealed a bargaining landscape that is more complex and variable than the unidirectional obsolescing bargain assumes. The thesis demonstrates that static positional asset-based models to identify winners and losers lack sufficient explanatory power.

By unpacking the country-specific factors, this study also revealed the importance of the bargaining “game-within-the-game” in determining the actual policy courses followed. By contrast, much of the bargaining literature treats states and firms as “whole actors”, neglecting the micro-politics and bargains struck inside each state and firm that were decisive in determining state-firm bargaining terms and outcomes. Even ‘triangular bargaining models’<sup>393</sup> underplay the importance of intra-state and intra-firm bargains.

*Trade-off between technology transfer and international competitiveness.* The thesis highlights a fundamental, shared dilemma for host countries with respect to information technology: Is it better to be a dependent consumer of state-of-the-art informatics equipment and services, or an autonomous producer of uncompetitive

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<sup>392</sup> Adler, *Op. Cit.* (1987) and Grieco, *Op. Cit.* (1984).

<sup>393</sup> Stopford and Strange, *Op. Cit.* (1992).

information technology? The two cases studied side by side illustrate the fundamental trade-off between objectives of international competitiveness and technology transfer. Brazil aggressively pursued the latter over an extended period of time, to the detriment of the former. México placed greater emphasis on international competitiveness and exports much earlier, and forfeited to a large extent sustained indigenous technology development. The thesis clearly demonstrates the difficulty of pursuing an economic development strategy that isolates the country from state-of-the-art technology inputs. If the aim is national economic development, then a narrow industrial development mindset (“protect and develop a national information technology industry”) ignores the universal importance of information technology to the economy as a whole. The national economy as a whole will be better served by framing the policy objective as “the rapid diffusion of information technology as the critical productivity-enhancing input for industry.”

*Importance of firm-level analysis.* The thesis illustrates the importance of firm-level strategy and management competence to explain industrial success. In much of the international political economy literature, the focus on industrial policy, national and international politics and economics often obscure or ignore the importance of firm-level factors. Discussion of these is conspicuously absent from discussions of dependency and bargain theory. However, the actual results documented in the cases studied cannot be understood without reference to the firm-level strategic choices and the management capability of local capital. The general theoretical approach cannot explain the competitive success of Lanix and Softek in México or Itautec and PROCOMP in Brazil. These may indeed be exceptions to the general trend, but they are important enough to show that “local capital” cannot be treated as a homogenous

bloc. Scholarly work in the IPE field will benefit from integrating perspectives from the business disciplines of competitive strategy and organisation with those of politics and economics.

*State role as catalytic venture fund investor.* Finally, the thesis identified the need for a more nimble toolkit to be applied by developmental states seeking to harness dynamic, globalising, high technology industries to develop national capability for the sake of the economy as a whole. Evans documented the critical importance of a highly competent state bureaucracy that is both embedded in varied networks within its society, but at the same time able to maintain sufficient autonomy to avoid capture by vested interests so it can pursue its own vision of national development (“embedded autonomy”).<sup>394</sup> Stopford and Strange acknowledged the importance of understanding the international structures of industries and the competitive strength of individual firms.<sup>395</sup> Findings from this thesis show that such embedded autonomy and industry insight are necessary but not sufficient to harness and direct a rapidly evolving high technology industry. Evans goes on to describe concrete ways the state may create “greenhouses” for local capital to invest and develop in strategic industries, using the language of “midwifery” and “husbandry” to describe two of the potential state roles.

However, this thesis shows that the hyper dynamism of the informatics industry makes these roles exceedingly difficult for a state to play well, even if local and international politics are supportive. The thesis posits a different role: that of a catalytic investor not in a firm but in an industry via a professionally managed fund or

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<sup>394</sup> Evans, *Op. Cit.* (1995).

<sup>395</sup> Stopford and Strange, *Op. Cit.*, p. 96.

funds that are better (even specially) suited to identify and develop competitive firms in rapidly evolving sectors. While Malaysia has taken this approach with respect to developing a biotech industry and Rwanda has assumed a similar role through two national holding companies investing across sectors, this is a state role that is not well documented or explored in the literature.<sup>396</sup> Even as it is mentioned here as a distinctive contribution, it is clear that this type of approach would benefit from further research.

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<sup>396</sup> A recently published Working Paper describes the case of Rwanda since 2000, where the state is effectively an investor in two private holding companies making strategic investments in national enterprises: Tri-Star Investments (recently re-branded Crystal Ventures), owned by the ruling party; and Horizon Group, owned by the Rwandan military. David Booth and Frederick Golooba-Mutebi, "Developmental Patrimonialism? The Case of Rwanda. Working Paper 16." London: The Africa Power and Politics Programme of the Overseas Development Institute, March 2011.

**APPENDIX A**

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## APPENDIX A

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**APPENDIX B**  
**DEPTH INTERVIEWS**

## APPENDIX B

### DEPTH INTERVIEWS - MÉXICO

Name	Title	Organisation	Date
<b>INDUSTRY</b>			
Lee Ting	VP International	HP (California)	01/87
Jorge Martínez	VP	HP de México	04/87
Juan Flores	Marketing Director	Honeywell Bull	04/87
Robert Cook	President	Unisys de México	04/87
René Mondragón	External Relations	Unisys de México	05/87
Ramiro Zavala	President	Control Data	04/87
Rubén Bernal	President	NCR de México	04/87
Gene Towle	Marketing Director	Apple de México	04/87
Raúl de la Parra	President	Equipos y Sistemas	03/87
Jaime Nares		Tandem de México	06/87
Rodrigo Guerra		IBM de México	05/87
José Gomez	Marketing Director	IBM de México	05/87
Jorge Espinosa		AES Printaform	05/87
Antonio Castro	President	Grupo Mexel	05/87
Alfredo Gonzalez	President	Grupo Sigma	05/87
José Quiroga	President	Micrológica Aplicada	05/87
Eduardo Sittón		Planta Industrial Digital	05/87
Fernando Ruiz Salazar		IEPRO Olivetti	05/87
Enrique Martínez	Vice President	Electron	06/87
Luis Thion		Sistemas Inteligentes	06/87
<b>GOVERNMENT</b>			
Adolfo Hegewisch	Undersecretary	SECOFI	06/87
José Warman	Director General	SECOFI	03-06/87
Ricardo Zermeño	Director General	SECOFI	04-05/87
Alberto Montoya	Director	INEGI	03-04/87
Pablo Grijalva	Director General	INEGI	04/87
Pedro Treviño		SECOFI	04/87
Ernesto Marcos	Dir Genl Industries	SEPAFIN	05/87
Mario Espinosa		SECOFI	05/87
Mauricio de Maria		SECOFI	05/87
<b>ASSOCIATIONS &amp;</b>		<b>ACADEMICS</b>	
J. Francisco Thions	President	Infocom	03, 06/87
Ricardo Rosas	President	AMFABI	03/87
Irma Amaya Gonzalez		CANIECE	03/87
José Luiz Marquez		CANIECE	03/87
Matthias Sachse		ITAM	01-05/87
Victoria Bajar		ITAM	02/87
Margaret Miller		ITAM	02/87
Rogelio Ramírez		Ecanal	03/87
Franklin Rendón		CONACYT	03/87
Timothy Berry		Infotext (California)	01/87

## APPENDIX B (CONTINUED)

### DEPTH INTERVIEWS - BRAZIL

Name	Title	Organisation	Date
<b>INDUSTRY</b>			
Paulo Aratangy	President	Tesis/Hewlett Packard	09/87
Celso Furiani	External Relations	Tenpo/Olivetti	09/87
Edson Fregni	President	Scopus	09-10/87
Fernando Dominques	Vice President	Scopus	09-10/87
Conrado Venturini	Director	Itautec	09-10/87
Roberto Mors	Manufacturing Dir	IBM Brasil	09/87
Georg Herz	External Relations	Unisys Brasil	10/87
Henry Eicler	President	Unisys Brasil	10/87
Enrico Misosi	President	Olivetti	09/87
Arnon Schreiber	President	Digirede	10/87
Koenraad Visser	President	DEC Brasil	10/87
Paulo Tigre	Planning Director	Cobra	10/87
Mario Ripper	President	Elebra	10/87
Herman Katzender		Elebra	10/87
Claudio Mammana		Elebra	10/87
Mario Frassatti	Director	Prologica	10/87
José Nelson Salvetti	General Manager	Texas Instruments Brasil	10/87
Henry Maller	General Manager	Fairchild Brasil	09/87
Antonio Carlos Rego	President	SID Informatica	09/87
Ricardo Maciel		SID Informatica	10/87
<b>MAJOR USERS</b>			
Jon Elsasser	President	Timken do Brasil	09/87
John Blahmik	Treasurer	EDS (General Motors)	09/87
Luiz Fernandes		EDS (General Motors)	09/87
George King	President	Kodak Brasileira	09/87
David Benadof	President	J.I. Case	10/87
Norbert Gmur	President	Ciba Geigy Quimica	10/87
John Mancel	Director of Admin	Ciba Geigy Quimica	10/87
Vitor Baumgartener	President	Caterpillar do Brasil	10/87
Eugenio Monteiro		Romi Ind. SA	10/87
Morris Abadi	Finance Director	Metal Leve	10/87
Ricardo Hamlet C.		Cofab CIA Fabric.	10/87
Sirleu Jose Protti	General Manager	Gerdau Metalurgica SA	10/87
<b>ASSOCIATIONS</b>			
Arturo Perera Nunes	President	ABICOMP	10/87
Claudio Mammana	President	ABICOMP	10/87
Washington Franco		SUCESU	09/87
Edson Fermei		FIESP	10/87
Chris Lund		Grupo das 30	10/87
Laerte Setubal		Grupo das 30	10/87
Luigi Nese	President	ASSESSPRO	10/87

**APPENDIX B (CONTINUED)**

**DEPTH INTERVIEWS – BRAZIL**

<b>Name</b>	<b>Title</b>	<b>Organisation</b>	<b>Date</b>
<b>GOVERNMENT</b>			
José Ezil		SEI	10/87
Roberto Spolidoro		SEI	10/87
Dorgival Brandão		SEI	10/87
Luciano Coutinho	Secretary General	Science & Tech Ministry	10/87
Clelia Piragibe		Science & Tech Ministry	10/87
Roberto Campos	Senator	Congress	10/87
Cristina Taveres	Senator	Congress	10/87
Severo Gomes	Senator	Congress	10/87
Edison Dytz		SEI	10/87
Mike Delane		US Consulate	08/87
Steve Dacchi	General Consul	US Consulate	09-10/87
Claude Fontaine		Canadian Consulate	09/87
William Jackson		Canadian Consulate	09/87
<b>OTHER</b>			
Vivian Morgan-Mendez	Vice President	Bank of Boston	09-10/87
Rik Turner		McGraw-Hill	08-10/87
Norman Gall		Forbes	10/87
Francisco Viana		Senhor	09/87
Esther Donio Bellegard		Pinheiro Neto, Avogados	10/87

**APPENDIX C**  
**INDUSTRY INTERVIEW GUIDE (MÉXICO)**



MEXICAN COMPUTER INDUSTRY  
COMPANY PROFILE QUESTIONNAIRE

Company Name: \_\_\_\_\_

Respondent: \_\_\_\_\_

Position: \_\_\_\_\_

Date: \_\_\_\_\_

## INTRODUCTION

### I. BACKGROUND ON LOCAL OPERATIONS

#### 1.1 Date of entry in México?

- As distributor (for what firm?)
- As subsidiary office for foreign company
- As manufacturer/assembler
- Other

#### 1.2 What is the range of products being sold in México? How long have they been sold here?

#### 1.3 Which products are being produced in México? For how long?

#### 1.4 Annual product sales & growth?

#### 1.5 Number of employees and percent employed in which areas? (Does this include maquiladora operations?)

- Manufacturing
- Marketing (including sales)
- Management/administration
- Maintenance service
- Research & development
- Other

#### 1.6 Of your managements and R & D personnel, what percentage are foreign or have lived abroad for a significant period of time?

#### 1.7 What is the educational background of your employees (%)?

- Ph.D.
- Masters
- Undergraduate degree
- High School
- No degree

#### 1.8 Did you have difficulty finding qualified personnel? For which areas?

#### 1.9 Do personnel receive training from the foreign firm? Who & how much?

#### 1.10 What manufacturing processes are carried out here in México?

- Assembly
- Test
- Other

How does this differ from operations in the U.S.?

1.11 Number and location of manufacturing facilities and number of square meters in your manufacturing facilities? How has capacity changed since entry?

## II. GENERAL EFFECTS OF GOVERNMENT POLICY

2.1 Is your firm registered with SECOFI? When was contact first made for establishing local computer production?

2.2 What was the role/impact of government policy pre-1982?

2.3 With which government institutions/representatives did you negotiate in establishing your operations in México?

2.4 To what extent has government policy affected your strategic decisions:

- Decision to assemble locally
- Level of investment
- Organization & ownership
- Level of exports
- Level of local integration
- Level & direction of R & D expenditures
- Pricing
- Other

2.5 What areas were negotiable with SECOFI? (i.e., what were the areas of government flexibility and tradeoff?)

2.6 How has the policy changed since its introduction in 1982? What seem to be the government's policy objectives now?

2.7 How has the policy change affected your business? Is the negotiated agreement still binding?

2.8 How has government policy affected the competitiveness of your products in the Mexican market? International market?

2.9 What have been its effects on the industry as a whole?

2.10 What would you like to see as government policy in this area?

Note: The rest of the interview focuses on more specific effects of government policy in five areas:

1. Ownership & control
2. Foreign currency balance
3. Local integration
4. R & D investments
5. Marketing/pricing

## III. OWNERSHIP & CONTROL

3.1 What is the capital structure of your firm?

- Total assets
- Shareholder equity
- Major shareholders & % of equity

3.2 How has the capital structure changed since entry?

3.3 Please describe your joint-venture/licensing arrangement.

- Evolution
- Rationale
- Roles/contributions

3.4 To what extent are decisions controlled or influenced by the foreign firm?

- Product introduction
- Product positioning (e.g., price)
- Management personnel
- Foreign trade

#### IV. FOREIGN TRADE

4.1 What is the value of your exports?

- Products exported?
- To which markets?
- Trends in exports?

4.2 What products are produced in in-bond facilities? What is the value of these exports? Trend?

4.3 Is México a good export base? Why?

4.4 What is the value of your imports?

- Products/components imported?
- For internal use/for re-sale?
- Trends in imports?

4.5 What percent of these imports are dedicated to your in-bond facilities?

4.6 Have you had trouble obtaining import licenses? In which cases?

#### V. LOCAL INTEGRATION

5.1 What components are sourced from vendors located in México? From whom?  
Are your suppliers affiliated with your company?

5.2 Do you have trouble finding competitive components in México? How many suppliers are there to choose from for each major component sourced locally?

5.3 What percentage “local integration” is there in your products? How has this changed since entry?

5.4 If the government stopped requiring domestic content, how would your sourcing operations change?

#### VI. RESEARCH & DEVELOPMENT

6.1 What is the level of R & D investments in México? How has this changed since entry?

6.2 How are R & D moneys being spent?

- Basic research
- Product adaptation
- Supplier development
- Software development
- Other

How does this compare with your operations in the U.S.?

6.3 Which investments count toward your local R & D requirement?

6.4 How would the level and/or direction of R & D investment change without policy requirements?

#### VII. MARKETING

7.1 What percentage of your sales are attributed to:

- Government (excluding state-owned enterprises)
- Banks/financial
- Large industrial
- Small business
- Education
- Home
- Other

Has this changed?

7.2 What factors are most important to your customers (e.g., price, technology, time of delivery, support, etc.)? Have these changed?

7.3 What product-markets are served by direct sales? Which by dealers? Has your distribution strategy changed? Why?

7.4 How do the prices of your products in México compare to prices of the same products in the U.S.? In Europe?

7.5 Have your prices been lowered as a result of market forces (i.e., increased competition), by government policy restricting price differentials, or other?

7.6 What are the key success factors for computer manufacturers in México? How do these differ from those in the U.S., Europe, or Japan?

VIII. GENERAL COMMENTS