THE LOCATION OF THE IN-BOND ELECTRONICS INDUSTRY IN MEXICO 1965-1990.

by

Patricia Erika Aguilar Zeleny

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Department of Geography
London School of Economics
London WC2A 2AE

ABSTRACT

This thesis presents an analysis of the electronics in-bond industry in the Mexican Northern Border. It is argued that the location or subcontracting by foreign firms of the assembly phase of electronics production in Mexico constitutes a new pattern of industrial location different from that of the heavy industrial concentrations in the the three biggest cities, Mexico City, Monterrey and Guadalajara. As this new pattern consolidates and spreads into the interior of the country, the labour processes upgrade, requiring a more skilled labour force with the consequent changes in the structure of the labour force.

This process is linked to the general process of internationalisation of capital which has had as a result the integration of more countries into world trade thus changing the structure of world production capacity and the subsequent geographical redistribution of worldwide production. In this way, firms have located production facilities in the the Newly Industrialising Countries (NICs) and, nowadays, the New-NICs. However, in opposition to the somewhat one-sided views developed hitherto of the phenomena, the research undertaken on the electronics industry at world level and the empirical data gathered on in-bond electronic firms in the Mexican Northern Border identifies several factors as interacting in the emergence of new patterns of location in countries integrated into international trade: a) the role of technological innovation; b) increasing capital-intensiveness of industry versus labour intensity in certain phases of the production processes; c) intense competition at world scale; d) the characteristics of labour force in the host countries and e) the role of the nation-states -both home and host countries- which through economic and social policies influence the relocation offshore (in the former case) and establish the conditions for the successful performance of the labour processes relocated in the latter.

To the memory of my little daughter Maryam
and to my sons Ibrahim and Ismail.

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INTRODUCTION

During recent decades the international mobility of capital has reached an unprecedent level. This is particularly evident in the industrial activity. Manufacturing sectors such as electronics, electrical machinery and transportation equipment, for example, have shown a high degree of international integration, forming a complex pattern of production and trade linkages.

Since the mid-1960s there were some signs of relocation of particular sectors or, more specifically, of particular segments within those sectors from the core industrial regions to areas in less developed countries (LDCs). The host countries were the most advanced of the developing world, a group of which came to be known as the Newly Industrialised Countries (NICs). South Korea, Hong Kong, Taiwan, Singapore, India, Argentina, Brazil and Mexico were initially included within that group. Subsequently, in the 1970s, a number of other countries were added to the list of NICs (Malaysia, Philippines, Thailand, Venezuela, Yugoslavia). By the late 1970s there was a relatively significant redistribution of world industrial capacity. Part of this was located in free production zones (FPZs) in developing countries where exceptional conditions for lowering costs of production were offered. Since the early 1960s tariff reductions, improvements in transportation and communication systems as well as the betterment in infrastructure, result of governments' intervention, had as a corollary an increase in labour qualifications in many developing countries thus making possible such moves. The world slump of the early 1970s came to accelerate the pace of industrial relocation because of the need of many firms to minimise their production costs. For many of them the relocation of complete production system or part of it was the only way to survive in the world market.

During the 1980s, a new wave in the shift of manufacturing activities to developing countries has been in progress. The recession of the early 1980s, along with the arrival of new world-class competitors (Japan and, more recently, South Korea and Taiwan) have sharpened international competition and have pressed firms to look for new low cost production sites for sectors restricted only to developed countries in the past. In addition, trade restrictions and fluctuations in the exchange rate of particular countries have also pushed some firms to change their locations of production facilities or locate their new investment in an advantageous region.

The process of integrating more and more areas into the world market has not worked without changes or in an uni-directional way, both in sectorial and geographical terms. In the first phase, the sectors involved were those with simple technical processes and mainly labour-intensive operations, such as in textiles and electronic components. In the latest phase, sectors that require more sophisticated production processes and capital-intensive operations were included. On the other hand, the geographical distribution of such sectors has been changing too. Some countries were integrated in a first wave, some others later. Those which were included in the first phase have changed their initial production base by moving on to other manufacturing sectors. For instance, Mexico is now attracting more firms involved in capital-intensive operations, while industries such as textiles are moving to areas where labour is even cheaper, as the Caribbean region. The same pattern happened in Hong Kong, which is losing its labour-intensive operations to other LDCs of the East Asian region, including the Peoples's Republic of China. The so-called "comparative advantages" in the production of goods are constantly changing among countries.

This process can be seen as the result of a change in the structure of world production capacity and its subsequent geographical redistribution. As competition increased with waves of expansion of world trade and periodical crises, firms sought to maintain their profitability through several strategies, such as innovations in production processes, products and in organisations which supported the great dynamism of some industrial sectors in terms of location. However, this process or relocation offshore would not have taken place had the potential locations not undergone a process of structural change in their economies which enabled the firms to successfully perform production processes at current levels of productivity.

The purpose of this research lies in analyzing the pattern of location of the in-bond electronics industry in Mexico in what we have called a new pattern of location in its Northern Border in order to answer a question rarely addressed in "Grand Theories" such as the world-systems and globalisation theories: what are the inducements for foreign corporations to locate production facilities offshore in particular parts of the LDCs rather than elsewhere? We are talking here not of an undifferentiated "Third World" as opposed to the "First World" as any centre-periphery theorist would argue but to particular geographical areas. The relevant factors would include a series of external and internal factors. As external we find process of competition (inherent to the essence of capitalism) as well as the policies of the government in the home countries (like military purchases, etc). The internal factors include not only the policies directly concerned with making the host country attractive for the industry - tax conditions, repatriation of profits and labour legislation- and the economic policies of industrial deconcentration, provision of industrial facilities, upgrading of labour productivity, export-led growth, and the like -but also the social policies and adequate investment necessary to guarantee the availability and continued reproduction of both unskilled and skilled labour force able to perform the labour process at current levels of productivity. These would include the provision of scientific and technological institutions for high-skill engineers and technicians and centres for the education and training of lower lever technicians and workers, also the provision of health and public services, transportation and infrastructure and housing are included.

These factors are a result of the governments' initiative to attract foreign investment. Thus, and opposing all those arguments which link the redistribution of production capacity within a given country to the more generalised, as a direct outcome, process at the world level (the "Grand External Forces") in my analysis "government policy remains, therefore, an independent, local variable" [the stress is mine] (Henderson, 1989:xvii), and not only a "permissive" factor, as N. Harris points out, just facilitating the integration of the economy with the international arena (1986:36).

Here the in-bond electronics industry is used as an empirical vehicle to analyse the dynamics of industrial location. Also I am interested in the electronics industry because I consider it as a prime example of the current process of redistribution of world industrial capacity for the following reasons.

a) Since the mid-1960s the sector has become highly internationalised with the NICs (and lately the so-called New-NICs) as important offshore locations for leading transnational corporations (TNCs).

b) The widespread use of its products for many activities (as end-products or crucial inputs) in home, office and industry for processing information to such an extent that for many "life without electronics is almost unthinkable".

c) The characteristics of the production processes and the products themselves: relative labour-intensive phases and the high value/low weight products facilitate the location offshore. So a technical division of labour is found in which each country specialises in certain part of the production process with different requirements in the skill of the labour force.

d) As a result of (b) and due to the impacts of (c) in the host countries, governments in many developing countries give great importance to this sector in terms of the development and expansion of an export-oriented electronics industry or (as in the case of some of the Asian NICs) the development of an indigenous one with world standards able to compete with the big American or Japanese producers.

Therefore my main argument is that redistribution of world production capacity has had as a corollary, the emergence of a new pattern of location of the industry in the host countries, away from the old industrial cores which dominated the global economy. As the new locational pattern consolidates and spreads into the country the labour processes upgrade and result in changes in the structure of the labour force in response to the need for more skilled labour. Taken as an alternative for industrialisation and development, in a country which up to some few years ago was one of the most protected countries, the production processes thus located offer ample opportunities for the qualification of the labour force in processes which require productivity at world levels and for the making of a more competitive environment which will force the improvement in efficiency and quality of production at world standards of those local industrialists willing to provide inputs to the in-bond electronics industry.

The analysis begins with an exposition of some [illegible] developments which attempt to explain the current process of internationalisation of capital and its implications in both developed and developing countries. There is no pretension of giving a conclusive verdict on the theories, but to show some of their flaws in such a complex problem. In Chapter II, the redistribution of electronics production capacity is examined highlighting what above I identified as external factors [to the host countries], competition, technology, governments' policies in the home countries, etc. which acted as a "push" factor for the TNCs and led them to relocate facilities in LDCs. Chapter III deals with the "pull" factors which induced the location of some electronics firms in the Mexican Northern Border, the economy and host government's policies and finishes with a brief outlook of Mexico's international trade and its performance in the trade of electronic products. In Chapter IV I start with an exposition of the creation of the Border Industrialisation Programme in the late 1960 s and the in-bond industry legal regime and then proceed to examine the general characteristics of the in-bond electronics industry and its consolidation as a new locational pattern. In Chapter V is examined the empirical data drawn from my survey on the Mexican Northern Border in order to corroborate the findings in chapter IV and, ultimately the assumptions given in my argument, that the new locational pattern is consolidating and spreading into the country and bringing about important changes in the structure of the labour force. Finally, in chapter VI, some conclusions are drawn about the viability of the new locational pattern for the further industrialisation and development of the country, also some policy suggestions are given in order to consolidate the in-bond electronics industry by forging durable links with the rest of the economy.

I. THE ELECTRONICS IN-BOND INDUSTRY IN MEXICO: A review of the literature.

INTRODUCTION.

The economic, social, political and spatial implications of the process of internationalisation of capital are far-reaching, for both "developed" and "developing" countries, and are the object of a heated debate and research in both the academic and governmental institutions (Henderson and Castells, 1987). As a result there is an extensive literature which examines the impact of this redistribution of world production capacity of specific industrial branches in particular territorial units (e.g. Hall and Markusen, 1985; Hansen, 1981; Harris, 1986; Jenkins, 1986; Langlois et. al., 1988; Massey, 1984; Perlo, 1987; Salih, Young and Rasiah, 1988; Saxenian, 1985; Scott, 1988; etc). Also there is some work which tries to explain this worldwide redistribution in several industries at global scale (see, for example, Dicken, 1986; Grunwald and Flamm, 1985; Scott and Storper; 1986). However, there has been relatively little research on how the changes in the structure of world production capacity has led to an increasingly more elaborate territorial pattern of specialisations (see Scott, 1987).

Before analysing the in-bond electronics industry in Mexico, it is necessary to examine the theoretical attempts to explain the process of internationalisation of capital since there is no single view about its emergence, expansion and impact in both the developed and developing countries. In many cases, these attempts fail due to their one sided explanations of the process, giving a lot of weight to the labour-force factor, or to the technological change, or to the role of the TNCs and its decisions on foreign direct investment (FDI) in developing countries and neglecting all the other factors which are also involved in the location offshore of production facilities.

I will start with one of the earlier attempts at interpretation of the process of internationalisation, the product-cycle approach applied to the electronics industry by Hirsch (1967). In the second part a brief examination and critique of the New International Division of Labour Theory of Frobel (NIDL) et.al. (1980). is given. The works of Hymer (1979) and Jenkins on the internationalisation of capital and its spatial implications are dealt with in part 3. In part 4 I examine what I have called other neo-marxists developments, Massey (1984) and Sayer (1986). The analysis of Schoenberger (1986, 1988) about flexible technologies and its implication in the production of semiconductors (the change to semi-custom and custom) together with the work of Scott (1987, 1988) and Scott and Angel (1987, 1988) on transactional relations of the firms is grouped in what is called approaches on the strategies of the firms. Finally in part 6 there is a group of works which see the current process of internationalisation of capital as a restructuring of capital in order to overcome the ever-deepening crises (Henderson, 1989; Salih et.al, 1988 and Sklair, 1989).

1. PRODUCT-CYCLE APPROACH.

In one of the earlier attempts at explaining the location of electronics industry, Hirsch (1967) uses the product cycle approach first introduced by Vernon (1966)[1]. To start with, Hirsch proposes that:

> "the comparative advantage a country has in particular industries is determined by the degree of development attained by that country and the maturity of the industries concerned, less developed countries having an advantage in mature industries, industrial leaders in growth products, and small developed countries in new products with a high engineering and scientific content. One relevant factor given special consideration is the effect of marketing costs in industries of differing maturity" (1967:v-vi).

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[1] Another interesting attempt based on Vernon's approach is that of the profit-product cycle proposed by Markusen (1985). An interesting critique can be found in Henderson (1989:23-4).

To determine the maturity of the industries he uses the definition of Kuznets of new product as one being manufactured by methods which were not previously used by the industry or if it is based on a recent invention or unfamiliar developments.

In the introductory phase of a new product, the model asserts, the manufacturers try to keep their fixed assets and overheads down as much as possible so they refrain in installing machinery and rely on subcontractors and independent specialist firms. Since the introduction of a new product requires the cooperation and availability of highly skilled personnel (engineers, managerial staff, etc) and specialised services, the production is generally confined to the firm's home country where all these external economies are available.

The second phase of the product-cycle is characterised by the emergence of sufficient demand in other core states so that local production for these markets begins. By this time the product has been refined and its production technology standardised so that routine manufacturing operations can be safely conducted in locations remote from the corporate core (Wallace,1990:127).

The opportunity for the developing countries -as Hirsch affirms- comes with the mature phase of the product due to the production process is well established, the machinery standardised, easily obtainable and maintainable. Likewise since the skill-requirements of the labour-force are low it is easier to train it. The few people needed with specialised skills and experience can be hired from the local elite or even from abroad (1967:25).

Wallace (1990:127) suggests that "interpretations of changing spatial distributions of manufacturing activity must be sensitive to their conjunctural (historically and geographically specific) origins". In this way, he affirms, the product cycle model was developed when the US economy was the world's largest, richest with the most technologically advanced market to the advantage of the US TNCs. Apparently the model proved to be right for the analysis of, to say, the textiles industry and the electronics industry of the early 1960s (See Hirsch, 1967:63-82).

However, recent developments in the industry have proved the model's inaccuracy, for example, the increasing importance of the Asian NICs as locations of phases of the production processes with greater skill requirements[2] for the production of relatively new products and even the emergence of indigenous production in those "new products" proper of developed countries in the model. In addition, some technologically- mature products -like televisions- experienced some technological rejuvenation and reversing of the cycle and are now successfully manufactured by firms from the NICs. For example, the South Korean companies Samsung and Gold Star are moving into more sophisticated colour television production and into the manufacture of video cassete recorders (VCRs) and they have also built colour television plants in the US. Tatung, the major television manufacturer in Taiwan, has plants in Japan, Singapore, the US and UK and acquired a manufacturing plant in the latter (Dicken, 1986:348).

In addition Hirsch asserts the dynamism of the model upon the proposition that:

> "comparative advantage is not a static phenomenon which remains constant overtime. One of the model's major premises is that a country which has a strong competitive position in a particular industry at a given point in time may well lose this position when the industry enters into a new phase" (1967:129).

However, this proposition gives a lot of weight to the characteristics of the product and of the industry itself in the locational pattern of the industry and, to a certain

[2] See Henderson, 1989; Salih, Young and Rasiah, 1988 and Scott, 1987 in the case of semiconductors production and Evans, 1986 and Evans and Bastos Tigre, 1989 for computers.

extent, neglects the dynamic of the economies of the countries themselves and the existence of specialisation of production. Thus the components of a given product are increasingly produced in different countries and each one specialises in certain components independently of the "maturity" of the product or the "degree of development" of the country. This is so just because that country had -in the proper time- the required resources (skill of the labour force, capital, external economies) to perform that particular phase of the production process. Once the production is established, the dynamic of growth of the country may allow the upgrading of the production process, as in the case of the Asian NICs and to lesser extent the Latin American NICs -a process which is utterly neglected in the product-cycle approach.

2. THE NEW INTERNATIONAL DIVISION OF LABOUR THEORY.

As noted earlier, the failure of some attempts to explain the offshore location of the industry in general -and electronics in particular- is due to the one-sided view they have of the problem. This is the case in the neo-marxist interpretations like that of the New International Division of Labour (NIDL) theory of Frobel et.al. (1980) which examines the dynamics of production developed in the 1970s when firms moved offshore[3] and formed a global network of production establishments (often through subcontracting rather than foreign direct investment, FDI) "located to exploit comparative advantages within a functional division of labour" (Wallace, 1990:126). These comparative advantages are: the existence of cheap labour force in the developing countries[4], the provision of equipment and infrastructure, the removal of trade and currency restrictions and the granting of investment incentives by the host countries (Frobel et.al. 1980).

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[3] A small proportion established production facilities in Free Production Zones (FPZs).

[4] "... this is the chief determining factor of the structure of production in free production zones in the context of the transnational organisation of capitalist production" (Frobel, et.al., 1980:322).

The critiques to the NIDL theory can be centred around the following factors:

a) It is said that the NIDL is based on the existence of cheap labour force and although the high female participation rates are mentioned, no account is given of the working conditions as long hours, short holidays, intensity of labour, causes of accidents in the work place, etc (Corbridge, 1986; Sklair, 1990). This point is developed in other attempts, yet they overestimate the role of female participation in export-led development (Fuentes, et.al., 1987; Lin, 1987; Porpora. et.al., 1989; Sassen, 1987) and in the valorisation of capital (Duncan, 1981).

b) The location in FPZ and the super-exploitation of the labour force is seen from the perspective that the function of labour in the valorisation process of capital is guaranteed by the compliant governments. They (Frobel, et.al) devalue the role of the nation-state to the simple provider of the optimum conditions (whatever the means, even repression of unions) for the successful performance of the production process. This view is not necessarily wrong but it is too simplistic to leave no place for the governments in the promotion of industrialisation. As we will see later this view is similar to that of Hymer (1979) about the role of the TNCs.

c) Following the previous point, Frobel's account is not dynamic in the sense that it sees industrial location in FPZ as "enclave" development (that is, few linkages are forged with the rest of the economy); thus despite of the NICs success, it cannot be considered as "real", "developmental" or "independent" (Corbridge, 1986:148). Consequently, it misses the importance of changes in the production processes and in the locations subsequent to the establishment of the plants, for instance, the upgrading of the skill of the labour-force and the rise in wage-levels that led electronics companies to relocate some labour intensive phases with low skill requirements from Hong Kong and Singapore to Malaysia, Thailand and Philippines, leaving in the former those labour-intensive phases with higher skill requirements. In this way we witness the emergence of a regional division of labour in which each location specialises in a specific part of the production process. Ernst suggests that,

> "... the availability of a low-priced, highly subsidised infrastructure with a minimum of environmental regulations and labour standards is becoming increasingly important for wafer fabrication and silicon foundries. In fact, governments in developing countries are likely to continue, if not to expand, their programs to promote foreign investments in so-called 'high technology industries', through a variety of tax incentives and policies to reduce overhead costs" (1985:346).

d) The NIDL is said to be a main factor of the crisis now afflicting the core economies in the 1980s, provoking a substantial job-loss, unemployment, deindustrialisation and fiscal crisis due to the decline of the domestic investment. According to Harris (1986), the NICs are still too small to lift or lower the world profit rate: rather it was the slump that caused all these problems and the way of lessening the impact was the integration of a multitude of countries into the world economy. An example is the in-bond industry in Mexico, much criticised in some circles in the US for the supposed job loss it means there. Nonetheless, the American Chamber of Commerce defends in-bond activities under the considerations that a great amount of direct employment in US depends on in-bond assembly plants. They use around an average of 65 per cent materials and components produced in US and, furthermore, from 1984 to 1985, 165 000 high skilled jobs were created in US because of the activities of in-bond plants in Mexico (El Financiero, Dec 3, 1987). As a matter of fact, "the export of capital is still predominantly between the countries of the core rather than from the high-wage countries to the low-wage countries" (Grahl, 1983, quoted in Corbridge, 1986:152).

e) Finally, the NIDL centres on the production and supply sides, neglecting the impacts demand conditions might have in the redistribution of world production. For example, the shift in US semiconductors demand from military and government uses to industrial and consumer applications influenced the relocation to the periphery. Also, market access or the avoidance of trade sanctions or tariff and non-tariff restrictions on imports in the host countries (specially those of the OECD) influences the relocation as well as other factors in the home countries like inflation in wages or land prices, currency exchange rates, etc. (Dicken, 1988; Corbridge, 1986; Hamilton, 1986; Sayer and Morgan, 1987).

It is important to stress that without the considerations included in points (a) to (e) it is not easy to understand the whole dynamic of the redistribution to some countries as the NICs and the New-NICs of certain segments of the production process. The important thing in analyzing the process is not just to examine one or another factor but how all these "push" and "pull" factors interrelate which each other and lead to the relocation decision.

3. THE INTERNATIONALISATION OF CAPITAL APPROACH.

Another block of neo-marxist approaches, to be found in the works of Hymer (1979), Palloix (1975, 1978, quoted in Jenkins, 1984), Amin and Smith (1986) and Jenkins (1978, 1984 and 1987) among others, characterise the current phase of capitalism - internationalisation of capital as they refer to the NIDL- as a large scale global expansion of all three circuits of capital (financial, commodity and productive). This process "is seen as a tendency of the capitalist system towards an ever more integrated world economy" (Jenkins, 1984:17).

The driving force in the internationalisation of capital is seen to be both the contradiction between capital and labour and the competition between capitals. To survive and expand, capital must maintain the rate of profit which requires increases in labour productivity (Jenkins, 1984; Hymer, 1979, ch 2 and 3). Since direct foreign investment (DFI) by the TNCs is considered an important expression of the internationalisation of capital, these approaches are devoted to examine the TNCs and the spatial implications of this investment. However, they differ in the weight they give to the TNCs in their analysis.

For example Hymer (1979, ch 2.) underestimates the role of the state in industrial policy-making, pointing out (as do also Amin and Smith) that TNCs play a prominent role in laying down the terms of international trade and national economic development and in reducing the options for development. In fact, they (the TNCs) reproduce or even aggravate the uneven development problem between DCs and LDCs. According to Hymer, the NIDL is moulded in the image of the TNCs' own vertical division of labour.

> "The application of location theory to the Chandler-Redlich scheme suggests a <u>correspondence principle</u> relating centralisation of control within the corporation to centralisation of control within the international economy" (1979;64).

In this way, he suggests a "pyramidical" structure of corporate power where Level III activities (production) spread all over the world according to the existence of manpower, markets and raw materials. Because this level spreads more evenly, the TNCs may be a force for industrialisation in LDCs through the creation of new centres of production in the periphery.

Level II activities (lower level of administration) locate in large cities where white-collar workers, communication systems and information are available. TNCs in different industries tend to locate these kind of activities in the same city leading to a greater geographical concentration than the localisation of Level III activities. The activities of R & D and strategic planning development are even more concentrated in a few Level I cities: New York, London, Paris, Bonn and

Tokyo. This arrangement gives place to a geographical specialisation where the characteristics of the labour-supply of the host countries depend upon its function in the international economic system (1979:64).

This analysis oversimplifies the complexity of the current distribution of world economic activity. As some critics assert (Morgan and Sayer, 1983), it seems cities in each level can have only the activities corresponding to their level. Obviously, this is not the case, Level I cities contain not only Level I activities but also Level II and Level III activities; Level II cities contain also Level III activities. Likewise, these stratifications do not take into account the contemporary trends in the redistribution of world production capacity as, the movement of some segments of US industry from the old industrial areas to the "Sunbelt" areas in the West; the movement to backward areas within the DCs (e.g. Ireland, some areas of the UK and Spain); the upgrading of some NICs (notably the Asian Gang of Four, Hong Kong, Singapore, South Korea and Taiwan) which, thanks to either government policy or business activities, are locations of more sophisticated labour-intensive processes and regional headquarters of important TNCs in the electronics industry. Also there are the New-NICs and some academics are concerning nowadays with the emergence of TNCs in the NICs.

It is necessary to keep in perspective that the redistribution of production capacity is not simply the consequence of TNCs operations alone (as the dependence and development theories also argue). Nation-states, world slump and the policies of international institutions (like the World Bank or IMF) have played an important role.

In this context, the contribution of Jenkins (1984) to the study of the internationalisation of capital is more objective in terms of the factors involved in the process. He stresses the need to avoid an exclusive focus on the TNCs in isolation from those broader contextual tendencies of which they constitute a part. Furthermore, it is important to point out that "despite the concentration and centralisation of capital the TNCs remain subject to the compulsion of competition" (1984:178). Consequently, Jenkins suggests that the analysis of the internationalisation of capital must be done through the study of individual branches of industry, since international competition takes place at the level of individual branches and the internationalisation of products and processes occurs at this level.

> "The specific ways in which the dynamic of capital accumulation require the internationalisation of capital can be spelt out in some detail through historical analysis of individual branches" (1984;20).

Jenkins points out that the relocation of production to cheap labour countries has been of little importance, considering the size of the market and investment in the OECD countries. Also it has been concentrated in particular branches (as clothing and electronics). In addition, he suggests that some of the conditions for relocation in those countries were result of developments in the other circuits of capital, money (for instance, the financial support to export-credits and loans for some Third World countries) and commodity capital (in some cases the relocation in Third World countries is not because of cheap labour but because of the market or the platform to access other markets they offer) (Corbridge, 1986:153).

In the case of the electronics industry, the pace of technological change in the products makes uneconomical the investment in fixed capital for assembly operations which would be obsolete after a while. This peculiarity and the intense competition in the industry (in spite of being highly concentrated with 20 firms accounting for almost 95% of world production of semiconductors in the mid-1970s) has led the firms to seek strategies for cutting the cost per unit of output through the relocation of the labour-intensive phases of production in countries with cheap labour-force with the required levels of productivity and skill. The existence of special tariff regimes, like items 806.30 and 807.00 of the Tariff Schedule of the US[5] in the home countries and the establishment of infrastructural facilities and incentives in the host countries made the rest (Jenkins, 1984).

4. OTHER NEO-MARXISTS DEVELOPMENTS.

This block of Neo-marxist approaches emphasises, as Hamilton points out, "the capital deepening process with capital/labour substitution and restructuring in places of rising wages (or real labour costs) and the displacement of more labour-intensive functions to lower labour-cost areas (1986:4). The attempts to explain the redistribution of world production capacity in this line are many, as Sayer (1986) points out, the French Regulationist School (c.f. Aglietta, 1979; Boyer, 1986; Lipietz, 1986, quoted in Sayer, 1986), studies about imperialism (Mandel, 1975; Radice, 1975, quoted in Sayer, 1986) and many more. Here I shall deal with some of them from the perspective of the electronics industry.

From a geographical point of view, Massey (1984) argues that behind major shifts between dominant divisions of labour within a country lie changes in the spatial organisation of capitalist relations of production, whose development and reorganisation she calls "spatial structures". In the most classical Marxist tradition she identifies the changes in class relations as the cause of this process, "the geography of industry is an object of struggle (ibid. p. 7). In her view the world is not the linear result of the capital requirements but the result of the struggle which, with the characteristics of the industry itself, give place to a wide range of spatial structures.

[5] These items allow the reimport of articles whose manufacturing process began in the US and were processed abroad and duty was to be paid only on the value added.

In analyzing the location of electronics industry in UK, Massey differentiates the spatial structures of large firms from small firms. The former resembles Hymer's pyramidical structure and the latter's spatial structure is characterised by high concentration. She explains that the spatial structures of the large firms are characterised by the locational separation of research from production according to the availability of labour-force.

> "Each of these parts of the labour force -different social groups- operates in different ways as a 'location factor'; the way it affects the location of industry is different in each case. Each social group, moreover, is unevenly distributed across the country -indeed if they were not they would not be operative locational considerations" (1984:141).

The "best staff" (R&D) tend to cluster in places with high quality of the environment[6] and the firms locate accordingly. Work follows this staff which has the power to influence industrial location. Conversely, the activities at the bottom-end of the production process locate in those places with reserves of new workers coming for the first time to the capitalist labour market[7] (particularly the female labour force). Because of the dynamic of competition, firms need to cut costs so, instead of clustering, they tend to disperse to monopolise labour markets, though this is not always the case. Firms indeed cluster together to take advantage of infrastructure available in some places without which labour could not be exploited.

On the contrary, as we mentioned above, small firms, characterised by small batches of high-tech products requiring a highly-skilled labour-force, are geographically concentrated. These firms are less prone to competition-based costs but more to competition based on technological

[6] In what Massey defines as a mutually reinforcing relation between location and social status.

[7] Suitable for the assembly job and their lack of organisation and union militancy (1984).

characteristics since their production is mostly for specialised markets (1984:150).

Both types of spatial structures -Massey asserts- reinforce the pattern of spatial differentiation, that is the concentration of particular kinds of labour-force and the concentration of ownership in the same area. Although she points out that location factors should not be taken for granted but it is necessary to know why and how certain factors become geographical attractions for industry, the apparent dynamism of her proposed spatial structures is lost. The self-reinforcing pattern of geographical distribution of firms neglects, as in the case of Frobel et. al., the developments which can occur *a posteriori* in the locations as a result of the interaction of firms and inner developments in those areas.

Rather than having different spatial structures for different sizes of plants, this thesis suggests that it is the concurrence of several firms of different sizes as one of the factors which structure the space due to the presence of interlinkages which are continually evolving. For example, in the electronics industry in the Asian countries, big firms, subcontractors, even the carrier services to bring the products, materials and components to and fro have a say in the "spatial structure" of the locations[8].

Sayer criticises this kind of "radical views" which wrongly treat the patterns of uneven development as a linear result of the tendencies of capital accumulation in the abstract. These tendencies: "work through specific mediating technical and social forms, such as particular technologies, types of labour and management systems (i.e. ways of combining labour, materials and machinery)" (1986:107-8).

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[8] As a matter of fact this example is extensive in any kind of industry, the complexity in the analysis arises from the overlapping of the patterns of the different industries and other economic activities in the same city (Harris, 1983).

Thus, in his analysis of the internationalisation of the semiconductor industry emphasises a series of factors which drive the internationalisation rather than the sole interplay of capital/labour relations. These factors are:

a) Innovations are causes and consequences of competition among capitals and responses to the actions of labour. That is, they are responses to the operation of the law of value and involve the search for time economies in the circulation of capital; new ways of extracting surplus value; or new products to compete effectively (Sayer, 1985).

b) **Home markets.** To continue accumulation, firms cannot expect to survive within the narrow limits of the domestic markets (even in the massive American market). Internationalisation through exports or FDI becomes necessary to amortise the burgeoning R&D.

c) **Characteristics of the industry.** Offshore production is an option open only to "certain kinds of production: mass produced high-value per unit weight, and involving a substantial element of low skilled manual labour and lacking a need for intensive technical management or proximity to customers" (Sayer and Morgan, 1987:23).

d) **Social and institutional characteristics of capital and labour,** for instance the differences between Japanese and British capital. Such differences have spatial implications, not only directly through their differential consequences for the competitive strength of capitals and hence for global patterns of uneven development.

e) **The role of the nation-state** which, through tariff import quotas, technical standards, policies on investment and transfer of technology, support for domestic producers and R&D, regional policy, etc. can influence the internationalisation of capital.

After analyzing how these factors influenced the internationalisation of the semiconductors industry and finally determine the location in the NICs, Sayer asserts that some developments in the industry may lessen the influence of the "pool of cheap labour-force". Because of the slump -he argues- firms are facing the need to automate in order to remain competitive. Innovations in microelectronics offer the possibility of accessing cheap production technology which may favour developed country locations.

Likewise, technological developments give place to the growing importance of customised products with the resulting need of a closer seller-user proximity. This trend is observed also in the investment in consumer electronics in the developed countries where automated facilities and changes in product design shifted cost advantages back toward production in those markets. Moreover, in some products as computers, after-sales services favour the location in the developed countries.

However, Sayer points out that those these trends do not constitute a reversal of the attraction of the pool of labour-force. "The diversity of cost structures for different types of firms means that automation and use of cheap labour will have different advantages and disadvantages for each one" (1986:121). The so-called "exodus to the DCs" is still far away of the reality. Ernst (1985, 1988) suggests that developments in automation technologies in electronics manufacture have not yet led to the redeployment back to the DCs (specifically in the case of semiconductors), but is likely to penetrate into a very select group of Third World countries, in Asia, Latin America and the Middle East. Based on Malaysia's and Hong Kong's experiences, Salih, Young and Rasiah (1988) and Henderson (1989) assert that this scenario is likely to be the case. The chief drawback to automated assembly is not the operating cost but the problems of adapting machines to changes in semiconductor package designs. The machines must be flexible and reprogramming is costly (Langlois, et.al, 19888:55).

With regard to the pull of market access for customised devices (in the case of semiconductors)[9] and after sales services (in the case of consumer electronics) we shall suggest that, though they may constitute important segments of the industry, they are different markets from those standardised products assembled in the NICs and the New-NICs.

In this respect we have three possible scenarios: growing standardisation of products and production processes joined to the cheapening of materials (characteristic of the capitalist production) may lead even the high specialised customised products to mass production. Technological developments in telecommunications networks can make some face-to-face design phases or after-sales services unnecessary[10]. The upgrading of the skilled labour-force in some NICs and the growing importance of their markets may lead to the production of customised products in those countries. However, it is possible that these three scenarios coexist increasing the complexity of the set of interrelations among the several factors influencing the location of electronics industry.

5. APPROACHES ON THE STRATEGIES OF THE FIRMS.

Here an attempt is made to examine some developments in the field which focus on other factors to explain the internationalisation of the electronics industry. Particularly interesting are the works of Schoenberger (1986, 1988), Scott (1987, 1988) and Scott and Angel (1987, 1988) for the case of semiconductors industry. They stress the need to search beyond the view of the Marxist approach to the NIDL which divides the world into two simple blocks of economic activity[11]. Without

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[9] Which made up 11% of world market for integrated circuits in 1986 (Henderson, 1989: table 7.1)

[10] See for example the case of Dell Computers in US which sells its products by telephone and keeps a hot-line to offer technical assistance to customers and, in the case of minor repairments, spare parts are delivered by an express parcel service within 24hrs! (The Economist, various issues).

[11] The core as centers of managerial control, R&D and technology intensive production with large numbers of highly skilled labour force and the periphery with an undifferentiated mass of cheap labour force (Scott and Angel, 1988:1064).

disputing the importance of the labour process and employment, their objective, rather, is to suggest that the nature of competition (Schoenberger) and the "transactional structure of production" (Scott and Scott and Angel) also influence the evolution of production and its spatial patterning. Their analysis is done in the light of the current change in the regime of accumulation from Fordism to flexible accumulation.

Schoenberger argues that in the context of crisis of the Fordist regime[12] firms have responded with a series of strategies:

> "rationalisation of existing capacity, mergers and acquisitions, plant shutdowns, location of facilities offshore, the adoption of new manufacturing technologies and new ways of organizing production, the restructuring of supplier and subcontracting relationships, and all manner of formal and informal cooperative and joint ventures on a national and international scale: (1988:245).

In the midst of this crisis and the transition to what is called regime of flexible accumulation, the advent of new flexible automation technologies in production is believed to have a major impact in employment, the use of labour and ultimately the way production is spatially distributed.

The main issue in Schoenberger's work is how the new technologies of production need to be used by firms to restore their competitiveness and profitability. Since the crisis of Fordism is linked to rigidities in the sphere of production and in the way competition takes place, then flexible technologies have to be used in a way that supports both the reorganisation of production and the restructuring of competitive strategies. Thus a change in the spatial distribution of production arises.

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[12] The Fordist regime of accumulation was fully elaborated in the decades after the World War 2, encompasses both a characteristic technology and organization of production. The labour process is structured around the semiautomatic assembly line (the familiar standardised mass-production operation based on costly machinery) which gives rise to huge productivity gains (Shoenberger, 1988)

Under Fordism the nature of competition is constrained by the mass production techniques (which require considerable standardisation of output in order to capture economies of scale) and the wage bargain with labour. Crisis and the expansion and intensification of international competition without the concomitant expansion of the domestic markets gave rise to two responses. One, to erode the position of labour in the core and search for low-cost and non-militant labour in the periphery. The second is the extracting of competitive advantage from greater differentiation and destandardisation in the market. This latter strategy, incompatible with the Fordist regime, was facilitated by parallel changes in the techniques and organisation of production.

In the case of semiconductors industry, standardisation is becoming a less viable strategy. Consequently, over the course of the last years, a number of major IC producers have announced their intention of shifting to semi-customised and customised chips (with the result of a proliferation of products and markets). Although to offer a wide and changing range of customised chips at low volume with the conventional technology could be done at very high cost, Schoenberger's key point is that custom and semi-custom markets can be expected to strengthen vis-a-vis commodity chips as costs of design and fabrication decline due to new technologies as, for instance, standardised and automated design (1988:269).

These changes in the competitive strategy of the industry have significant implications for the location of production facilities, since the move into custom and semi-custom markets increases the need for customer-supplier interaction as the customer needs to be involved in the design process (1986:326). However, she notes three countervailing pressures: a) the cost of moving or dismantling production facilities offshore; b) the major offshore production region, the Far East, has evolved into a significant market; c) the region has also expanded as a supplier of equipment, materials, and technically qualified labour at relatively low-cost thus some firms are moving other phases of production processes (e.g. design and engineering) to integrate with the already existent facilities in order to serve the regional market. The likely scenario Schoenberger suggests on the international level is intensified investment -and cross-investment- among major market areas, much more complex set of relations than the pure model of the NIDL, in a kind of concentrated deconcentration: US, Europe (EC) and Asia (1986:327).

In his analysis, Scott asserts that the regime of flexible production focuses above of all on the flexibility of production processes and labour markets and on the search for external economies of scale in the organisation of the industrial apparatus (1988:10). The shift to this regime of accumulation involved a set of "locational transformations" which consist of the twofold tendency to a) definite spatial reagglomeration of production in selected areas; combined with b) active evasion of labour dominated now or in the recent past by Fordist industry.

Thus, "new industrial spaces" have come into being typified by a resurgence of the phenomena of the social division of labour and agglomeration, combined with rapid rates of local growth (1988:1307). In an attempt to explain the emergence of these new industrial spaces beyond the mere listing of so-called location factors (specially in the case of high-tech growth centres), Scott argues that they can most effectively be comprehended as <u>transactions-intensive agglomerations of human labour and social activity</u>. These places experience a "self-reinforcing spiral of growth" sustained by the endogenous creation of external economies of scale. That is, as markets for final products expand, the whole system evolves internally by means of a deepening social division of labour and increasing elaboration of local-labour structures (1988:109).

> "In this context, technological innovation, entrepreneurial activity and genealogical structures of horizontal and vertical spin-off become the proximate expressions of the underlying logic and pattern of growth. In particular, a process of

> territorial reproduction is set in motion in which the production system and the social system come simultaneously to depend upon and yet to sustain one another's existence. Additionally, individual producers in different growth centers develop multiple transactional relations with one another, so that these centers eventually form a mesh of interlocking local economies evolving interdependently through time" (1988:109).

These transactional relations are of two types, intrafirm, in which the production of activities are coordinated by managerial hierarchy; and interfirm governed by price signals in market and quasi market institutions. The interface between both is constantly in change depending upon factors such as technology, labour relations, wages, prices, location, etc. If the firm's internal transactional activities increase (either upstream or downstream) <u>vertical integration</u> is taking place; when transactions are being externalised, then <u>vertical disintegration</u> takes place. The latter is the fragmentation of production apparatuses into larger numbers of separate specialised production activities performed in different firms. This situation corresponds to a production system involving different operations tied together by intrafirm linkage relations (Scott and Angel, 1987:887).

The nature of transactional activity gives place to two different patterns of location, geographical dispersal associated to vertical integration and geographical clustering associated to vertical disintegration. The inducement to converge spatially depends on the cost of transactions per unit of output and per unit of distance. Reduction on cost of external transactions encourages vertical disintegration and spatial convergence lying the foundation of an incipient growth center. Increases in these costs (rising land-prices, inflation, increasing wages, organisation of labour, and some external diseconomies) lead producers to adopt alternative strategies. One of the commonest is vertical integration associated with the spatial dispersion of production in large routinised branch plants that can be profitably relocated in peripheral areas where land and labour are cheap and unions weak or absent. However, Scott's main analytical issue is not how these areas (in the core or periphery) started but how they subsequently grew systematically as a function of their own internal dynamic of disintegration, externalisation, transactional proliferation, diversification and job creation (1988:878). This is by no means, a smooth process of organisational-locational change going from agglomeration to dispersal but both phenomena may overlap in different segments of the same sector.

In the case of semiconductors production, the major centers of discrete devices are Massachusetts, the Mid-Atlantic States, Silicon Valley and Southern California; for integrated circuit production Silicon Valley is the undisputed center. From Scott's statistical analysis it is suggested that this pattern of location merged as manufacturers for discrete devices can survive on the basis of a very generalised sorts of agglomeration economies, whereas manufacturers of integrated circuits (ICs) are more dependent on highly specialised kinds of agglomeration economies available at a relatively small set of locations as Silicon Valley (Scott, 1988; Scott and Angel, 1987).

The growth of this central complex (Silicon Valley) has been accompanied by a steady locational diffusion of the industry throughout the rest of US and the world. One of the manifestations of this diffusion is the spatial and lately vertical disintegration of wafer fabrication and assembly operations, and the assignment of the latter to various locations, mainly offshore. This phenomena can be interpreted as a search for various "location-specific advantages", among them cheap labour, under circumstances specific to the firm which inhibit externalisation, such firms are vertically integrated but geographically separated.

However, there have been growth and development at some favoured areas in the periphery and semiperiphery (e.g. Hong Kong and Singapore) where semiconductor plants have engendered significant upstream economic linkages and created demands for new kinds of labour skills. This being true for the computer industry in South Korea and Taiwan, as well. Although it is acknowledged that the advent of automation assembly may prompt some repatriation back to US, the widening and deepening of external economies available at offshore locations are likely to delay that trend[13]. Moreover, as mentioned earlier, a regional division of labour is merging in that area interwined with the broader division of labour at the world scale. This intraregional division of labour can be identified in terms of a "core" of high wage countries (Hong Kong, South Korea, Singapore and Taiwan) and a "periphery" of low-wage countries, Indonesia, Malaysia, Philippines and Thailand. According to Scott (1987), this phenomenon is mainly due to four factors.

a) Increasing wage rates and other production costs in the intra-Asian core have given place to a decentralisation to the New-NICS (mainly Malaysia and Philippines).

b) The emergence of a secondary flow of assembly work inside the Southeast Asian region in a both intra-firm and inter-firm basis, from plants in the core to plants in the periphery (specially for assembly simpler devices).

c) The emergence of Hong Kong and Singapore as centres of testing for the international semiconductor industry in the whole region. These two centres have a special abundance of the kind of scientific labour and consulting services that facilitate efficient production in this relatively high technology activity at cheaper rates than in US example.

d) The growth of local markets over the last decade[14] has encouraged several major producers to establish marketing,

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[13] "National Semiconductor has indicated that its new fully automated Odyssey chip -assembly system is now being installed in its offshore assembly plants" (Scott and Angel, 1988:1061).

[14] "Some 16%-18% of all shipments of semiconductor devices from US-owned plants in the region now go directly to consumers in the same region (including Japan)(Scott, 1988:154).

sales and after-sales services facilities in Southeast Asia. Again, Hong Kong and Singapore merged as important locations for regional headquarters. Thus they function as localised centres of management and control within the global structure of the industry as in Hymer's model. The clustering of producers, services, etc. around these two major centres is done in order to minimise the costs of their transactional interrelations. The internal dynamic of these complexes gives place to a new industrial spaces -as argued above- which can be considered as "incipient small-scale Silicon Valleys" (Scott, 1987:154).

We consider that the analysis of location under the transactional relations framework helps to understand the locational decision of the firm at the micro-level. However, the factors which compel the firms to move are much more complex than the existence of agglomeration economies or diseconomies. Likewise, the analysis is devoid of an explanation about how the role of the nation-state, or competition, affect the locational decision or the dynamic of growth in the "new industrial spaces". Nonetheless it has the advantage (over other rather simplistic approaches, like the NIDL of Hymer's) of clearly demonstrating that the new international division of labour no longer consists of core-periphery relations. Rather, it has evolved into a complex spatial system with many different hierarchical levels and sub-regional articulations. In this context, it <u>does</u> recognise the possibility of further development in those places - eroding the enclave economy view of the NIDL or the so-called repatriation back home argument.

6. THE RESTRUCTURING OF CAPITAL APPROACH.

In the same line of analysis, the works of Henderson (1989), Salih, Young and Rasiah (1988) and Sklair (1989), offer a rich account of the emergence and growth of key locations for electronics industry in Third World countries, particularly some of the NICs (Hong Kong, Malaysia and Mexico, respectively) in the context of global restructuring of capitalism (or reformation of capitalism as Sklair proposes) brought about by the ever-deepening crises tendencies. The response of the firms has been the initiation of major processes of organisational and technical restructuring. It is argued that, at the global level, restructuring -as in previous crises- is predicated on the search for new bases for capital accumulation.

Henderson attempts to examine the relation between economic, social and spatial change in particular territorial units and the dynamics of global restructuring. He argues that in previous crises, restructuring was usually confined to the given territorial unit.

> "In this contemporary crises restructuring "internal" to the territorial unit has been combined with spatial (both intra- and inter-national) shifts in investment and a massive expansion of the radii of organisational control associated with the growth of transnational corporations, it is precisely this combination of the increased use of space together with the expanded transnationalisation of corporate structures that has given the current restructuring process its global character and dynamic" (1989:3).

To confront fierce competition and generate new accumulation possibilities capital turned to the "global option" which was made possible thanks to the emergence of new technologies, particularly telecommunications. These technologies enabled phases of production processes or entire production facilities to scatter across the globe whereas managerial control remained centralised in the major cities of the core. So important are these new technologies (especially microelectronics) in a number of activities that Henderson argues that industrialisation based on them takes a different form from previous rounds of industrialisation: "we can begin to specify what is about the manufacture of semiconductors and electronic products more generally, that may have brought into being this new mode of industrialisation" (ibid p. 4)

The characteristics of this new mode of industrialisation are given by the distinguishing elements of the electronics industry:

a) Knowledge, that is, continuing technological innovation as a primary basis to keep competitive. Knowledge embodied in labour power is a factor of production unevenly distributed which influences the spatial distribution of production facilities.

b) Processing of information. Since social relations are based on communication, electronics production is important for the entire realm of human activity in contemporary societies.

c) Electronics production has generated social and technical divisions of labour different from most other manufacturing industries. This has led to the emergence of socially and spatially segregated labour markets based on skill and gender relations.

d) Electronics production is organised in terms of technically disarticulated labour processes which can be dispersed to selected locations onshore or offshore to take advantage of production factors."With modern telecommunications and transport systems linking dispersed production units to the centralised control function, the 'world factory' phenomenon merges (1989:5).

These elements -Henderson asserts- in articulation with historically specific factors such as state development strategies internal to the given territorial units themselves, have produced economic, social and spatial transformations in Silicon Valley, M4 corridor and Scotland in UK, Toulose and other parts of Southwest France and,in addition, in some peripheral societies such as those of East and Southeast Asia.

To understand this new mode of production and its impact on the dynamic of the international division of labour, Henderson suggests a methodology to explain the globalisation of semiconductor production (or any other branch) and why some territorial units, rather than others, have been upgraded in terms of their technological basis and control functions and why regional divisions of labour have merged. His methodology pays attention to the following elements:

> "(a) the structure of capitalist commodity production at large; (b) the central dynamics of labour processes in the context of the contradictory capital-labour relation; (c) the internal and external organisation of industrial production; (d) the influence of state and development strategies; (e) the socio-spatial consequences of these phenomena, and (f) the way this ensemble of relations changes over time" (1987:6).

In relation with the capitalist commodity production, Henderson points out that in relation with the valorisation process, we should look to the nature of labour processes and associated phenomena, capital-labour ratios, technological change, wage rates and actual or potential labour conflict. With regard to the commodity circulation, the structure of the market influences the spatial dispersal of the industry and its subsequent evolution.

As noted earlier, in the case of the internationalisation of the semiconductor industry, fierce competition between the major producers, the emergence of some external diseconomies in Silicon Valley, the decline of military markets and the relative growth in civilian markets (which brought about an increase in standard commercial markets), induced stringent cost-cutting measures. Also the characteristics of the production process made possible the spatial disarticulation of the different phases of production. So US firms invested in production facilities in order to reduce costs taking advantage of the huge supplies of cheap labour offshore. However, Henderson points out that subsequent development of the industry cannot be understood in terms of such narrow unicausal explanation. The emergence of regional division of labour in South-east Asia with core-periphery relations is associated with the increasing ability of those areas to provide good quality engineering and technical labour, the development of an indigenous electronics industry (including semiconductors) and particular forms of state intervention.

Specifically, Hong Kong (the case he examines) had additional advantages to the pool of cheap labour force[15]. These advantages were as follows: a) political stability; b) an open financial system with no limits on the repatriation of profits, and c) excellent telecommunications and air transport facilities. Moreover, since Hong Kong had previously developed an important textile industry and later radio assembly and production of cheaper varieties of consumer electronics, the work force was habituated to the kind of labour process characteristic of the semiconductor industry (1989:51). In the case of Scotland, US firms and later Japanese came to locate there to avoid tariff and non-tariff barriers. Additional factors were the existence of cheap and qualified engineering and technical labour and the existence of a substantial and growing market there (Henderson, 1987).

The characteristics of the labour process implanted in both locations are rather different. Starting from the manual assembly of transistors, diodes and integrated circuits, Hong Kong upgraded, so, by the mid-1980s, US companies had restructured their operations and engaged in a process of capital deepening and had begun to specialise in more technologically advanced processes such as final testing, circuit design and automated assembly. Hong Kong's education system could provide the qualified engineers and technicians for the testing and design activities more cheaply and in more reliable quantities than in US or Scotland. Another important reason as Scott (1987) noted is the emergence of a electronics production complex in the region.

15 As in the case of Taiwan, South Korea and Singapore which also developed flourishing semiconductor industries.

In contrast , the initial investment in Scotland was in warehousing, testing and, occasionally, assembly (for 'testing the water' in Henderson's words). After a while US firms invested in the more capital-intensive, technologically sophisticated process wafer fabrication. As in the case of the Asian NICs it has merged a string semiconductor production there (sub-contractors, suppliers, services, etc.) which represents an additional inducement for investment[16]. From his detailed analysis of Hong Kong's and Scotland's semiconductor industr , Henderson concludes that since Scotland has received more advanced phases of production processes than those implanted in Southeast Asia, it is clearly in a more favourable position, that is, more autonomous, within the new international division of labour than the latter area (Henderson and Scott 1987:71)[17].

However, it seems that the question in this case is not addressed in the proper terms. At this respect there are three points to make. First, Hong Kong (as Singapore, Taiwan and South Korea) does have indigenously-owned production facilities (although at present capable of producing only low-grade semiconductors) which Scotland lacks. Secondly, many firms make the masks (production of celluloid filaments that contain the microscopic electronic circuits) in the core centres (e.g. US), fabricate the wafers (process by which the circuits on the mask are transferred to the silicon wafer and etched into its surface) in Scotland; then, the assembly of transistors diodes and integrated circuits is made in some New-NICs (Malaysia, Indonesia, etc) and from there the ICs are sent to Hong Kong or Singapore to be tested and then they are distributed directly to the markets. In this context, it is

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[16] "The growth of this complex has been underpinned by the development of local and foreign firms supplying a wide variety of components and subcontracting services to the industry. Most significant technologically has been the emergence of the Scottish mask-making firm, Compugraphics and the recent decision of the Japanese silicon wafer producer, Shin-Etsu Handotai, to set up a plant in the country" (Henderson, 1987:70).

[17] In relative terms, since both Scotland and Southeast Asia remain subordinated to the US in terms of organisational and managerial control and in terms of scientific and technological inputs. The most technologically sophisticated parts of the production process remain in US.

difficult to say which country has a stronger electronics industry since they specialise in different activities[18]. Finally, The importance of the growing market in East and South East Asia which is an inducement for new investment and for upgrading the industry there, should not be neglected

Salih, Young and Rasiah (1988) examine empirically the growth of the semiconductor production in Malaysia. In theoretical terms they focus on the exchange-productionist debate[19] on the role of TNCs in Third World industrialisation. They assert that the debate is particularly relevant because changes in the structure of the industry, in terms of technology, production and markets, transform the nature of the international division of labour itself, as in the case of the regional division of labour in Southeast Asia and the Pacific Rim. The analysis focuses on the changes in the patterns of growth and stagnation of the "local" semiconductor industry in terms of cycles and rhythms in the internationalisation of capital and the competition amongst capitals in peripheral industrialisation (1988;376).

Malaysia in the mid-1980s became the largest single concentration of offshore semiconductors assembly in the Third World. As with the other locations, its development was affected by the crises of 1974-1975, 1982 and the crash of 1984.

> "According to McFarlane (1986) crises are periods when outmoded technology gives way to new and more productive technologies. Increasing the organic composition of capital was meant to raise the productivity of labour and in that way help the firms to eliminate the obstacles impeding increased valorisation. The response to conjunctural shifts, of which retrenchment of labour is the most drastic,

[18] In the computers industry can be observed the same trend, Taiwan and South Korea are leading terminal exporters, Singapore a major supplier of disk drives and Taiwan, South Korea and Hong Kong could expect to play a considerable role in the expanding world market for personal computers (Ernst, 1985:339).

[19] See Corbridge, 1986.

> also includes job enlargement and rationalisation and the recomposition of some labour processes. This recomposition of tasks is an effort by management to readjust the labour process in order to realise increased relative surplus appropiation" (1988:380).

However, structural and cyclical transformations do not take place alone. They are conditioned, as noted earlier, by competition between capitals, by the role of the home and host countries, etc. In the case of semiconductor industry, declining costs of production have led to a growing demand for end-use markets for semiconductors. This in turn has stimulated product innovation and growth in semiconductors applications, expanded volume of production and reduced costs further, giving place to intense competition between producers in terms of product innovation, production technology and markets. This developments, the state policy directed towards the maintaining of semiconductors production facilities in Malaysia and the inducement of new investments and the availability of skill labour force[20] and suppliers have induced the increasing automation in assembly and testing facilities in Malaysia and the decision of National Semiconductor to establish a new wafer fabrication unit there (although of a lower-end, wafer plant technology is an important step towards upstream activity).

Under this condition, the so-called repatriation of investments back to the home countries and reintegration of the industry around some cores seems to be unlikely as far as Malaysia is concerned. However, since the economy is heavily dependent on the semiconductors industry, in consequence is more vulnerable to the periodical crises of the industry than the Asian NICs which have developed indigenous electronics industry. The aim of the state policy is to attract end-use producers to consolidate the industry there.

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[20] "So specialized and advanced are the Penang engineers in the areas of assembly and testing that they are often sent back to the US to train Americans -an interesting case of reverse technology transfer" (1988:383-4).

With a similar argument, Sklair (1989) emphasises that the export-led industrialisation fuelled by foreign investment (ELIFFIT, as he calls it) strategy represents a "fundamental coming together of the interests of the TNCs and some key elites in the countries of the Third World: (1989:1). This coincidence of interests is a result of the globalisation of production since the 1950s, the growth in world trade of manufactured products and the changing nature of the relationships between TNCs and Third World countries. These changes -Sklair argues- constitute a new phase in the history of capitalism and a new ideology. This new phase is a "reformation of capitalism", the latest readjustment capitalism is making to overcome the continuous crises it faces. He analyses how the TNCs started to locate offshore the labour intensive phases of production at a time of rapid growth in some Third World countries, the NICs. Some as a result of a successful export-led industrialisation policies (the Asian NICs) became internationally competitive and had the labour-force and infrastructural facilities (FPZs) required to attract foreign investment, specially in electronics industry. Others (the Latinoamericans) pursued an import substitution strategy which proved costly for those governments. We rather argue that this import substitution strategy laid the foundations in terms of infrastructure and labour productivity for a later and successful production for the world market. In Mexico's case an export-oriented assembly industry program was introduced in 1965 to encourage firms to build factories along the US-Mexico border. It was not the Taiwan or South Korean model, but in a more regional context, that is, a development and industrialisation strategy in which the in-bond assembly plants[21] could play a catalytic role in the economic take-off of the whole border region (1989:10).

[21] They are better known by their Spanish name, the **maquiladoras** or the abbreviated form, **maquilas**.

The interest of TNCs in this border region comes from some problems, Sklair argues, they had operating in Asia. The main one is logistical. It is expensive to ship equipment and components and tiresome for personnel to commute to the Far East. Moreover, in the 1960s, many US companies began to buy their materials and components in Asia (from Japan and the Asian NICs). This meant that the advantages of items 806.30 and 807.00 were lost since US firms assembled goods with materials and components that were not manufactured in US. The wage differentials between Asia and the US for assembly were so substantial that the loss of advantages under 806.30 and 807.00 was outweighed by the savings in production costs.

In this context, the connection between maquilas and the reformation of capitalism is that some US based TNCs saw the advantage offered by the maquila industry as typical of "the global embryonic reformation of capitalism" (like the FPZ in Asia) and in terms of logistical advantages of the US-Mexico border region.

> "The embryonic reformation of capitalism can be perceived in both quantitative and qualitative terms. Technological changes in process of production in the advanced industrial countries and changes in the political economy of foreign trade and investment in both First and Third World countries are beginning to alter the ways in which global capitalism works, albeit in as yet quite limited fashion" (1989:10-1).

This impact can be a "dependency reversal" which means that the progressive development of the host country will take place when the needs and interests of the populations of the LDCs begin to displace the needs and interests of the TNCs and their local allies. The issue for the reformation of capitalism is whether foreign investments strengthen or weaken global capitalism in its struggle to maintain its hegemony over competing forces, that is, if dependency reversal displaces dependent development. To approach this question Sklair chose four countries, one of them Mexico, specifically the maquila industry which, established in the northern border, did not seem to constitute a threat to the Mexican national industry. However, when it was extended to the rest of the country as a strategy of industrialisation and development, it raised serious questions about its real contribution to national development[22]. In response, Sklair offers a methodology to evaluate the developmental effects of foreign investment in those "maquila like" zones. The methodology is based on a set of criteria -he points out- both logically and sociologically related to a general theory of development and underdevelopment.

> "The 'maquila effect' originates from the Mexican experience, but the phenomena it conceptualises are universal effects of the global reformation of capitalism in its relations with the countries of the Third World. This methodology is intended to give the capacity to decide concretely where an export oriented assembly zone is in the process of transformation to a 'development zone'" (1989:19).

Sklair identifies six elements to assess the developmental success or failure of a zone: linkages, retention of foreign exchange, upgrading of personnel, technology transfer, conditions of labour and distribution of costs and benefits between TNC and the local population. In Mexico's case, it was found the existence of few linkages with the local industry (there are more linkages in the Asian countries); and the retention rate of foreign exchange is decreasing (in terms of value added and because population in the border tends to buy their goods in the US border cities). On the other hand, there have been an upgrading of personnel, professional, supervisory and production workers thanks to the demand of the maquilas. Since this kind of labour force is cheaper than the personnel in the home country, the growing demand induces the universities and technical colleges to provide it. Regarding technology transfer, though the location of phases of production of high-tech as semiconductors and computers presents the possibility of some technology transfer as the transmission of skill and the transfer of workable technology from its controllers to

[22] See Sklair, 1988.

those employed to work with the products and processes, Sklair argues that the reformation of capitalism does not permit the transfer of the technological monopolies.

The question of the conditions of labour has generated a long debate on the literature, long journeys, job security, hazardous processes endangering the health and safety of the worker[23]; the fast pace of production, are some of the problems encountered.

With regard to the distribution of benefits, the devaluation of the currency and inflation rates of the country means a decline of the standards of living of the workers, specially maquila workers who purchase their household goods in US. On the other side of the spectrum, there are the Mexican professionals and *comprador* bourgeoisie along the border who have done very well because of the maquilas. Industrial park developments, including legal and commercial services for the maquila have created a new class of wealthy Mexican maquila *facilitators* and a strong middle class. Although most commentators argue that maquila industry has been responsible for considerable multiplier effects along the border, it is extremely difficult to asses the distribution of costs and benefits.

Sklair ends his analysis affirming that the reformation of capitalism is a series of process within the global system as it tries to regulate the relations between the countries of the core and those of the Third World. In this context, TNCs depend on the continual increase in international trade for their accumulation purposes. To this end Third World countries are of importance for two reasons. First, as locations (or potential locations) since the globalisation of production is increasingly taking place in those countries with the proliferation of in-bond assembly plants or production sharing

[23] The strict US codes on health and safety at work and environmental protection laws and the inadequacy of Mexican industrial health and safety legislation encourages some US firms to establish in Mexico (Sklair, 1989).

and the like, analysed under the rubric of NIDL. Second, as markets (or potential markets) in so far as these countries integrate to the world economy, the TNCs will be seeking to satisfy not only demands of mass consumer markets but the demands for materials, components, capital goods and services as well.

The analysis of Sklair, however full of facts about the establishment of in-bond assembly plants along the border and its consequences in the cities concerned, is rather linear in the sense that he identifies two poles, First and Third World, and emphasizes their mutual dependence (using the argument of "dependency reversal"). By focusing on the Mexican case without reference to developments the emergence of a regional division of labour in the production of electronics in South-east Asia, the impacts (which not necessarily mean a dependence reversal) in terms of development and subsequent dynamics of this kind of industry are not stressed enough.

7. CONCLUSIONS.

From this review of the literature it can be concluded that the analysis of the location of electronics industry is not an easy one given the complexity of interrelations between the different actors involved. It is clear that we cannot approach the analysis of locational patterns of the electronics industry in isolation from the growing internationalisation of capital in a context of recession in one of the main cores (USA) and the rising importance of Japan and some of the NICs as competitors.

The role of the nation-states in policy making (at the country, regional and local level) is often underestimated. Governments in the home and host country influence the location and subsequent development and upgrading of the industry. In this context we consider that the view of the TNCs as an evil laying the conditions for any development at the country or even world level is somewhat exaggerated. Since TNCs are subject to the market forces, they will look for strategies to minimise costs and, hence, increase profitability (or keep their market shares). Strategies involving new technologies in production processes, new systems of organisation, opening of new markets and new locations for production facilities bring about changes in the structure and geographical distribution of world production capacity.

Therefore, to analyse the geographical distribution of the electronics industry worldwide and the resulting emergence of new patterns of location in the host countries is necessary then to look at both, external and internal factors. External factors include, the competition among firms and the role of the nation-states in the home countries (government and military purchases, industrial policy, trade legislation, etc). Among the internal factors of the nation-states, first and foremost are the social and economic policies, the role of the local industry in those places integrated to the world production of electronic goods, and the lack labour-force organisation.

II. PATTERNS OF INTERNATIONAL TRADE IN THE ELECTRONICS INDUSTRY, 1970 - 1985

INTRODUCTION.

After the long boom of the post-war period, the worldwide economic crises in the early 1970's intensified the competition in some industrial sectors, hastening the trend of redistribution of world production capacity that was observed in the early 1960's. To maintain the rate of profit, capital needed to increase labour productivity by different means: increased mechanisation, new technology, relocation of some phases of production processes or the adoption of new organisational systems which were more suitable to the new conditions of production and competition on a worldwide scale.

To understand how the process of internationalisation of capital has occurred I shall deal with the electronic industry, which is characterised by intense competition, which led to a redistribution of the world production capacity from the developed countries to the more developed of the developing countries (the so-called New-NICs) in a first wave, and in a second wave to the next tier, the New-NICs. Nowadays, the process continues, not only from developed to developing countries, but from the most developed NICs to the less developed.

Therefore, it can be observed the emergence of an international division of labour in the electronics industry and lately the emergence of a regional division of labour between the NICs and the New-NICs. The logic of this process of redistribution of production capacity was to increase labour productivity through the relocation of the labour-intensive phases of the production process to those countries which offer a cheaper labour-force (skilled, semi-skilled, and unskilled) than in the main production sites, with the same levels of productivity per unit of output, or even higher levels in some branches of the industry. The process took place at the same time that the strategies of the governments in these countries changed to reinforce the export-led policies, offering facilities to the establishment of plants (in some cases in the FPZs), stressing the advantages of such locations for the industry.

Hence, in discussing the internationalisation of the electronics industry, attention will be focused on the patterns of international trade in some of the most important branches of the industry, from 1971 to 1985. It should be noted that the electronics industry, as a whole, has more than 25 categories of products (at the 4 digits level of the Standard International Trade Statistics, rev. 2 UNIDO). Some of these categories are completely new and for some there is a lack of information for some years or some categories appear aggregated in the first years of the period, making the analysis of all the categories for the period difficult. Consequently, in this attempt I choose just some of the branches without denying the importance of expanding the analysis to the other branches in further stages of research.

1. <u>ELECTRONICS INDUSTRY:</u>

a) <u>Classification.</u>

The starting point of the electronics industry was the radio, followed in the 1930's by the television set. Communication equipment, entertainment and information systems are an important part of the industry and they are being transformed by the electronic computer. In this way the telephone system today increasingly uses electronic exchanges and switching computers, and is increasingly used for data transmission and for communication between computers. Domestic television and video-cassette-recorders (VCRs) can be linked through telephone networks to provide a wide range of information services, both for households and for businesses. Likewise, office activities are transformed by the use of electronic equipment (Freeman, 1982:78). All these developments within the electronics industry constitute a wide range of different products which are classified within four divisions of the Standard

International Trade Statistics Rev. 2 (UNIDO), as can be seen in table 2.1.

TABLE 2.1 ELECTRONICS INDUSTRY: Classification.

DIVISION 75: Office machines and data-processing equipment	Typewriters; calculating and cheque writing machines; other automatic data-processing machines and peripherals; cash registers, incorporating a calculating device; postage, franking and ticket issuing machines, incorporating calculating devices; duplicating machines; photo copying and thermacopy parts for this type of equipment not elsewhere classified.
DIVISION 76: Telecommunications and sound recording and reproducing apparatus and equipment	Television and radio broadcast receiving equipment; gramophones dictating machines an all other sound recorder and reproducers, including record players and tape decks and systems; microphones and loudspeakers etc.; telephonic and telegraphic apparatus; radio and television transmitters; other telecommunications equipment; television cameras; radar and radio navigational aid apparatus; parts for these not elsewhere classified.
<u>Group 776:</u> Electronic tubes, valves, transistors	Electronic valves and tubes;piezo-electric crystals; diodes; transistors; and other semiconductors and similar semiconductor devices; electronic microcircuits; parts of these components.
DIVISION 87: Professional, and instruments, etc.	A wide range of optical, scientific controlling instruments, including telescopes and microscopes; medical instruments, meters and counters; surveying and navigational instruments; drawing, mathematical and marking-out instruments and machines; electronic, electrical and other automatic control and analytical instruments; parts for these products not elsewhere classified.
DIVISION 88: Photographic apparatus and supplies;	Photographic and cinematographic cameras projectors, optical goods; watches and clocks, sound recorders, etc.;photographic film, plates and paper; optical goods including lenses, spectacles, etc.; watches, clocks and other time recording equipment, time switches, etc.

Source: P. Hall and P. Preston, 1988:Table 11.5.

In terms of the end-use demand of the electronic products the industry is conventionally divided into four main sectors, as Freeman (1982b:58) pointed out. These are:

(1) Consumer electronics (radio, T.V., record-players, tape recorders, etc.)
(2) Electronic capital goods (radar, computers, process control equipment, communication equipment, telephone exchanges, instruments, etc.)
(3) Electronic components (valves, semiconductors, integrated circuits, Large Scale Integration (LSI), Very Large Scale Integration (VLSI), chips, resistors rectifiers, capacitors, etc.)
(4) Military equipment (radar, missile control systems, electronic battlefield equipment; etc.)

The author has found that the fourth group is sometimes classified separately, but more usually with the second. It is important to mention that the products of the third sector are intermediate goods which are incorporated in the final products of the other three sectors. Lately, with the advent of the microprocessor, electronic components are increasingly incorporated in a wide range of products from other industries (eg. toys and missiles) which are not classified as 'electronic' (Freeman, 1982b:58).

Such a variety of products makes it difficult to analyse the location pattern of each one over a long period of time. For none of these products existed at the beginning of the century, and most of them did not exist in their present form, even ten years ago, due to the high rate of innovation. As in some other sectors of industry (e.g. chemicals), electronics is one of the most research-intensive. Therefore, in as much as the available data allows I shall try in the next sections to identify the pattern of international trade related with the location of some of the main subsectors of the industry.

b) International Trade in the Electronics Industry.

As mentioned above, the electronic industry is characterised by intense competition and rapid technological change in its products. Therefore, it is "uneconomical to invest heavily in fixed capital for assembly operations (to increase labour productivity) because of the short time period within which such equipment would be rendered obsolete" (Jenkins, 1984: 129). This element has brought the industry to its leading role in the internationalisation of capital from the 1960s through the relocation of the labour-intensive phases of the production process (assembly) in Asia (Southeast and East) and Latin America.

Although it can be observed a general pattern of redistribution of the electronic production capacity, each branch has its own specific characteristics and locate accordingly. In this way, some high-skilled phases as well as research and development activities remain in the core countries. The most sophisticated phases of the assembly process, which require a skilled labour-force, are sent to the most developed NICs, whereas the less sophisticated phases are sent to the New-NICs, due to the fact that they require a labour-force with lesser levels of skill to perform the assembly activities. This process gives place to the emergence of specialisations of production related to specific geographical locations.

Before starting to examine specific branches a broad outline of the international trade of electronics products at the most aggregated level will be given. Table 2.2 presents the proportion of each category of products in some countries' exports of electronics in 1982. These give some idea of the specialisation patterns in the international trade of great importance in this study. In the American exports of electronics, office machinery (including computers) dominates, at 43% of the total. In the UK exports its share is 38%; 28%

in FRG; about one-fifth of Japanese exports; one-third of the EC total and just 11% of the NICs total.

TABLE 2.2: Electronics Industry Exports: percentage composition by sector, 1982

	UK	USA	JAPAN	FRG	EC	NICs	TOTAL 38 nations
Office machinery ADP equipment	38	43	20	28	33	11	29
Telecommunications and sound recording	11	9	46	22	16	41	26
Transistors, valves, etc.	13	19	13	10	11	35	16
Professional and scientific	24	21	5	25	21	3	15
Optical goods, etc.	14	8	16	15	19	10	14
TOTAL	100	100	100	100	100	100	100

SOURCE: P. Hall and P. Preston, 1988:Table 11,7.

Consumer electronics (including telecommunications) has a big share in the Japanese total (46%) and in the NICs total (41%), highlighting the export performance of both NICs and Japan compared with, for example, British exports (11%) and American (9%). With regard to transistors, valves, etc. (electronic components) the core sector of electronics, the export performance of the NICs is remarkable, being 35% of their total exports, followed by USA (19%). In professional and scientific equipment, a subsector which requires high levels of skill, it is hardly surprising to find that the developed countries dominate; FRG 25%; UK 24%; and both USA and EC 21% each. Optical goods is a subsector which has little importance in the countries concerned, the EC being an exception with a share of about one-fifth of its total exports, followed by FRG with 15%. This means that the core centre of production for these kind of goods is located away from the main producers of electronics.

With regard to the world total exports of electronic products it can be seen that office machinery is the dominating subsector, with 29% of the world total, followed by consumer electronics (26%) and electronic components (16%). However, it should be noted that the above-mentioned shares can underestimate the electronic components sub-sector due to the existence of intra-firm trade. Japanese firms, for example, are characterised by their vertical integration; this means that part of their electronic components production is incorporated in the final goods (e.g. consumer electronics) without being accounted for as exports. The same happens with reference to an inter-firm trade in some countries, the final result being that they have a large bulk of exports in, for example, consumer electronics, which incorporates home-assembled devices. Unfortunately, this kind of trade is difficult to measure with the data available.

To summarise, the above percentages indicate the existence of patterns of specialisation in the international trade of electronic products. The NICs in consumer electronics and electronic components, subsectors which makes up more than three-thirds of their exports of electronic products. Japan performs better in consumer electronics than in the other sectors and America in office machinery, including computers. In the next sections attention will be focused on some of the most important branches of each subsector.

2. INTERNATIONAL TRADE IN SEMICONDUCTORS.

Before examining the trends in the international trade of electronic components, a broad outline is presented of the characteristics of this subsector. This is particularly relevant due to changes in the structure of the industry, brought about by changes in technology, production and markets have influence in the nature of the international division of labour. The process gives place, for instance, to a regional division of labour in Southeast Asia (Scott, 1985; Henderson, 1989), which is reflected in the emergence of "new exporters" during the period of study.

a) Characteristics of the Industry

The predecessor of modern semiconductors is the vacuum tube, invented in England at the beginning of this century. It consisted of from two to five electrodes surrounded by a glass tube. The tube was sealed to a metallic base and a vacuum was induced inside it to improve conductivity. This device became central for the development of all electronics, but it was fragile, bulky and relatively slow in transmitting electronic signals, though it could be easily and cheaply produced (Henderson and Scott, 1987:38). World War II brought new developments. The corner stone of the modern electronics industry, the transistor, was developed by the Bell Telephone Laboratories in the United States (1948). The transistor displaced the vacuum tube and made possible the technological development of electronics and microelectronics through the progressive sophistication and miniaturisation of the electronic components. The wide range of implications of such technological change are not only in the characteristics of products but in the type of labour processes needed in the production (Dicken, 1988).

The transistor is made with materials such as silicon, which acts as a semiconductor of electrical current. Later developments allowed the semiconductor to be manufactured commercially. In the late 1950's the integrated circuit (ICs) became the second major innovation. Integrated circuits consume little power, have high reliability and are cheap to produce. Moreover, they are tiny devices which can perform the functions more quickly than their predecessors (Henderson and Scott, 1987:40).

As Henderson and Scott pointed out, since its commercial development, integrated circuit technology has become increasingly sophisticated in two senses. First, the number of circuits embodied in a piece or 'chip' of silicon, of less than 1/4 inch square in size, and the number of functions that can be performed have increased enormously[1]. Secondly, the number of functions that the integrated circuit can perform has advanced in such a way that nowadays there are five forms of semiconductor technology ranging 'discrete' devices used, for instance, in telephone systems to the most sophisticated microprocessor. The microprocessors are able to manipulate data and hence can perform the functions of computers (1987:40).

In essence, the production of semiconductors involves five stages, or different labour processes, which can be technically disarticulated: R&D, mask making, wafer fabrication, assembly and testing. The continued development of integrated circuit technology has had implications for the first three stages. Assembly and testing remain manual processes, which can be performed offshore, owing to several aspects, as pointed out by Langlois, et al:

> "First, scale economies are minor, capital requirements are modest and few learning economies attach to assembly beyond the worker-training period. Second, although package designs are continually changing, the manual assembly process itself is a relatively stable technology. Third, in view of the high growth rate of the industry, decisions about the establishment of offshore assembly were generally confronted as capacity-expansion decisions. Without sunk costs, the lower average total cost of offshore assembly was often the deciding factor" (1988:53).

However, in the last few years, as a result of the evolution of VLSI technology, the assembly processes have begun to be automated and final testing controlled by lasers and computers. Nonetheless, this process can hardly spread out and jeopardise the advantages of offshore locations in the short-term. High fixed costs, rapid technological

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[1] "With first 'large scale' (LSI) and then 'very large scale', (VLSI) in the 1970's, each chip in the latest generation of integrated circuits now contains in excess of 100,000 microscopic transistors" (Henderson, and Scott, 1987:40).

change and expansion of market niches for customised designs are the main factors preventing the full adoption of automated assembly. The machines, once they overcome the high-cost of establishment, must be flexible and reprogramming is costly (Langlois, et al, 1988:55).

In view of this brief introduction to the characteristics of the industry, I will now turn to some aspects of offshore assembly and competition of the main firms and countries involved in the international trade of semiconductors.

b) Development of Offshore Assembly

The US semiconductor industry, as has already been indicated, dates back to the early 1950s as a strategic sector for military purposes. The federal government via the Department of Defence and NASA spent great amounts in supporting R&D programmes and extending the production capacity. Moreover, as the main purchaser, the federal government[2] encouraged the production capability and the technological development of the industry.

At the same time, Silicon Valley in Santa Clara County, California consolidated as an important location for the industry. Several electronic and military related enterprises located there and, with Stanford University nearby, it made possible the development of technology as a result of the interaction between firms and scientists[3]. This does not mean that the mere existence of the university led to the emergence and shape of the semiconductor industry as some literature affirms. Without neglecting the importance of them, I believe that to understand the dynamic of this subsector (and of the electronics industry as a whole) it must be seen as a sector of production in capitalism and subject to

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[2] "...100 percent of sales in integrated circuits in 1962" (Sayer, and Morgan, 1987). And "...a half of sales in the semiconductors" (Flamm, 1985).

[3] For further information on the genesis of Silicon Valley see Saxenian, 1985.

the pressures of the capital-labour relation and the competition between capitals. Only in the light of a clarification of this issue is it possible to understand how the redistribution of world production capacity has taken place in the semiconductor industry and in the electronic industry.

In the early 1960s, the standardisation of production lines emerged as a consequence of improvements in technology, the decline of military demand and the growth of a civilian market (with less sophisticated needs) (Flamm, 1985:41). The reduction of military demand had two important effects on the industry[1]:

i. the emergence of strong price-competition and cost-cutting strategies;

ii. the internationalisation of production, restricting domestic manufacturing to military purchases by federal law (Henderson, and Scott, 1987: 59).

The intensity of competition and the entry of new firms pressed location shifts on the industry to reduce production costs. So the firms began to seek out low labour-cost locations. The first 'runaway' firm, in the strict sense meant by Frobel (1981:331-8) was Fairchild, which established a plant in Hong Kong in 1962. Therefore, in the first location wave the first beneficiaries were the NICs since they had the best cost-cutting conditions, that is, a cheap labour force with the required levels of productivity per unit of output. They also constituted a favourable investment environment, the host governments offered tax holidays, few restrictions on repatriation of profits and ,and lax enforcement of labour legislation, important for this kind of industry. Likewise, the policies of government in fomenting economic

[1] "...from 39% in semiconductors and 100% in ICs in 1962, to 27 and 53 respectively in 1966" (Flamm, 1985: 43).

growth had resulted in improvements in infrastructure and public services adding to the incentives.

In 1964, General Instruments set up some of its assembly activities in Taiwan. In 1966, Fairchild located a plant in South Korea. Also, several US semiconductor plants were established in Latin America, particularly Mexico and the Caribbean region. In the later 1960s, they were established in Singapore and Malaysia (Dicken, 1988; Sayer and Morgan, 1987).

The reimport of assembled devices into the US was possible under items 806.30 and 807.00 of the Tariff Schedules of the United States. As mentioned in chapter I, only the duties on the foreign value-added had to be paid, rather than on the total value of the devices. These items were added to the tariff code in 1963 and the semiconductor industry became a major user of them. The duties added only 1 or 2 percent to the total cost of the reimported devices in the late 1970s, in April 1985 the tariff rate on semiconductors was reduced to zero, thus eliminating this cost (Langlois, 1988:54).

Nonetheless, the outstanding position of the US firms was challenged by Japanese newcomers. They did not receive stimulus from the military sector and lacked a rich technically- sophisticated domestic market such as the US firms. After great efforts at imitation and a long term strategy (which includes restrictions on imports and foreign investment, licensing of foreign technology) encouraged by the Ministry of International Trade and Industry (MITI) the Japanese firms became a major force in the world semi-conductor market in a range of chips which took advantage of high quality volume productions.

The second location wave was the result of the strong competition of Japanese firms, which grew at a rapid rate; the world crisis which brought about the first overproduction crises in the industry (1974-1975) and the increasing cost of labour in some NICs. Therefore, the firms searched for locations with still cheaper labour-cost in some New-NICs such as the Philippines and Indonesia in addition to Malaysia. Moreover, the 'old' locations in South East and East Asia and Latin American were consolidated and upgraded in terms of the characteristic of the assembly process performed there as a result of improvements in skilled and semi-skilled labour-force, infrastructure, government incentives, etc. (Duncan, 1981; Dicken, 1988).

A standard pattern of internationalisation can be identified for the industry in general. Firms employ mostly young unmarried female workers (see Sklair, 1989 among others) Wafers fabricated in Silicon Valley are air-freighted to South-East Asia for assembly. Once assembled the discrete devices or integrated circuits are air freighted back to Silicon Valley for final testing and marketing. Since transport costs per unit of output amount to less than 1% of the total production costs in the international semiconductor business, distance is not an obstacle to offshore assembly, provided that the air service is reliable and rapid from the host country (Scott, 1987:145). Lately, the assembly of more sophisticated devices and final testing has been performed successfully by the more advanced Asian NICs - Hong Kong and Singapore - giving rise to the emergence of a sub-regional division of labour. Less sophisticated devices are assembled in the New-NICs mentioned above and then sent to Hong Kong and Singapore for final testing (Scott, 1987; Henderson and Scott, 1987).

The third major producing region, Western Europe, shows some backwardness in terms of production of semiconductors. Since the late 1960s several US companies have started operations in the UK; General Instruments set up in 1968 and was followed by National Semiconductors, Motorola and Hughes (Financial Times, September 8, 1981). However, the labour processes implanted in the UK (Scotland) are rather different from those in Third World locations. Initial investment was in warehousing, test facilities and occasionally assembly, as a manner of "testing" the advantages of the location. After a while, all the American firms had invested in the more capital intensive, technologically sophisticated process, wafer fabrication.

> "No American firm has yet invested in offshore wafer fabrication facilities other than in Europe or Japan and thus their Southeast Asian plants, for instance, are totally dependent on assembly processes or in certain locations (Hong Kong and Singapore in particular) on final testing" (Henderson, 1987:11).

Moreover, there are well-established companies from the Netherlands, (Philips) and from West Germany (Siemens and Telefunken) among the world's leading semiconductor companies. However, the development of the European industry has to confront several problems to increase its share in the world market and to reduce the importance of US firms in Europe. First, the market fragmentation in several small national markets, each with its own technical standards, strategies, government policies and low level of sophistication. Second, with such a fragmentation, it is difficult to achieve economies of scale and efficiency. Also there is an absence of linkages between sectors like in the US and Japan. Moreover, the failure to develop a long term strategy instead of responding to customer's individual needs and the development of defence markets has had major consequences in the wide penetration by foreign investment. Specially, US firms began to produce and sell in Europe, to penetrate EC tariff barriers and hence to compete effectively with European suppliers (Morgan and Sayer, 1987; Sayer, 1986).

> "The fact that the 17% EC tariff was levied on the value-added during the production process, meant that semi-conductor firms could produce most of the values-added in their European plants - namely at the wafer fabrication stage - and cheaply assembly and test the semiconductors in their South East Asian facilities, and subsequently import the completed product back into EC" (Henderson, 1987:17).

After the crisis of 1973-1974, the performance of the industry was spectacular; the average annual rate of increase from 1974 to 1980 was around 15 percent (Financial Times, April 30, 1980). Intense utilisation of semiconductors in a wide range of completed products, from the most sophisticated electronic equipment for telecommunications to the most simple watch, and the fierce competition were some of the factors for the development of techniques to cut down production costs[5].

Therefore the prices of individual devices decreased by as much as 30 percent per year (Financial Times April 30, 1980). This tendency was increased by the crash of 1984. But what happened to such a successful industry? First, extra capacity was installed by both US and Japanese firms to respond to the great shortage of semiconductors between 1976 and 1980. Second, the industry was hit by world recession (Europe) and high interest rates (US). There seem to be problems of adjusting output: cyclical problems of oversupply and the high inventory levels maintained by customers (Financial Times June 17, 1981).

As pointed out in the previous chapter, the introduction of automation in production is the current focus of the debate. Some people have suggested that semiconductor offshore plants may be repatriated to the home countries in view of the need to assemble the more technically advanced devices (Sayer and Morgan, 1987). Also, there appears to be a tendency to locate the industry in the developed economies. For example, Britain remained the first choice for overseas investment by US electronics companies (Financial Times February 2, 1983). The core idea of the 'exodus' from the NICs to advanced economies is that of demand for high levels of skill from the labour-force; wage differentials have narrowed between NICs and the West; worker resistance (in the case of Philippines' illegal strikes in 1985); and political instability in some countries.

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[5] **"Perhaps the most significant structural shift within the labour process was the accelerated introduction of automation" (Salih, et.al., 1988:380).**

But the above debate seems to neglect the emergence of important changes in the structure and organisation of production. As Jenkins points out, the TNCs remain subject to the compulsion of competition, despite concentration and centralisation of capital (1984;17). So, they create more intricate production networks which may lead to a rapid vertical integration and increase in the division of labour, for example, the subregional division of labour in South East and East Asia.

Likewise, the high costs of establishing a plant (to carry out any phase of the process) seems to be not only a great barrier to entry, but also to promote the need to maintain offshore plants in the NICs and New-NICs (Duncan, 1981:183). In this way, as Ernst points out, to maintain a low level of unit cost for the expensive equipment, it is only possible if "the effective annual utilisation of this machinery can be increased considerably by means of uninterrupted work" (1985:346). Therefore, NICs and New- NICs locations have an advantage, because they have soft labour regulations and, in some cases, no effective existing unions, as in the developed countries. In the case of places like Scotland, the location is a result of the EC tariff barriers. As Dicken mentions:

> "...the type of international production located by electronics firms in these developed countries is substantially different from that located in the Third World. Whereas offshore production in most developed countries is aimed at cost-minimisation, the dominant motivation for overseas location within developed countries is market access" (Dicken, 1988:343).

Besides, as seen in chapter I, Scotland specialises in different production processes than those performed in the Asian NICs. Additionally, there are two other factors which have to be considered in the analysis. First, the expansion of the market in the NICs, though not considerable now, could be important in the next decade. Second, the specialisation of labour processes in the different locations, given the differences in sophistication and complexity of the devices must be taken into account. Since each location has its own advantages in performing different phases of the production process, it would be expensive to move the plants from one already specialised location to another.

c) The Nature of Competition.

The production of semiconductors is dominated by a handful of companies. All of them have a variety of backgrounds, but the most evident is the division between the Old School and the New Comers. The former consist of firms like Siemens, firms which come from the older electrical industry, and Motorola and Fairchild which were in electronics before the 'chip' was conceived. Most of them are already diversified but have had failures in the mass markets. Texas Instruments and National Semiconductor were founded in the 1950's to take advantage of the transistor technology (Duncan, 1981:178).

The leader, Texas Instruments is almost the only strictly semiconductor company meeting the Japanese competition there. The others, in their quest for further vertical integration, are concentrating on other areas like communication. Others, like IBM were already in the computer industry and make their own semiconductors (The Guardian, June 18, 1979).

There is another block, the 'New Comers', which came in with the chip. The successful ones have expanded rapidly and tend to lead the technology more often than the 'elders'. Intel, for instance, from a small beginning in 1969, achieved a great turnover in 1979. Mostek, even younger, is questing for diversification beyond the chip itself and tends to be restricted to building working blocks for customers (Duncan, 1981; The Guardian June 18, 1979). Likewise, there are the Japanese firms, which were aiming to become a force in the worldwide market for silicon chips (Fujitsu, Hitachi, NEC, Toshiba, Mitsubishi). With only a tiny fraction of the semiconductor market they have an aggressive campaign (particularly NEC) for increasing their market share by means of establishing plants in some of the European countries (UK) and in the US. The five companies are also vertically integrated, controlling their business from chip design and manufacturing to the assembly and marketing of finished products (Financial Times, September 9, 1980).

The data for semiconductor sales in 1979 and 1988 show the increasing importance of Japanese firms (figures 2.1 and 2.2). In 1979 NEC and Hitachi were the only two Japanese firms in the top ten worldwide integrated circuit producers (8th and 10th place). By 1988, there were six Japanese companies the among the ten top producers of semiconductors, the three top places were for Japanese companies, NEC (1st), Toshiba (2nd) and Hitachi (3rd). However, nowadays the American firm Intel is firmly established as the world's top chip maker. Finally, there is another block of newcomers from Asian NICs, especially from South Korea (also some firms from Taiwan are incursioning in the production of semiconductors); Samsung, Gold Star and Daewoo are large producers of electrical and electronic system products already, while one - Hyundai - has no previous experience in this area (Langlois, 1988:45).
Since the late 1980's, the semiconductor industry is going into a gradual slow down, due, again, to the high levels of inventory maintained by most of the purchasers. For example Advanced Microdevices (AMD), National Semiconductor and Texas Instruments reported a significant worsening in market conditions which led to lay plans for restructuring their businesses and cut their labour forces (Financial Times, November 12, 1988; Financial Times, November 22, 1989).
Thus the slump joined to the competition of Japanese firms[6] will have definite implications in the international division of labour[7].

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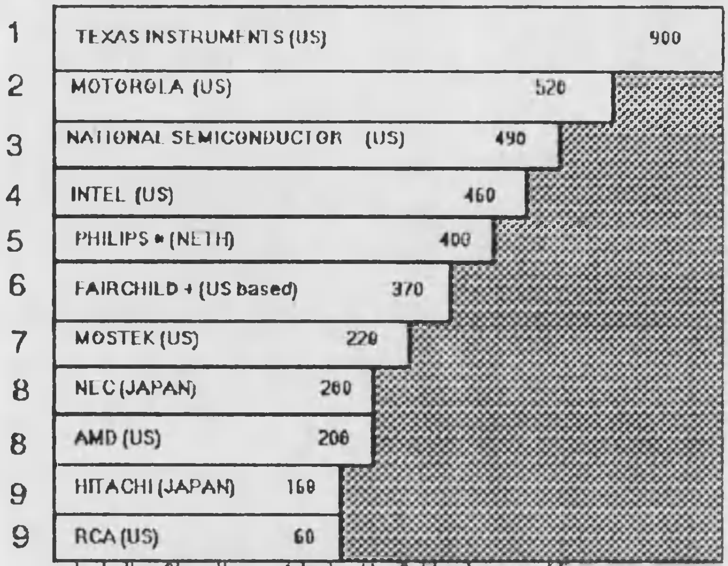
[6] For example, Japan has overtaken the U.S. as the largest source of components for electronics companies in Scotland (Financial Times, November 11, 1988). Likewise Japanese semiconductor sales in the U.S. have increased by over 70 percent in the past three years (Financial Times, May 12, 1989).

[7] In October, AMD announced 1 400 workers were going to be laid off in its plants in the Philippines (Financial Times, November 11, 1988).

FIGURE 2.1

TOP TEN WORLDWIDE INTEGRATED CIRCUIT PRODUCERS, 1979 SALES

(MILLION US DOLLARS)

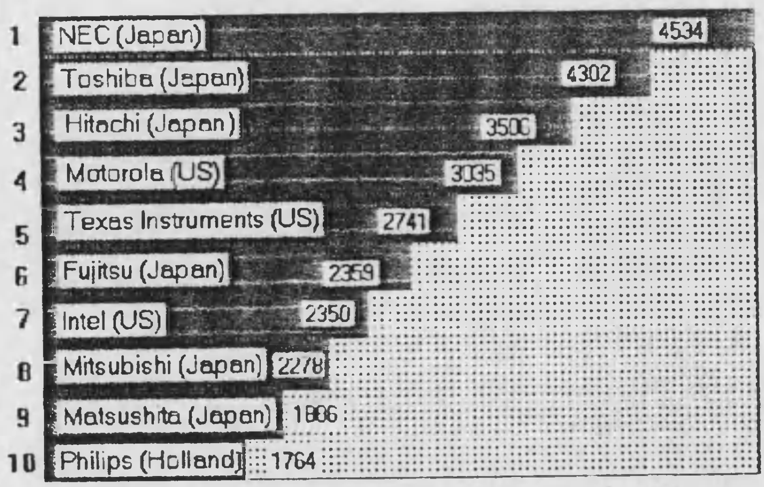


* Including Signetics. + Acquired by Schlumberger of France.
SOURCE: FINANCIAL TIMES, April 30, 1980.

FIGURE 2.2

TOP TEN WORLDWIDE INTEGRATED CIRCUIT PRODUCERS, 1988 SALES

(MILLION US DOLLARS)



SOURCE: The Economist, February 18, 1989.

Another dimension of competition in the semiconductor industry is that of the national shares achieved in the worldwide markets for various IC products. In a broad outline the specialisation of different types of semiconductors can be seen in Table 2.3. US based firms have undoubtedly great strength in most of the different types of semiconductors but, particularly in bipolar digital ICs, whose end-use is basically in computers.

TABLE 2.3. National Shares of the World IC Market: by Product Type, 1982, as percentage

PRODUCT	UNITED STATES	JAPAN	OTHERS*
IC Total	62	31	7
MOS IC	60	35	5
Microprocessors	64	33	3
Memory	65	33	2
Logic	49	40	11
BIPOLAR	62	27	11
Linear	51	35	14
Digital	74	19	7

Note: Excludes captive production
* Mostly Western Europe
SOURCE: R N Langlois, et al, 1988:Table 12.

Japanese and European firms have relative strengths in bipolar linear ICs, whose use is in consumer electronics. Despite their leading position, US firms are at present being challenged by Japanese firms, which are showing relative strength in some areas as MOS (Metal-oxid semiconductors) products. Langlois et.al. pointed out that

> "Japanese firms had no share in the 1K DRAM (Dynamic Random Access Memory) market in the early 1970s and achieved only a 12 percent share of the 4K DRAM merchant market in the mid-1970s, they captured about 40 percent of the world merchant market for 16K DRAMs in the late 1970s, and about 60 percent of the world merchant market for 64 DRAMS in the first half of the 1980s." (Langlois et.al., 1988:35).

The most important application for the 64K DRAM is computers. Memory chips store data and, if they are combined with data-processing logic chips like microprocessors, DRAMs become the "brains" of computers, missiles, robots and other microelectronic products (Rogers and Larson, 1984: 208). Likewise the Japanese have successfully in 256K
broken into

DRAMs market (about 80 to 90 percent of the world market). The introduction of 256K DRAM suggests that the Japanese and South Korean firms are becoming technological leaders, with the resulting efforts of US firms to stop them through several means.

d) International Trade in Semiconductors.

It is necessary for an attempt to analyse the new redistribution of world production capacity taking place in the semiconductor industry, to look at the exports from the main producer countries in a defined period of time. Having in mind the nature of the industry in its main aspects - production process, types of products and competition and how these phenomena take place in the geographical sphere - makes it easier to understand the redistribution of production capacity from the DCs countries to the NICs, New-NICs, within the DCs countries and from the NICs to the DCs (e.g. South Korean firms). Due to problems of data aggregation for the first year of the period of analysis (1970), I will only examine the main trends in the selected years of 1975, 1979 and 1985. Table 2.4 (see next page) shows exports of transistors, valves, semiconductors, etc. as a percentage of world exports (from market economies) by main geographical area and country. In 1975, the main exporter area was Asia with almost fifty percent of world exports, followed by Western Europe (38.6 percent) and America with 11.0 percent.

The main exporter country was Japan with about 32 percent share of world exports. The US, West Germany and Netherlands shares are almost the same, about 10 percent each. The US share has to be carefully considered due to the fact that US-based firms had already started offshore assembly operations in the NICs. Since the products assembled are not always re-imported into US markets, but go directly to third markets or are included in final products it is possible that US production is underestimated in terms of exports.

TABLE 2.4: Exports of Transistors, Valves, etc. (Valves as percentage of world market economies, rate of growth in brackets) 1975 - 1985.

COUNTRIES	1975	1979	r75/79	1985	r79/85
WORLD MKT EC	100.0	100.0	(16.7)	100.0	(10.2)
ASIA	47.0	38.0	-	46.0	-
Japan	31.8	18.0	(6.6)	21.0	(12.3)
Hong Kong	2.4	4.1	(24.2)	4.0	(10.0)
Singapore	7.3	10.7	(22.7)	6.2	(2.9)
South Korea	4.9	4.6	(15.9)	5.0	(11.3)
Malaysia	0.2	n.a.	n.a.	8.3	(38.2)*
Philippines	0.0	n.a.	n.a.	1.1	(56.9)*
Thailand	0.4	n.a.	n.a.	n.a.	-
Indonesia	0.0	0.6	(74.9)	0.3	-
AMERICA	11.0	16.3	-	24.8	-
USA	10.5	15.9	(23.4)	23.6	(15.2)
Brazil	0.3	0.4	(17.7)	0.4	(12.3)
Mexico	0.2	n.a.	n.a.	0.8	(25.1)*
EUROPE	38.6	30.5	-	24.1	-
France	7.2	6.3	(14.4)	4.4	(5.6)
Italy	3.0	2.7	(14.7)	2.4	(8.7)
UK	4.7	4.3	(15.2)	5.8	(13.9)
West Germany	10.2	9.7	(15.8)	6.4	(4.8)
Netherlands	9.7	5.1	(5.2)	2.9	(2.6)
Australia	1.2	n.a.	n.a.	1.0	(13.0)
Belgium-Lux.	1.6	1.2	(12.1)	0.2	(-12.6)
Ireland	0.4	0.5	(22.3)	0.7	(14.0)
Switzerland	0.6	0.7	(19.8)	0.3	(1.2)
REST OF THE WORLD	3.4	15.2	-	5.1	-

Notes: n.a.= not available
* r - 75/85

SOURCE: United Nations 1976, 1980 and 1988.

The next important exporters are Singapore and France, about 7 percent each one; and South Korea and UK (offshore location of US-based firms) with about 5 percent each one. In 1979, the distribution of world exports changed; Western Europe's share declined to 30 percent and that of Asia to 38 percent, while America's share increased to 16.3 percent due to a growth in US exports. In view of these percentages I shall suggest that after the slump in the industry in 1974-1975, which affected mainly US production, the industry recovery (at a growth rate of 16.7% per year between 1975 and 1979) had an impact on US production (which grew at a rate of 23.4 %). Also, the growth of re-imports of devices into US from offshore assembly plants under items 806/807 must be taken into account (Scott, 1987:146).

Japanese exports share decreased to 18.0 percent which could be due to the expansion of assembly operations offshore[8], especially in the Asian NICs (Singapore, South Korea, Taiwan and Malaysia). Langlois has suggested that a large part of the devices assembled offshore are sold in foreign markets rather than re-imported into Japan (1988:56).

The expansion of offshore assembly (either US or Japanese firms) and subcontracting firms is reflected in the growing importance of some of the host countries. Singapore increased its share to about 11 percent (at a growth rate of 22.7 percent per year). Hong Kong increased its share to 4.7 percent (at a growth rate of about 25 percent). Meanwhile, European countries slightly reduced their shares in world exports, especially the Netherlands, their shares decreasing to 5.1 percent. All of them had a growth rate lower than that of the world total exports, with the exceptions of Ireland (22.3) and Switzerland (19.8).

During the period 1979-1985, the growth of world exports decreased to 10.2 percent per year due to the 'crash' originated in 1984 (Salih, et. al., 1988:380). Considering the major geographical areas, Asia consolidated as a major exporter with a share of 46 percent. America increased to 24.8 percent while Western Europe decreased from 30.5 percent in 1979 to 24.1 percent in 1985.

By country, table 2.4 shows the outstanding performance of the Asian countries, with Japan as a leading exporter (21.1 percent share), and the consolidation of the Asian NICs (Hong Kong, Singapore and South Korea) as important exporters. Malaysian success as an offshore location is impressive, from a small beginning in 1975 world exports, to becoming the third major exporter of semiconductors in 1985 with 8.3 percent share. In this respect, Salih et. al. point out that:

8 "Japan has a provision in the tariff code similar to the American 806/807 items. Japanese components of certain designated manufactured imports, including various types of semiconductors, can be granted relief from duty upon reimport..." (Langlois 1988:56).

"The growth of Japanese exports after 1975 was due to increased capacity beyond domestic demand, and experience gained from providing for domestic end-users. At the same time, the 1974-75 recession had affected US capacity owing to a lack of capital investment and reduced workforce. When the US semiconductor demand later accelerated, Japanese firms were able to increase their import penetration. However, Japan became a net exporter of semiconductor, particularly memory ICs, only after 1980-81. The cost-effectiveness and high quality of Japanese semiconductor products in the late 1970s and early 1980s enabled them to compete effectively with American producers not only in the US market but also in other markets. Japanese offshore production facilities, as found in Malaysia, were important in this process" (1988:389-90).

On the contrary, all the European countries decreased their shares in world exports, with the exception of the UK (the favourite location of US-based and Japan-based firms), which increased from 4.3 percent in 1975, to about 6 in 1985. This reflects the poor performance of European countries in the industry as compared with the leading exporters such as the US, which increased its share to about 24 percent, or Japan.

Table 2.4 clearly shows a redistribution of world production capacity of semiconductors from the core countries (US, Japan and some Europeans) to the NICs and New-NICs, with particular strength in the Asian countries. The advantages they have in the performance of assembly operations and the upgrading of the processes performed by some of them make difficult the announced 'exodus' of offshore operations to the core countries. In view of the current overproduction crises and the intensification of competition, increased by competitors from the NICs, it can be foreseen in the immediate future a consolidation and intensification of the above mentioned trends. That is, a greater articulation of the geographical areas involved in world production of semiconductors reinforcing the specialisations that already exist.

3.- INTERNATIONAL TRADE IN PERSONAL COMPUTERS.

a) Characteristics of the Industry.

The development of semiconductors and increased miniaturisation has been the most important development of the last three decades of the century. It made possible the incorporation of a great number of electronic components in a wide range of products. One of these, the computer, has had an enormous impact on almost all activities. The computer has both decreased its size and cost and increased its functions, speed applications and efficiency.

After the semiconductor subsector, the computer subsector is one of the most technology-intensive in the electronics industry as a whole. In 1982, for example, the share of sales revenue devoted to research and development expenditures was 7.7 percent in the semiconductors industry and about 6 percent in the computers industry (O'Connor, 1985:312). The innovation in design and manufacture of semiconductors is the driving force in computer design. Likewise, the computer industry's huge demand for semiconductors enables the firms to realise the learning economies that have resulted over the last decade in the dramatic decline in per unit costs of computing power[9]. The result of this articulation has been the appearance on the market of successive generations of computers, each one with smaller machines, more powerful and versatile and cheaper than their predecessor.

Apart from the microprocessor, the 'brain' of the computer, there are other elements of the hardware called peripheral equipment. Such peripherals include keyboards, terminals and monitors, memory storage units (tape and disk drives), printers, x-y plotters and modems. All this peripheral equipment can be assembled without having to manufacture a complete computer system. Actually, the major producers of

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[9] In 1985, the computers share of world demand for integrated circuits was 36 percent (Langlois et. al., 1988: table 8).

computers contract specialised outside suppliers to manufacture their requirements of this equipment. That means, a complete computer is the result of different labour processes which can be geographically separated, performed all over the world. This allows for the internationalisation of production, which will be dealt with in the next section.

b) <u>Development of Offshore Assembly.</u>

The internationalisation of the computer subsector dates back to the early 1960s, from the traditional location in the developed countries to some production sites in the Third World, such as the NICs in Southeast Asia and Latin America (Mexico and few countries in the Caribbean). Locations (some of them FPZs) have provided numerous benefits, as in the case of semiconductors, a cheap and docile female labour force, the availability of infrastructure, government incentives, lack of restrictions on foreign investments, etc. (Ernst, 1985; Frobel, et. al., 1981).

The increasing worldwide demand for computers (personal computers, telecommunications, defence, security, and medical systems, etc.) has produced strong competition among firms for market shares. The obvious consequences were improvements in R & D and the search for locations for the labour-intensive phases of production to cut production costs, increase the overall productivity and reduce the prices. For instance, in 1978, IBM made 10 times as many computers as in 1970.

> "The prices for microprocessor memory was about half the price of ordinary (mainframe) computers memory; in 1977 it was one third of the price and in 1978 came down to one tenth the price" (The Economist March 4, 1978).

The main US firm for computers, IBM, has a undisputed leadership in the mainframe market, but such is not the case in smaller scale systems. Although, [illegible] Apple, was the pioneer, launching the first personal computer Lisa in the early 1980s, and later the first Macintosh, IBM rapidly caught up and achieved first place, dominating the direction and shape of the PC industry. Competitors started to make computers which closely resembled IBM machines, but with higher performance at lower cost. Such computers are known as 'plug compatibles' because they can be plugged into an IBM system (Financial Times September 9, 1980).

In the late 1970s and early 1980s firms preferred West European locations (mainly UK and Ireland), to access that market (due to the tariff barriers imposed by EC on imports) and effectively competing with the European firms. Nonetheless despite the efforts for automation in production lines, the NICs locations remained important for computer production for several reasons:

i. Computers are characterised by rapid technological change and short product-cycles, both disincentives in the short run to invest in expensive automated equipment for computer production/assembly. Rather than undertake such investment, manufacturers prefer to keep their relatively labour-intensive processes in offshore locations, especially in the case of peripheral equipment and subassemblies (O'Connor, 1985:316).

ii. The availability of local suppliers of cheap components has had, as a result, the emergence of imitators of the main brands of personal computers in practically all major Southeast Asian countries.

iii. The emergence of markets in South East Asia and Latin America. Therefore, US, Japan and West European firms are looking for a share in this market (Ernst, 1985).

As in the case of semiconductors, an important element to be considered in the analysis is the emergence of a regional division of labour in the Asian NICs.

> "Already, there are first signs of how various activities are likely to be divided between different locations in the region: Taiwan and South Korea are expected to become two of the world's leading terminal exporters. Singapore, a major supplier of disk drives and Taiwan, South Korea and Hong Kong could expect to play a considerable role in the expanding world market for personal computers" (Ernst, 1985:339).

The emergence of specialisations in these countries and the upgrading of the skill of a cheaper labour-force and, in some cases, a more productive labour-force than that of developed countries, all reinforce the difficulty for the full implementation of automation. Also, the consolidation of the Asian NICs as important locations for the industry is implied.

c) Nature of Competition.

The production of computers, as in the case of semiconductors, is dominated by a handful of firms, mainly US-based. The pioneer, IBM - a manufacturer of office equipment - in the early 1950s started with the development of computers (mainframes), taking a large share in the world market. With the advent of the micro and the personal computer, innovative competitors emerged, due to the low barriers to entry. O'Connor argues that as the industry matures, a considerable reduction in the number of firms continuing to manufacture personal computers is likely (1985:316). By contrast quotation I suggest that, according to the trend of diffusion of electronics to all activities and the reduction in the price of semiconductors, it is possible that the number of competitors will increase in this subsector, as in the case of semiconductors.

Moreover, as a result of the technological developments in semiconductors, "the latest PCs are offering performance levels comparable with engineering workstations, but at a fraction of the price" (Financial Times September 29, 1989), thus increasing their demand by a wide range of users. The expanding demand in the main markets stimulates the proliferation of competitors.

In terms of world market shares, in 1986 Europe was the biggest importer of automatic data processing equipment (ADPE), about 60 percent of world imports, and 60.5 of computers. America's (mainly the US) share was 25.1 percent in ADPE and 9.9 in personal computers. Asia's (mainly Japan) share was 9.8 percent in ADPE and 9.9 in personal computers (UN, 1988). Although the US market is quite important as a single country, Europe as a whole constitutes the biggest market for this kind of product. Consequently, US and Japanese firms locate there to avoid trade barriers and to confront competition from European firms.

With regard to market shares by firm, tables 2.5, 2.6 and 2.7 show that the US based firms are the main producers of personal computers with IBM as a leader in the world, US and European market (11.5, 20.9 and 26.6 percent respectively). Commodore has a share of 10.7 percent in the world market; Apple has a good share in the three markets and Compaq only in the US and European markets. European firms have not penetrated the US market, Amstrad's (UK) share in the world market is 4.5 percent and Olivetti's (Italy) is 8.6 in the European market. However, it is important to note that Japanese firms are present in the three markets. Despite their small shares Japanese firms (Toshiba, NEC and Fujitsu) are effectively competing with US and European firms[10] to produce for their markets and, not far behind Japan, Korean and Taiwanese manufacturers (Financial Times December 27, 1989)[11].

[10] "There are clear signs that the Japanese computer industry is gaining ground. Five Japanese companies now rank among the top 20 in the world, up from three a year ago, according to a recent report..." (Financial Times, December 27, 1989). Also South Korea and Taiwan combined share of PCs sold worldwide soared from 2 percent in 1984 to 10 percent in 1988 (The Economist, August 19, 1989).

[11] Channel International, a Taiwan-based consortium acquired Wyse-Technology, a U.S. computer maker (Financial Times, December 12, 1989).

TABLE 2.5: Worldwide PC Unit Shipments, 1988.

FIRM	%
IBM	11.5
Commodore	10.7
Apple	6.4
NEC	4.7
Amstrad	4.5
Zenith	3.0
Compaq	2.7
Tandy	2.7
Hewlett-Packard	0.6
Others	53.2

SOURCE: Financial Times, September 27, 1989.

TABLE 2.6: U.S. Personal Computer Market, 1988.

FIRM	%
IBM	20.9
Apple	9.2
Compaq	7.7
Zenith	6.1
Hewlett-Packard	4.0
Sun Microsystems	3.7
Tandy	3.2
Toshiba	2.2
DEC	1.8
NEC	1.5
Others	39.7

SOURCE: Financial Times, November 6, 1989

TABLE 2.7: European Personal Computer Market, 1989

FIRM	%
IBM	26.6
Olivetti	8.6
Apple	7.4
Compaq	7.1
Hewlett-Packard	3.2
Tandon	3.0
Toshiba	2.6
Victor	2.6
Zenith	2.3
Bull	2.1
Nokia Data	2.1
Others	32.4

SOURCE: Financial Times, September, 1989.

As competition increases in this subsector, it seems to me that to cut production costs and therefore prices, firms will continue offshore assembly to increase productivity. Moreover, as innovations spread (as portable computers) and products' life-cycles get shorter, automation still will be difficult to implement.

Likewise, the emergence of specialisations makes it hard to think of the feasibility of the 'exodus' to core countries. Since each location has a place in the 'chain of production', the cost-effectiveness of ending activities in one location could be higher than the benefits. Also there are market considerations; US market growth is gradually slowing, becoming one of replacement, firms confront strong competition, to maintain their market shares they have to cut production cost to keep prices attractive in Europe and to enter new markets, which are growing in Asia and Latin America, by exploiting the locational advantages of these areas.

d) International Trade of Computers.

As has already been indicated, competition in the computer industry led firms to look for strategies to increase productivity and to lower costs per unit of output. Consequently, a redistribution of world production capacity has taken place. In so far as competition increases this redistribution will be hastened. Hence, the need to look at the international trade in personal computers to appreciate the changes pointed out in the last sections. Since personal computers are a relatively new subsector of the industry, the available data covers just the period between 1980 and 1985.

Table 2.8 shows that in 1980 the biggest exporting area was Western Europe with 44 percent of world exports, followed by America, 42 percent, and finally Asia with only 6.3 percent share. Looking by country, undoubtedly the US was the main exporter (42 percent), West Germany was the second exporter with a 14.8 percent share, followed by the UK, Ireland and Japan (12.7, 9.5 and 6.2 percent respectively). The high shares in the UK and Ireland should be attributed to their role as important locations for US-based firms for access to European markets.

TABLE 2.8: Exports of Digital Computers (Value as percentage of World Market Economies, rate of growth in brackets), 1980 - 1985

COUNTRIES	1980	1985	r/85/80
WORLD MKT EC.	100	100	(10.5)
ASIA	6.3	14.4	
Japan	6.2	9.1	(16.0)
Hong Kong	-	1.9	-
Singapore	0.1	1.5	(24.1)
South Korea	0.0	1.7	(62.3)
Malaysia	-	0.02	-
AMERICA	42.2	36.4	
USA	42.0	35.7	(8.03)
Brazil	0.12	0.44	(27.7)
Mexico	0.1	0.25	(23.3)
EUROPE	44.19	48.4	
France	1.9	2.6	(15.1)
Italy	0.7	0.06	(-35.4)
UK	12.7	2.6	(-16.4)
West Germany	14.8	13.0	(8.5)
Netherlands	3.6	5.1	(15.4)
Begium-Lux.	0.54	0.4	(5.8)
Denmark	0.24	0.22	(9.0)
Finland	0.21	0.22	(11.4)
Ireland	9.5	24.2	(23.4)
REST OF THE WORLD	7.3	0.8	

SOURCE: United Nations 1976, 1980 and 1988.

In 1985, important changes in the composition of world exports can be observed. Asia increases its share to 14.4 percent, as well as Europe (48.4 percent) while that of America decreases to 36.4 percent. With regard to the countries' shares, Japan increase its share to 9 percent (at a rate of growth of 16 percent per year). US share declined to about 36 percent possibly due to three factors: expansion of overseas investment (included offshore assembly), the emergence of competition from other countries (as Japan) and the world economic crises which could affect the exports of personal computers.

In Europe, the UK share decreased a significant amount, to 2.6 percent (rate of growth of -16.4 percent per year). The West German share remains almost the same and that of Ireland increased to 24.2 percent (at a growth rate of 23.4 percent per year), consolidating its place as an important location for overseas investment.

The Asian NICs merge as exporters of personal computers, despite their small share, Hong Kong, 1.9 percent; Singapore, 1.5 percent and South Korea, 1.7 percent. These shares, according to the industry trend, can increase in the short-run. With regard to the other NICs (Brazil, Mexico and Malaysia), their shares are negligible in this respect. However, it is possible that they can increase their shares in the future. Malaysia, for example, has a strong position as an exporter of semiconductors and its performance in electronics can be improved due to the government policy of fomenting backward and forward linkages in the industry. In addition, the two Latin Americans are performing quite well in the assembly of peripheral equipment:

> "In absolute terms, data processing equipment exports from Latin America still exceeded those from Asian developing countries in 1981, with Brazil accounting for the bulk of those exports. It is probable, however, that Mexico will increase its share of Latin American computer exports in the future, as a growing number of computer transnational corporations (TNCs) are investing in production facilities there to serve the Latin American region as well as the US market" (O'Connor, 1985:317).

The expected importance of Mexico is due to the restrictions on investment for mini and personal computers, as well as peripheral equipment imposed by the Brazilian government. Lately, Hewlett-Packard and Apple Computer have invested in Mexico. The former has a wholly owned subsidiary there, which manufactures minicomputers and a joint venture to make personal computers. The latter established a joint venture to manufacture personal computers for local and regional markets (O'Connor, 1985:330).

In so far as competition increases in the already established markets and with the upsurge of Third World market, firms will look for price-cutting strategies and innovations in software. Both strategies will spread out the computer applications even more. Consequently, it can be expected a growth in the demand for personal and portable computers. Thus the above mentioned trends in the redistribution of world production capacity will be reinforced. That is, offshore locations will be consolidated, as well as the patterns of specialisation in production.

4. INTERNATIONAL TRADE OF CONSUMER ELECTRONICS.

a) Characteristics of the Industry.

The introduction of integrated circuits made possible the launching of new products in the great markets, like the US and Western Europe. Old products were not ousted - TV and radio - but chips were incorporated in them and in many other goods to improve their performance or to cut their costs (watches, calculators, audio equipment, etc.)[12]. There was a great number of newcomers in the entertainment, communications and consumer durables (The Economist March 24, 1979).

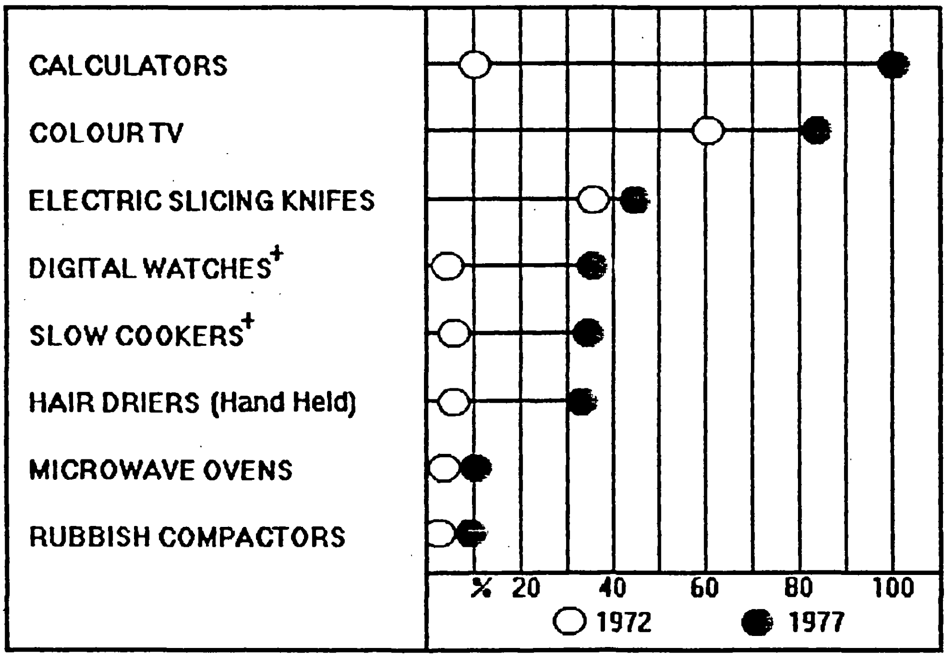
The varying pace of acceptance of some products in the 1970s reflects the success of new electronic products (figure 2.3). Especially in terms of consumer electronics, attention has been focused on television sets and audio equipment (sound recorders and phonographs). As a result of improvements in R&D, television sets, for example, are increasing their functions and new related products such as video tape recorders (VTR) and teletext systems have emerged.

[12] This is exemplified by the fact that in the early 1970s a typical colour TV set contained 1,100 to 1,200 separate components. Today, a British set contains less than 600 components and Japanese designs have only 420. In such products the increasing use of integrated circuits leads to a reduction in overall component demand (Financial Times, November 19, 1979).

FIGURE 2.3

CONSUMERS' CHOICE

% Penetration of US Market*



* Cumulative sales as % of households.
Adjustments made for obsolescense.
\+ 1973.

SOURCE: The Economist March 24, 1979.

> "These are part of a broader developments in communications systems in which the domestic television receiver is seen, potentially, as the centre of a sophisticated entertainment, educational, commercial and general information system" (Dicken, 1988:331).

In general terms, the manufacture of consumer electronic products is less technologically sophisticated than the production of semiconductors or computers. Therefore, these branches of the industry were the earliest to be internationalised and were less geographically concentrated in the developed countries. Despite the great rate of technological innovation, it is still largely an assembly production process which requires a high proportion of low or unskilled labour force.

In the 1960s, there was a great labour cost differential between the US and developing countries (Dicken, 1988). So, to cut cost per unit of output it was necessary to transfer labour-intensive phases of production process to those countries to increase productivity levels.

> "- Admiral came to make both colour and black-and-white sets in Taiwan.
> - General Electric moved the manufacture of circuit boards and other colour components to Singapore.
> - Magnavox (A Philips subsidiary) imported from a Taiwanese plant owned by its parent.
> - RCA used Taiwan and, in 1975, began moving colour-chassis operations to Mexico.
> - GTE Sylvania opened operations in Mexico in 1973 and bought a plant in Taiwan in 1975 for production of both kinds of televisions.
> - Zenith built up subsidiary plants in Taiwan and Mexico, and, in late 1977, announced a major shift of jobs to them" (Turner, 1982).

However, Asian competitors caught up and rapidly merged as strong competitors to the alarm of US and Europe producers which concerned for a coming flood of cheap Asian sets started to restrict imports[13].

For example, Japan was originally many years behind the US with colour television, but it not only closed the gap in the 1960s and 1970s but went ahead to undisputed leadership in this industry until the advent of electronic producers from the Asian NICs. By 1977 Japan accounted for over half of world production in colour television and three quarters of world exports including a large share of the US market. Later in the 1970s, Japanese investment in the US and Europe, together with trade restrictions, has diminished its share of direct exports, but not its leadership domination in the industry at world level which however is becoming seriously contested by producers from the other Asian NICs. The explanation of Japan's success can be found in the high levels of productivity, high quality and the more rapid and efficient introduction of advanced electronic technology than either the US or European producers (Freeman, 1982b:80).

Japan's success is not restricted to TV sets, in 1978 exports from Japan were about $4.8 bn (mostly tape recorders); the principal purchaser was North America (45 percent) and Western Europe (25.5 percent). Also between 1967 and 1977, the output of Japanese consumer electronics increased five times, from $2bn to $10 bn (The Economist April 22, 1978).

Both fierce competition and an increasing demand from high-income countries accentuated the preference for low labour cost locations such as Hong Kong, Taiwan, South Korea, Singapore, Latin America. The great advantage of this low labour cost locations for television assembly, for instance, is evident:

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[13] "In 1977, the Federal Government imposed restrictions - the euphemism was 'Orderly Marketing Agreements' - that cut the sales of Japanese companies from two and a half to one and three quarter million for three years. The following year, South Korea and Taiwan were brought into the Agreement. The restrictions prompted Japanese companies to build production facilities in the United States to escape import controls (Dicken, 1988: 331).

> "In the late 1970s, the direct labour costs per set produced in South Korea were £1.50 compared with £5.70 in Japan, £10.60 in UK and £15.00 in West Germany" (Dicken, 1988:331).

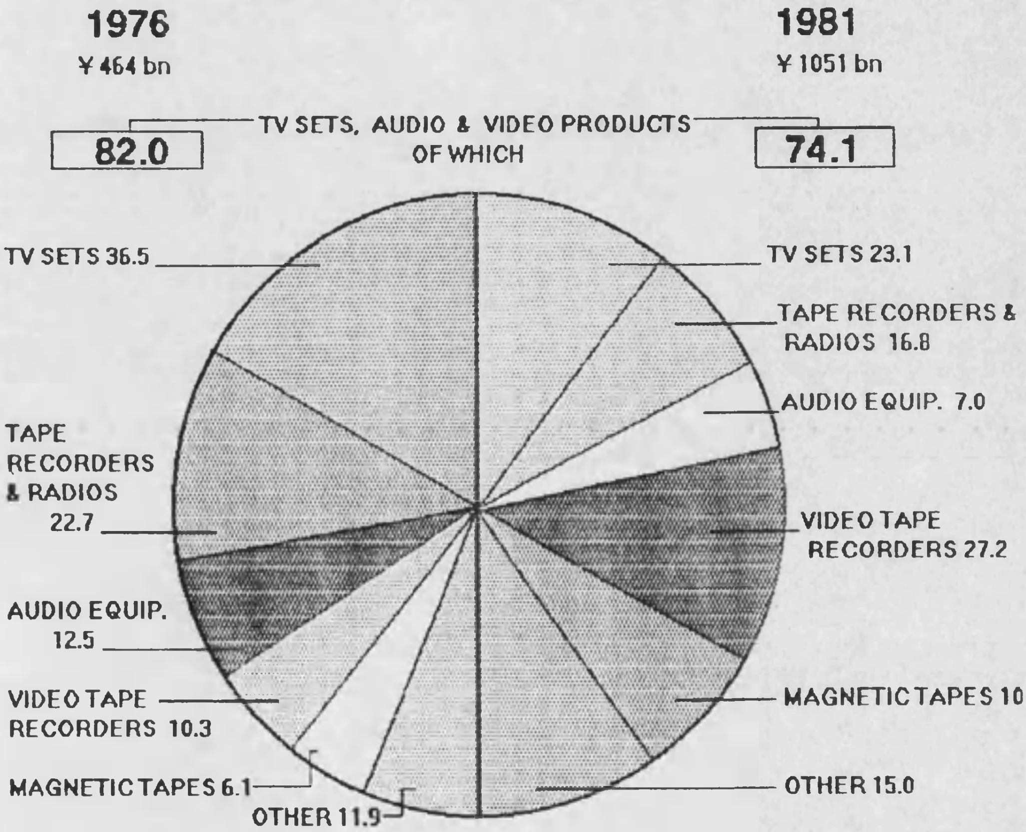
Therefore the production in the NIC locations rapidly grew in the 1970s. "The share of Taiwan electronic products in exports increased from 1 percent to 18 by the early eighties... Electronic product exports increased from Hong Kong which had the highest growth rates between 1973-1981, 302 percent... In Mexico, the electronic equipment subsector grew from 1970 to 1978 in 126 percent" (Harris, 1986:31 and 73).

However, in the early 1980s, world economic crisis and the 'saturation' in the developed market economies had, as a result, a decline in the demand for TV sets. The 'replacement' market is slower and more volatile (Dicken, 1988:327), Nonetheless, the demand for other consumer electronic products grew, see for example, sales by products of the most important companies (figures 2.4 and 2.5). Production in Japan of VTR went from 280,000 in 1976 to 700,000 in 1977 (The Economist April 22, 1978). By the early 1980s, the most important Japanese TNCs reported a spectacular growth in sales and it was expected that consumer electronics sales would continue growing (Financial Times, July 1, 1981). Although Japanese firms are the biggest producers within Asia, South Korea, Taiwan and Singapore have emerged as producers as well. As mentioned above, these shifts in the worldwide distribution of production in consumer electronics has led to trading frictions and the implementation of protectionist measures (especially in Western Europe) against Asian imports. High productivity levels allow the firms to keep low prices in products.

In the late 1980s, increasing competition between companies, as well as the rising labour cost in the Asian and Latin American NICs are the main factors for a new redistribution of world production capacity in this subsector, for instance:

FIGURE 2.4
SONY

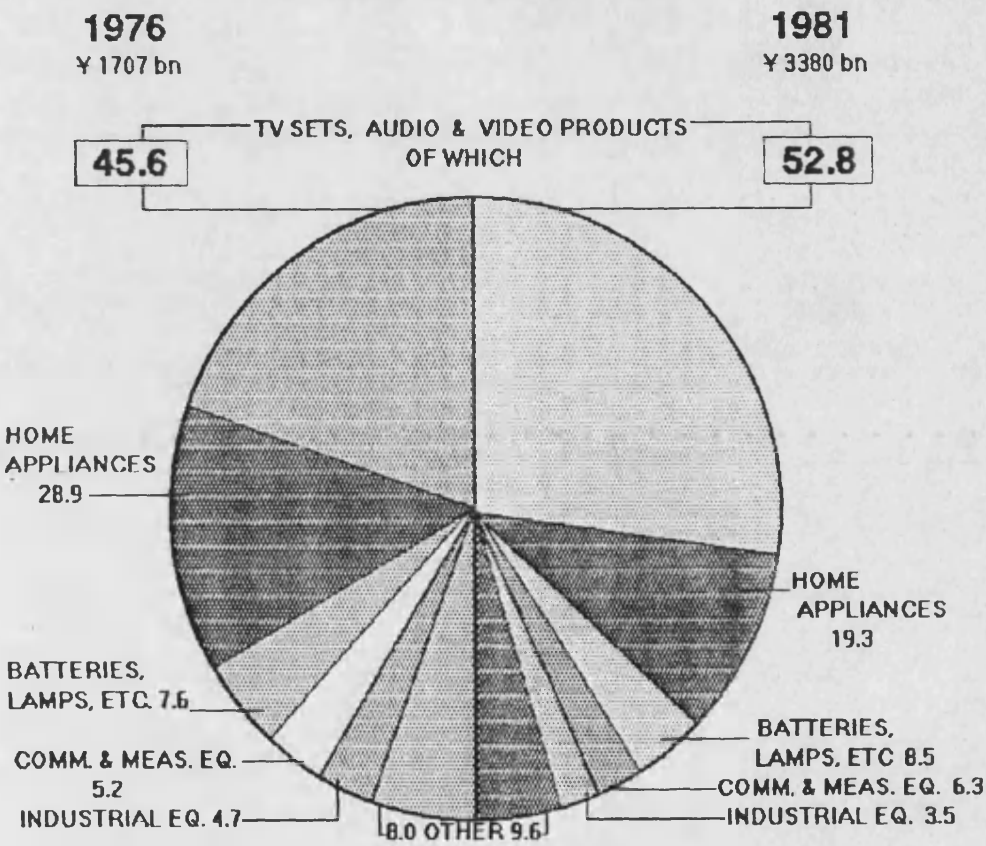
SALES BY PRODUCTS %



SOURCE: The Economist, February 20, 1982

FIGURE 2.5
MATSUSHITA

SALES BY PRODUCTS %



SOURCE: The Economist, February 20, 1982.

i. Japanese firms are shifting their assembly plants from the Asian NICs to the New-NICs -China, Thailand Philippines, Indonesia - which offers the labour force that is required to perform the less sophisticated phases of assembly process at low cost per unit of output[14].

ii. The South Korean companies (Gold Star, Samsung and Daewoo) are increasingly "planning to open plants abroad, especially in Europe, to manufacture household appliances such as TV sets and microwave ovens, so as to avoid protectionist threats" (Financial Times, November 22, 1988). In this way, the French electronics association is asking for the implementation of tariff and non-tariff protective measures because they say the European electronics industry would disappear! (Financial Times November 18, 1988).

As markets for consumer electronics expand not only in high income countries but also in middle-income countries it is possible that the trends above indicated will continue. That means, the process of geographical concentration of the industry in the Asian NICs and New-NICs as a labour-cost saving strategy and the penetration of markets in developed countries through foreign direct investment to avoid protectionist measures.

In view of this broad outline of the main characteristics of the industry, I will now turn to examine the pattern of international trade in three branches of the industry to better understand the changes in the distribution of world capacity during the period 1971-1985 of consumer electronics.

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[14] "Wages in South Korea rose by an annual average of 12% in real terms between 1977 and 1986 and though the rise slowed last year, the New-NICs have a big labour advantage. It is a similar tale in Hong Kong, Singapore and Taiwan" (The Economist, November 5, 1988).

b) International Trade in Consumer Electronics.

Since the consumer electronics industry includes a wide range of different products, most of which hardly existed in the early 1980s, I will only look through the pattern of international trade of only three branches, television receivers, radio broadcast receivers and sound recorders and phonographs. The consumption of these products is widely spread in developed and developing countries so they can be seen as representatives of mass-production in electronics. Despite the diffusion of other products like VCRs or microwave ovens, for instance, their market share is still small and restricted to a buyers of a certain income-level and their share in world exports, though increasing, is not quite important yet.

Table 2.9 shows exports of television receivers during the period 1971-1985. In 1971, exports from Asia accounted for about 51 percent of world exports; Europe's share was of 26.2 percent, while that of America was 10.7.

TABLE 2.9: Exports of Television Receivers (Value as percentage of World Market Economy, rate of growth in brackets) 1975 - 1985

COUNTRIES	1971	1975	r71/75	1980	r75/80	1985	r80/85
WORLD MKT EC	100	100	(16.6)	100	(10.8)	100	(3.4)
ASIA	51.34	35.12	-	50.14	-	66.11	-
Japan	49.4	31.1	(8.6)	34.5	(12.3)	45.7	(7.8)
Hong Kong	1.4	0.5	(-2.8)	1.8	(27.6)	4.0	(15.7)
Singapore	0.2	2.2	(49.5)	5.3	(23.0)	5.0	(2.5)
South Korea	0.3	1.2	(37.5)	8.4	(35.1)	9.6	(5.5)
Malaysia	0.04	0.1	(32.0)	0.02	(-22.8)	1.8	(55.3)
AMERICA	10.7	7.51	-	6.6	-	5.5	-
US	7.2	7.3	(17.0)	6.5	(8.8)a	4.0	(-2.5)b
Argentina	0.02	0.01	(1.7)	-	-	-	-
Brazil	0.05	0.2	(36.2)	-	-	0.1	-
Mexico	2.8	n.a.	-	n.a.	-	1.4	(7.3)c
EUROPE	26.2	37.78	-	36.2	-	19.03	-
Belgium-Lux.	3.8	6.8	(26.0)	6.1	(9.0)	3.3	(-7.1)
France	0.7	1.1	(24.4)	1.0	(6.9)	0.6	(-1.5)
Ireland	0.4	0.08	(-17.4)	0.1	(12.6)	0.03	(-13.9)
Italy	6.3	6.5	(17.1)	3.5	(1.0)	2.1	(-5.4)
UK	1.7	6.0	(35.4)	3.4	(2.0)	2.6	(-1.0)
W.Germany	13.3	17.3	(21.0)	22.1	(14.3)	10.4	(-9.5)

Notes: a. Data of 1979
b. rate of growth 1979 - 1985
c. rate of growth 1971 - 1985
SOURCE: United Nations 1976, 1980 and 1988.

The undisputed exporter country was Japan with loosely half of world exports, followed by West Germany (13.3 percent), US and Italy (7.2 and 6.3 percent respectively). It is important to note the share of some of the first NIC locations such as Mexico with a 2.8 percent share and Hong Kong, 1.4 percent. The former constitutes an important location of US foreign investment in assembly plants not only for better labour cost conditions but due to its closeness to the US market. However, problems like high wages, inflation and overvaluation of the currency during the 1970s made the spread of the assembly operations difficult for more sophisticated products such as semiconductors and computers as in the Asian NICs case. Although this kind of product is assembled in Mexico, its share is still small as compared to that of consumer electronics.

In 1971, due to the world economic crises and the import restrictions in some countries (as in Europe), a change in the distribution of world production capacity took place. Asia's share decreased to 35 percent as well as that of America (7.5 percent); obversely, Western Europe's share increased to roughly 38 percent.

With regard to each country, it can be seen that the share of Japan decreased to 31 percent (at lower growth rate than world exports, 8.6 percent per year). US share remained almost the same (7 percent)while European countries increased their share, West Germany to 17.3 percent; Belgium-Luxembourg to 6.8 and UK to 6 percent. Asian NICs, except Hong Kong, increased their shares at fast rates of growth, Singapore 2.2 percent share (49.5 percent per year) and South Korea, 1.2 percent share at 37.5 percent per year.

In 1980, world export growth decreased from 16.6 percent per year between 1971-1975, to 10.8 per year during the period 1975-1980. Asia recovered its leadership as a main exporter area with about half of world exports. European and American shares declined to 36.2 and 6.6 percent respectively. Japan and West Germany remained the most important exporters (34.5 and 22.1) with rates of yearly growth higher than world exports. It is interesting to observe that the share of all the other European decreased while that of the Asian NICs increased at a high rate of growth. Hong Kong's share increased to 1.8 percent; Singapore, 5.3 percent. The outstanding performance of South Korea in the industry is confirmed by a remarkable 8.4 percent share in world exports.

The trends noted in 1980, accentuated in 1985, the core of world exports of TV sets is in Asia, whose share increased to 66 percent. The other two major geographical areas decreased their shares, America to 5.5 percent and Western Europe to 19.0 percent. Although West Germany remained as an important exporter with 10.4 percent share, its growth as compared to that of other European countries became negative as a result of the strong competition from Asian producers, characterised by high productivity levels which allowed them to effectively compete with lower prices and high quality.

Japan remains as an undisputed leader in the industry with about a 46 percent share. The Asian NICs are consolidated as important exporters, South Korea with a 9.6 percent share, Singapore with 5.0 percent and Hong Kong, 4.0 percent. On the contrary, Latin American NICs decreased their already low share, for instance, Mexico's share decreased from 2.8 in 1971 to 1.4 in 1985.

As to radio broadcast receivers, table 2.10 shows almost the same trends mentioned above throughout the whole period. The core of production is strongly concentrated in Asia with Japan at the head, with about half of the world exports during the whole period. The Asian NICs performance in this industry is self-evident. However, it is important to note the decline of Hong Kong and Singapore's share during the period of analysis. It is possible that, as a result of the upgrading in the skill of their labour force and increasing labour costs, the assembly of less sophisticated products were lost to other countries, such as the New-NICs as in the case of semiconductors.

TABLE 2.10: Exports of Radio Broadcast Receivers (Value as percentage of World Market Economy, rate of growth in brackets), 1971 - 1985.

COUNTRIES	1971	1975	r71/75	1980	r75/80	1985	r80/85
WORLD MKT EC.	100	100	(13.7)	100	(12.0)	100	(0.6)
ASIA	73.2	66.57	-	82.93	-	72.35	-
Japan	61.3	49.1	(9.8)	51.6	(12.8)	43.7	(-2.1)
Hong Kong	10.0	11.4	(16.0)	14.5	(15.5)	8.9	(-7.8)
Singapore	1.4	3.5	(27.8)	11.0	(27.2)	8.2	(-4.4)
South Korea	0.5	2.0	(33.0)	4.9	(25.5)	8.2	(8.9)
Malaysia	0.01	0.5	(52.2)	0.8	(18.2)	3.3	(21.8)
AMERICA	2.93	3.51	-	0.6	-	13.1	-
US	2.6	1.9	(8.2)	n.a.	-	3.6	(7.6)a
Brazil	0.03	1.6	(59.0)	n.a.	-	3.7	(9.6)a
Mexico	0.3	0.01	(-66.6)	0.0	(2.3)	5.8	(69.0)
EUROPE	17.96	23.5	-	12.8	-	8.9	-
Belgium-Lux.	2.4	3.7	(21.0)	3.0	(8.6)	1.6	(-10.0)
France	1.1	1.7	(20.7)	1.4	(9.4)	1.6	(2.2)
Ireland	0.06	0.2	(29.3)	0.3	(18.1)	0.2	(3.8)
Italy	1.3	1.0	(9.9)	0.5	(2.0)	0.2	(-18.3)
Netherlands	4.3	7.3	(22.3)	1.6	(-136.6)	0.8	(-11.7)
UK	1.0	1.0	(17.0)	1.1	(13.3)	0.7	(-8.2)
W.Germany	7.8	8.6	(15.6)	4.9	(3.2)	3.8	(-3.8)

Notes: E - estimate
a - rate of growth 1979 - 1985
SOURCE: United Nations 1976, 1980 and 1988.

With regard to America, there was an increase in its share of world exports through all the period from 2.93 percent in 1971 to 13 percent in 1985, with an important contribution from the Latin American NICs, Mexico (from 0.3 percent in 1971 to about 6 percent in 1985) and Brazil (from 0.03 to 3.7 percent). On the contrary, all the European countries decreased their shares in world exports with lower rates of growth than those of the NICs and even had negative rates in the last part of the period (1980-1985).

Finally, in the exports of sound recorders and phonographs it is clear the strong predominance of Japan throughout the whole period. In 1971, Japan's share was about a half of the world exports, bigger than that of the European countries, here considered, which altogether made up about 32 percent share with West Germany and UK as the biggest exporters (11.3 and 7.6 percent respectively) (table 2.11). In 1975, the share of all the others remains roughly the same.

TABLE 2.11: Exports of Sound Records and Phonographs (Value as percentage of World Market Economy, rate of growth in brackets), 1971 - 1985.

COUNTRIES	1971	1975	r71/75	1980	r75/80	1985	r80/85
WORLD MKT EC.	100	100	(9.3)	100	(17.3)	100	(11.8)
ASIA	48.91	47.3	-	76.15	-	83.45	-
Japan	48.0	40.8	(6.3)	69.5	(24.3)	76.7	(13.2)
Hong Kong	0.4	1.1	(26.7)	2.1	(26.0)	2.15	(12.0)
Singapore	0.2	1.6	(60.5)	2.0	(20.3)	1.5	(7.6)
South Korea	0.3	3.6	(43.0)	2.5	(11.7)	3.0	(14.8)
AMERICA	6.15	7.83	-	6.2	-	3.4	-
USA	6.1	7.6	(13.3)	5.9	(13.5)	3.0	(1.6)
Brazil	0.01	0.2	(51.7)	-	-	0.4	-
Mexico	0.04	0.03	(3.1)	0.3	(44.3)	0.06	(-16.1)
EUROPE	31.9	33.5	-	13.0	-	10.3	-
Austria	4.3	4.9	(11.6)	-	-	1.2	(4.3)a
Belgium-Lux.	4.4	4.9	(11.4)	2.7	(8.9)	1.1	(-3.2)
France	2.5	2.7	(10.0)	1.1	(4.8)	0.4	(-5.6)
Italy	1.8	2.1	(12.4)	0.8	(3.8)	0.1	(-29.2)
UK	7.6	7.8	(9.8)	3.5	(5.3)	2.0	(3.6)
W.Germany	11.3	11.1	(8.9)	4.9	(5.3)	5.5	(13.4)

Note: a = rate of growth, 1975 - 1985
SOURCE: United Nations 1976, 1980 and 1988.

However, by 1980-1985, the trend accentuating Europe's share drastically decreased, as well as that of America, while Japan's share increased enormously to about 83 percent of world exports in 1985. Asian NICs performed quite well during the periods as compared to European countries or Latin American NICs, but still their contribution to world exports is small.

To summarise, it can be observed a redistribution of world production capacity of consumer electronics from US and Europe to Asia, constituting a heavily concentrated geographical pattern of production focused in Japan and in the Asian NICs, which merged as important producers as well. However, as Japan's performance was upgraded in other areas of the industry (computers, robotics, tool-machines, optoelectrics) it might be expected in the years to come an increase in Asian NICs' share in consumer electronics and, to a lesser extent in the Latin American NICs.

5. CONCLUSIONS.

We have shown in the above account how a redistribution of world production capacity of electronics has emerged since the early 1960s. The most important factors in the internationalisation of production of some of the subsectors of the industry are two; the internal characteristics of the production processes, strong competition between capitals in the industry and the role of the nation-states in the home and host countries. The former allows the spatial separation of labour processes in such a way that they can be performed elsewhere in the world. Competition leads the firms to look for strategies to increase productivity levels, cut down cost per unit of output and offer low prices of products in the market. The role of the nation-states is unquestionable, as in the case of US semiconductor production, the rise and decline of military purchases was one of the factors which led to the technological development and later internationalisation in semiconductor; in Japan, the industrial policy of the MITI fostered the emergence of a strong group of firms which are among the best in semiconductors and consumer electronics, the same can be said about the Asian NICs. With regard to the host countries, the social and economic policies implemented by their governments undoubtedly affected the decisions of location of the TNCs.

Seemingly
~~Therefore~~, firms have looked for the best locations to perform the several phases of production process. In this way, the R&D and design activities which required high levels of skill in the labour force and a great amount of fixed capital and other facilities remained in the developed countries while the assembly phases of production with lower skill-requirements were sent to the most developed of the developing countries, the so-called NICs in a first stage and later, the New-NICs. These countries offered a pool of cheap labour force with the required levels of productivity per unit of output to perform the assembly activities at lower cost than in the developed countries. This process gave place to the emergence of

specialisations in the worldwide production of electronics and regional divisions of labour as in the case of South East Asia.

In the first case, it was observed the predominance of US and Western Europe in the production of office machinery (mainly computers) and professional and scientific equipment. Meanwhile, Japan and the NICs perform better in consumer electronics and electronics components with the exceptional case of Malaysia which in less than ten years became the third producer of semiconductors in the world.

In the second case, a diffusion of more advanced phases of production from developed countries to selected NIC locations took place as a result of their upgrading and improvements in the performance of assembly activities and the increase of labour costs for less-sophisticated phases. At the same time, a process of diffusion of labour intensive phases of production took place from the Asian NICs to the New NICs (Thailand, Philippines, Indonesia, etc.).

I foresee for the immediate future a consolidation and intensification of the trends above described in contrast to the what some analysts foresee, it is hardly probable that the diffusion of automation in assembly-lines and the 'exodus' from the NICs to the DCs takes place due to several factors:

i. Increased competition between the already established firms.

ii. The upsurge of competitors from the Asian NICs characterised by high productivity and quality at lower prices than US or European competitors.

iii. The high cost involved in 'automation' investment.

iv. The high rate of innovation which makes the life-cycle of products shorter, so it is necessary great flexibility in assembly-lines possible with the utilisation of labour force.

v. The growing importance of the NICs and New-NICs (specially in South-east Asia) as markets.

Furthermore, as protectionism increases in US and Western Europe it can be foreseen a growth in the movement of production capacity from Asia to US and Latin America, especially Mexico (to avoid tariff barriers) and Western Europe. However, this process does not affect for the immediate future the current geographical distribution of the industry.

III. MEXICO: FROM INWARD TO OUTWARD DEVELOPMENT AND INTERNATIONAL TRADE.

INTRODUCTION.

As pointed out in previous chapters, the long boom of the postwar brought about important shifts in the worldwide economic structure. The tendency of manufacturing system to employ far greater quantities of equipment and changing technically accelerated much faster. Manufacturing consolidated as the dominant sector in industry with metal-working (engineering) and chemicals as leading subsectors of the postwar growth of international trade. Furthermore, world trade increased mostly between industrialized economies,

One of the consequences of these structural shifts was the transformation of the labour force in some industrial sectors of the DCs, from unskilled and semi-skilled to high-skill levels. The Composition of the labour force also changed, there was an increasing employment of women. Likewise, the economic boom stimulated the movement of labour to those places where there were jobs (Harris N, 1983).

The change in the industrial geography was not only in the old core region. Japan revived its devastated postwar economy to become a part of the core region. Moreover, in the sixties, a group of LDCs acquired the status of Newly Industrializing Countries (NICs). These countries through different strategies (outward or inward development) achieved a sustained growth of their industrial capacity for exports or domestic consumption and provided an outlet for much investment capital during the early 1970s (Storper and Scott, 1986:4).

In chapter two, it was examined the electronics industry in which increased world competition, internal developments of the industry and the role of the governments, led firms in the early sixties to search for cheap-labour locations for the labour intensive stages of the production process. The purpose of this chapter is to give, first a brief outline of emergence of Mexico as newly industrializing country, that is the social and economic conditions (or factors internal to the country) which made possible the emergence of a new pattern of location of the industry and the consequent change in the structure of the labour force. In the second part I shall deal with Mexico's international trade with particular reference to its trade in electronic products since ~~the~~ changes in the structure of exports relate to changes in the geographical distribution of industry. In part 3 some conclusions will be drawn about the role of the governments in economic growth, industrial location and in the integration of the economies to the world market.

1. ANTECEDENTS: THE MEXICAN ECONOMY UP TO 1989.

a) From Import-Substitution to the Oil Bonanza.

In the post-war period the development strategy pursued by successive Mexican governments was that of import-substitution (as in other Latin American countries and in some South Asian as India) unlike the South and East Asian countries of Hong Kong, Singapore, South Korea and Taiwan which were more export-oriented. The Mexico's government strategy sought the expansion of the domestic market through the protection (through import controls, subsidies and other incentives) of the ~~national~~ domestic production of non-durable consumer goods in a first stage and intermediate goods and producer and consumer durables in a second one (Jenkins, 1978).

As a result, Mexico experienced two decades of annual growth rates of 6-7 per cent in the 1950s, almost 8 in the 1960s, 6-7 in the first half of the seventies, and 8 per cent from 1977 to 1981. In the seventies, when much of the world stagnated, Mexico doubled the volume of its industrial output. There were other impressive achievements during the import-substitution industrialisation (ISI), the capacity to generate electricity grew from 6 to 16 million kw; the length of paved highway from 68 000 to 208 000; the number of registered vehicles, from 1.8 to 4.5 million (Harris, 1986).

The ISI was further supported by the direct intervention of the state in the form of public investment. The government and state holdings accounted for around 40% of the country gross fixed capital formation by 1975. It should be noted that the public investment was made in key areas in terms of the needs of the industrial sector energy, transport and communications which between them have accounted for about three fifths of public investment. However, most of the state spending was financed by increasing public indebtness, both internal and external (Jenkins, 1978:16).

In geographical terms, this strategy reinforced the market-oriented locational pattern of the industry and the great concentration of population, labour-force, infrastructure, amenities, services, etc., in the biggest industrial cities of Mexico, the main markets or Mexico City, Monterrey and Guadalajara (see figure 3.1)[1].

Later, the policy of *desarrollo estabilizador* ("stabilising development"), initiated in 1955, combined price and exchange rate stability with sustained economic and industrial growth. Again, this policy stressed the tendency of great spatial concentration as a result of the dynamic of the industry oriented to serve the growing domestic market for consumer durables. As shown in table 3.1, in 1965 the Central Region (constituted by Mexico City and the states of Hidalgo, Mexico, Morelos, Puebla, Queretaro and Tlaxcala, see figure 3.1) concentrated 46.3% of the industrial establishments, nearly 56% of the labour force, nearly 64% of the wages and about 60% of the Gross Industrial Product. During the period, the growth

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1 For an exhaustive account of public expenditure in the Metropolitan Zone of Mexico City and its impact in the profitability of manufacturing industry as well as in the great urban concentration in there since the past century up to the 1960s see Garza, 1985.

rate of Gross National Product (GNP) was high, 7.1 per cent from 1960 to 1970.

TABLE 3.1: MEXICO: Share of the Central Region in the Manufacturing Industry, 1965-1975.

CENTRAL REGION(a)	NO. OF PLANTS	EMPLOYEES	WAGES	GROSS PRODUCT	VALUE ADDED
1965	62 626	746 928	11523467	69021157	n.d.
% National Tot	46.32	55.81	63.61	59.3	-
1970	52 543	236 315	19811066	122033980	46553534
% National Tot	44.16	54.99	62.35	59.9	61.32
1975	52 675	912 955	47044192	276630213	106436357
% National Tot	44.39	55.18	61.46	60.0	60.49

(a) Central Region: Mexico City and the states of Mexico, Hidalgo, Morelos, Puebla, Queretaro and Tlaxcala.
SOURCE: G. Garza and E. Aguilar, 1988:Table 6.

In view of the problems of unemployment and lower living standards resulting from this accentuated regional imbalance the government implemented a series of regional and urban policies, as the new towns and industrial estates programme and the provisions for the in-bond industry (which shall be deal with in chapter IV). Created in 1967 under the name of Border Industrialisation Programme (BIP) to attenuate the regional disparity and unemployment in the Northern Border, the in-bond plants are either subsidiaries of American firms (mainly) or subcontractors who assemble imported American materials into finished goods for re-export to the United States, paying duty on the value-added in the plants located along the 2,000 mile border, thus taking advantage of lower costs in Mexico. The successful performance of in-bond plants in the Northern Border gave place to the emergence and consolidation of what I call a new pattern of industrial location.

One of the main consequences of the policies of the government was a change in the structure of employment, in 1960, 55 per cent of Mexican workers were recorded as employed in agriculture, 20 per cent in industry; in 1980, the figures were 36 and 26 per cent respectively.

Nonetheless, a series of imbalances merged since the protected manufacturing industry needed progressively more capital and intermediate goods imports to maintain the sustained growth.

> "Indiscriminate protection of local businesses resulted in inefficient, low-quality production, while excessive public and private industrial investment left agriculture so severely neglected that many of these nations began to import food. Further, the advancement of industry required more imports of capital goods and technology and therefore greater capacity to accumulate foreign exchange. This capacity, however, was limited both by the anti-export bias of ISI and by the limited availability of foreign credit. External sector deficits mounted, hindering economic growth. At the same time, swelling urban population and improved social and political organization brought government under increasing demands which they often were unable to fulfill. Policy changes were needed if economic prosperity and political stability were to continue" (Szekely, 1989:1779).

During the Echeverria Administration (1970-1976) the policy strategies shifted in response to social unrest and the slowdown in economic growth that resulted from the world economic crisis. The new policy of *desarrollo compartido* ("shared development") stressed the export promotion of manufactures as well as job creation, income distribution and a more balanced geographical distribution of industry to achieve sustained economic growth. To this end more emphasis was put on all those policies directed to alleviate regional imbalances. Specially, and in view of its success in terms of employment and foreign exchange, the government reformed the in-bond industry regulations allowing it to locate in the interior of the country and sell limited quantities of their output on the domestic market. Likewise, more funds were allocated to education, health care and the social infrastructure in general[2].

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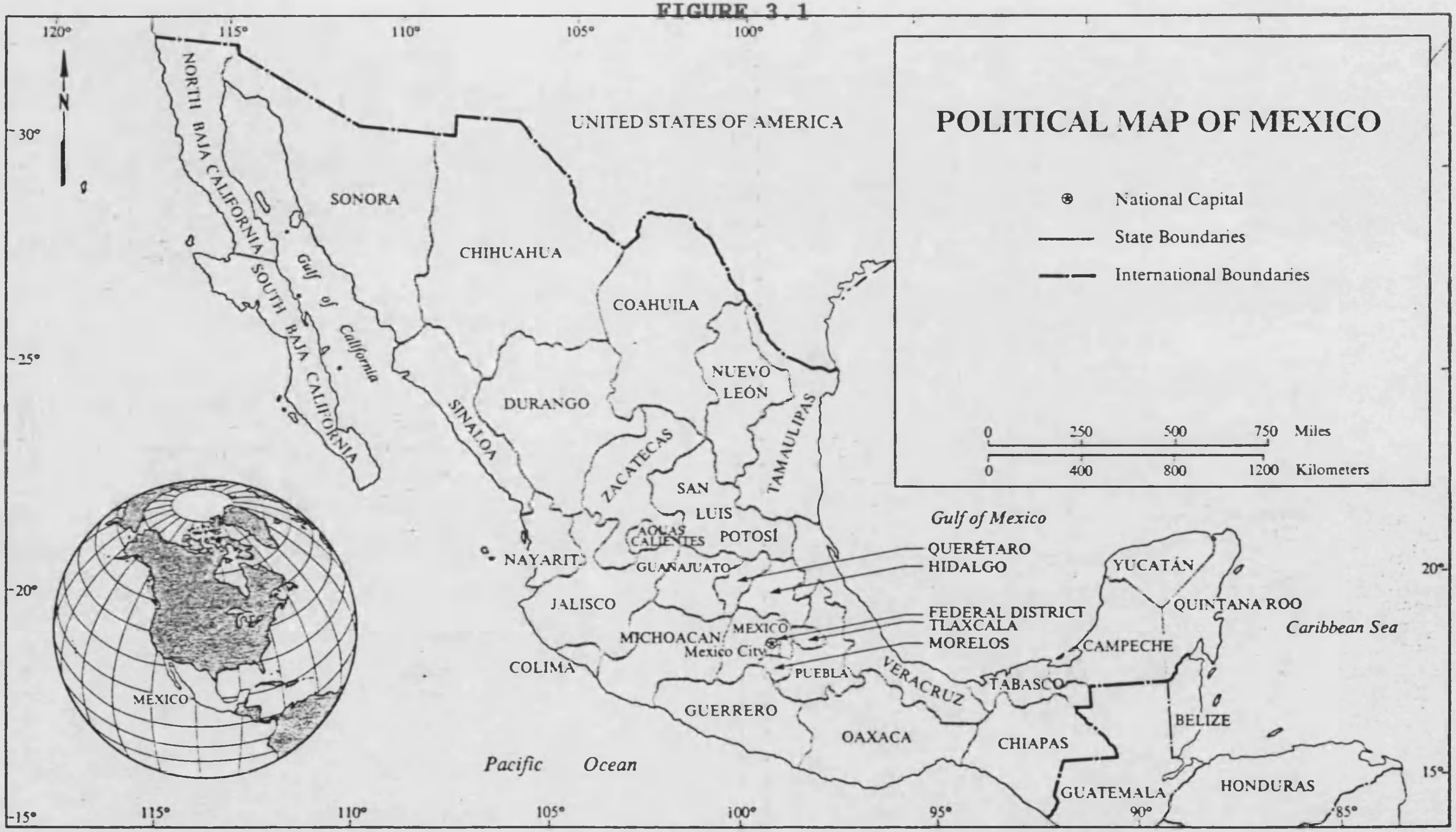
[2] "...the Mexican government has made extraordinary efforts to expand educational opportunities. During the decade following 1970, the proportion of the gross domestic product devoted to education almost doubled from 2.9 to 3.9 per cent according to data provided by the education ministry. Between 1972 and 1980, the real per capita expenditure on education more than doubled. A notable expansion of secondary schools and universities made it possible to accommodate an increasing proportion of the school-age population. In 1980, almost 40 per cent of the population of secondary school age was

FIGURE 3.1


POLITICAL MAP OF MEXICO
National Capital
State Boundaries
International Boundaries
0 250 500 750 Miles
0 400 800 1200 Kilometers
UNITED STATES OF AMERICA
NORTH BAJA CALIFORNIA
SOUTH BAJA CALIFORNIA
Gulf of California
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEÓN
TAMAULIPAS
SINALOA
DURANGO
ZACATECAS
SAN LUIS POTOSÍ
AGUAS CALIENTES
NAYARIT
GUANAJUATO
JALISCO
MICHOACAN
MEXICO
Mexico City
COLIMA
PUEBLA
VERACRUZ
GUERRERO
OAXACA
CHIAPAS
TABASCO
CAMPECHE
YUCATÁN
QUINTANA ROO
BELIZE
GUATEMALA
HONDURAS
Gulf of Mexico
QUERÉTARO
HIDALGO
FEDERAL DISTRICT
TLAXCALA
MORELOS
Caribbean Sea
Pacific Ocean
MEXICO
120° 115° 110° 105° 100° 95° 90° 85°
30° 25° 20° 15°

To offset the world slump in 1974, the government attempted to force growth by expanding public spending. However, higher government spending was not met by higher revenues so the budget deficit soared. Likewise, external debt grew substantially and inflation accelerated (from 5 per cent in 1970 to 23 in 1974) and the currency, the peso, became overvalued as the inflationary gap with its trading partners widened. In 1976, after 22 years having been pegged to the US dollar the peso was devalued by about 80 per cent.

The Lopez Portillo Administration (1976-1982) embarked on a post-devaluation stabilisation programme that had as its main goals reduction in the current account and budget deficits. Public expenditure was cut and income from state enterprises increased. A year after devaluation the current account deficit had narrowed to 3 per cent of GDP and the budget deficit to 5.7 per cent; GDP grew at 3 per cent.

However this brief recovery of stability was ended when the discovery of huge oil reserves and their availability for export reduced the foreign exchange constraint. Thus, the government expanded overseas borrowing to finance a public heavy-industry programme in oil power, steel and capital. As a result of domestic expansionary policies the economy expanded swiftly but Mexico lost export market shares in both traditional and nontraditional exports. Although the discovery of large oil deposits benefitted Mexico's balance of payments, it increased the overvaluation of the currency that discriminated against agricultural and manufacturing activities.

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enrolled, and 15 per cent of the group aged 20-24 was enrolled in institutions of higher learning. in 1969, the corresponding proportions were 11 and 3 per cent, respectively. Furthermore, as rapid expansion of vocational schools was affected, the 1970s saw an increasing diversification in the types of available opportunities [mainly in technical areas]. From 281 vocational schools in 1970, the number increased to 1573 by the 1979-80 academic year, and enrollment had increased fourtfould... The continuing trend in school enrollment is clearly in evidence in the findings of the labour force surveys of the past decade. By 1979, the proportion of the population of labour force age that was enrolled in school had risen to 18.3 per cent. Particularly notable has been the sharp increase in the enrollment of females" (Gregory, 1986:23-14).

b) <u>The Manufacturing Industry up to 1980.</u>

Following three decades of 6 per cent annual growth Mexico's manufacturing sector contributed 19.2 per cent to GDP by 1960. In the 1960s the sector grew by 8.4 per cent but slowed down to 6.3 per cent in the 1970s. Nonetheless, the performance of Mexican manufacturing output in the early seventies was remarkable. It expanded on "average by over 7 per cent per year with higher rates of growth in the heavy and chemical products sectors; 9 per cent in metal products, machinery and equipment, and in basic metals. These four have increased their share of the value of manufacturing since 1950 from 25 to 49 percent, while 'traditional' industries decreased from 73 to 49 percent" (Harris, 1986:73). Electronic equipment was one of the subsectors with high growth. While much of the world stagnated, overall manufacturing industry output doubled in volume of capacity (Harris, 1986).

The growth in employment was less impressive, from 1 343 510 workers in 1965 to 1 654 381 in 1975 with a growth rate of 2.08 per cent per year (tables 3.2 and 3.3), proving the increasing incapacity of the industry of generating employment since, due to the ISI, became more intensive in capital. This impressive growth of the industry remained concentrated in the old industrial cores of the country, the share of Mexico City in manufacturing remained important though employment slightly decreased from 46 per cent in 1960 to 41 percent in 1970 (Garza G and Aguilar E, 1988).

The only industrial activity able to make an important contribution to employment was the in-bond industry or maquila industry as it is better known. Between 1965-1975, the employment in electronics and electrical products subsector, constituted mostly of in-bond firms, grew to 106 016 employees (6.4 percent of the total manufacturing). The annual rate of growth was 3.18 per year, above most of the traditional subsectors such as food, beverages, clothes among others, but below the dynamic chemical products subsector (tables 3.2 and 3.3).

TABLE 3.2: Mexico: Distribution of Employment in Manufacturing by Industry, 1965, 1975 and 1985 (and percentage shares).

CONCEPT	1965	%	1975	%	1985	%
TOTAL	1343510	100	1654381	100	2568846	100
SUBTOTAL	762744	56.8	789444	47.7	1064185	41.4
Food	273186	20.3	309651	18.7	406722	15.8
Beverages	53650	4	69392	4.2	109477	4.3
Tobacco	8636	0.6	8645	0.5	9758	0.4
Textiles	168229	12.5	144444	8.7	181344	7.1
Garments/Footwear	108408	8.1	90606	5.5	150330	5.9
Furniture	45193	3.4	43113	2.6	18678	0.7
Printing and Publishing	30822	2.3	39164	2.4	61216	2.4
Leather	49463	3.7	50316	3	77334	3
Other	25157	1.9	34113	2.1	49326	1.9
SUBTOTAL	283146	21.1	444403	26.9	759622	29.6
Wood	10461	0.8	48108	2.9	93958	3.7
Paper and Paper products	18576	1.4	32002	1.9	79162	3.1
Rubber and rubber prod.	106734	7.9	125934	7.6	162474	6.3
Chemical products	2508	0.2	5247	0.3	47504	1.8
Petroleum	17556	1.3	53363	3.2	122001	4.7
Non-metallic minerals	76994	5.7	100714	6.1	133445	5.2
Metallic minerals	50317	3.7	79035	4.8	121078	4.7
SUBTOTAL	297620	22.2	420534	25.4	745039	29
Metallic products	104388	7.8	127474	7.7	186418	7.3
Machinery	35343	2.6	76375	4.6	129388	5
Electrical and electronics	77174	5.7	106016	6.4	197466	7.7
Transport Equipment	80715	6	110669	6.7	231767	9

SOURCE: Sria de Industria y Comercio, 1965 and 1975, Mexico. Secretaria de Programacion y Presupuesto, 1985 (preliminar data, not published), Mexico.

TABLE 3.3: Mexico: Employment in Manufacturing, rate of growth, 1965-1975, 1975-1985.

CONCEPT	1965-1975	1975-1985	1965-1985
TOTAL	2.08	4.4	3.2
SUBTOTAL	0.34	2.99	1.7
Food	1.25	2.73	2
Beverages	2.57	4.56	3.5
Tobacco	0.01	1.21	0.6
Textiles	-1.52	2.28	0.4
Garments/Footwear	-1.79	5.06	1.6
Furniture	-0.47	-8.36	-4.5
Printing and Publishing	2.4	4.47	3.4
Leather	0.17	4.3	2.2
Other	3.05	3.69	3.3
SUBTOTAL	4.51	5.36	4.8
Wood	15.26	6.69	10.4
Paper and Paper product	5.44	9.06	7
Rubber and rubber prod.	1.65	2.55	2.1
Chemical products	7.38	22.03	13.7
Petroleum	11.12	8.27	9.2
Non-metallic minerals	2.69	2.81	2.7
Metallic minerals	4.52	4.27	4.3
SUBTOTAL	3.46	5.72	4.5
Metallic products	2	3.8	2.9
Machinery	7.71	5.27	6.3
Electrical and electronics	3.18	6.22	4.6
Transport Equipment	3.16	7.39	5.1

SOURCE: Table 3.2.

Nonetheless its impact in employment, the in-bond industry developed few linkages with the domestic industry (over 95 per cent of inputs re imported). Its contribution to export earnings is significant, accounting for one-third of all manufactured exports in 1979 as a result of their dynamism and the low export propensity of the manufacturing industry.

Despite all the criticisms that the import-substitution strategy of government received (as opposed to the export-led growth of the Asian NICs) it is my belief that apart from fostering the industrialisation of the country, increased in employment, expansion in the domestic market rises in income and living standards, it laid the conditions for the establishment of production for the world market once the country was ready for the opening of the economy: construction of infrastructure and public services, educative and health institutions, a skilled labour force among others.

c) <u>From Boom to Bust. Economic Crisis in the 1980s.</u>

Mexico entered the 1980s on a wave of prosperity after the stabilisation period (1976-1980) and the discovery of huge new oil reserves. Daily output of petroleum more than doubled between 1978 and 1981 to over 1 200 000 barrels. Apparently undisturbed by the world recession and stagnation which started in 1979 and affected most other developing countries, the main variables of the economy expanded at high rates (output, employment and foreign trade). Thanks to the dynamism of private and, specially, public investment, the economy grew at between 8 and 9 per cent each year between 1978 and 1981. Unemployment in Mexico City dropped to 3.6 per cent in 1981.

Oil apart, only the in-bond industry was important in that period, it accounted by one third of all manufacturing exports in 1979 (mainly due to the decrease in other manufactured exports), but the growing overvaluation of the Mexican currency before 1982 contributed to decrease its great dynamism. The situation changed drastically in 1982 with the worldwide glut of petroleum and the subsequent fall in its price which had a great impact on economic development. To the fall in exports revenues followed a severe balance of payments disequilibrium and the rise of the cost of the debt service. Extension of foreign credits and the renegotiation of existing debt was made conditional on the adoption of policies designed to restrain domestic inflation, curtail the fiscal deficit and control the disequilibrium in the balance of payments. National output declined during the second half of 1982, canceling the entire peak growth of the first half. Over the entire year, GDP declined by 0.5 per cent from the level of 1981, and there was further contraction in 1983 as GDP fell by 4.7 per cent. Industry was hit in many aspects, recession and restrictive policies reduced the domestic market. Manufacturing output fell, mainly in the production of capital and consumer durable goods. It is estimated that industrial output fell by 2.7 per cent in 1982 and by further 8.3 per cent in 1983 (Gregory, 1986:271).

The government's efforts to reduce the current account deficit made it impossible to import materials and intermediate goods needed by non-in-bond industry. The firms heavily dependent on imports had to reduce production or even close (Liemt G van, 1988:93). However, the devaluation of the currency resulted in a boom in in-bond plants where imports were not a constraint.

In 1982, the selection of Miguel de la Madrid as candidate of the official party, the PRI, by former President Jose Lopez Portillo, seemed to be a political victory for the supporters of a more export-oriented development strategy which implies greater integration into the world economy.

In 1984, a 32 per cent growth of manufactured exports (mostly to United States) allowed GDP growth of 3.5 per cent and another trade surplus of US$14 000 million, however, the boom in the United States not only increased the Mexico's exports but also lifted the value of the dollar and sustained high interest rates, to Mexico's loss in terms of the burden of the debt. The ending of the boom in the late 1984 lowered interest rates and the value of the dollar, but sharply curtailed ~~contracted~~ the demand for Mexico's exports, particularly oil. Once again the economy was threatened with severe pressures, rapidly increasing trade deficit ~~on~~ ~~external~~ ~~trade~~ and a~~n~~ increase in the cost of ~~high~~ debt servicing. The earthquake in 1985 added disaster to the economic problems of 1986 (when the spot price of oil touched US$10 a barrel against a budget Mexican forecasted figure of US$22).

Amid all these economic problems employment in the manufacturing reached 1 654 381 employees with a rate of growth of 4.4 per cent per year between 1975 and 1985 above that of 1965-1975 and attributable to the expansion of the domestic market that the oil boom brought about. Employment in electrical and electronics production grew from 106 016 in 1975 to 197 466 in 1985 with a rate of growth of 6.2 per cent per year! above that of the overall industry. Also its share in the manufacturing industry rose, accounting for about 7.7 per cent (see tables 3.2 and 3.3). It should be noted that Mexico City decreased its share in the employment of the manufacturing industry in this period, from 41.2 per cent in 1970 to 36.6 in 1985 (Garza G and Aguilar E, 1988).

One of the most important effects of the crisis was that it forced the government to increase its efforts in encouraging production of manufactures for export. Nonetheless, during his first three years as president, de la Madrid ~~just~~ introduced measures to bring public deficit under control but ~~still~~ refrained from pursuing radical reforms on foreign trade policy. ~~Therefore~~, Import licenses and exchange controls remained practically intact, rendering his constant adjustments of the peso-dollar exchange rate insufficient to encourage growth of non-oil exports.

Upon taking office, in 1988, the new President Carlos Salinas de Gortari declared his firm commitment to continue the policies of his predecessor, reduce inflation, shrinking the budget deficit, privatise most of the holdings of the state[3] and liberalise trade. Added a successful rescheduling of the external debt and, according to some estimations, ~~by~~ during 1989 the economy grew at 3 per cent, stronger than the projected 1.5 per cent with inflation down to 19 per cent (Financial Times January 30, 1990). In 1990 GDP grew by 3.9 per cent, the fastest growth since 1981 (Financial Times May 29, 1991). Nowadays it seems there is a growing confidence among businessmen in Mexico, the continued lack of domestic credit in Mexico had led many of them recently to repatriate several billion dollars suggesting their interest in continuing their operations in Mexico[4].According to Mexico's central bank, around US$1.5 billion of footloose capital has returned in the past six weeks (The Economist August 12, 1989)

Some academics argue that the main result of the crisis was the renewed importance of exports of manufactured goods to maintain industrial production and employment, and to service the external debt (Harris, 1986; Liemt G van, 1988:94). Thus Mexico became ~~still~~ more integrated in the world economy. On the contrary, it seems to me that the government was playing all the time "the two cards", production for the domestic market while preparing the ground for the opening of the economy. After all, the in-bond industry regime was established as early as 1967 when the economy was still robust and there was no foreign constraints as low oil prices and external debt at the time.

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[3] "...Mr Salinas make it clear that nothing was out of bounds from privatisation except that prohibited by the constitution. He specified as "irreversible" the state-run Petroleos Mexicanos, basic petrochemicals, the Federal Electricity Commission, radioactive materials and nuclear-related activities, the railways the mail service and satellite communications. He added to the list important social institutions like Conasupo, the giant food production and distribution company" (Financial Times, April 25, 1990). The Mexican government is on the route of a successful privatisation of Telmex, the giant telephone company and the re-privatisation of the banks (nationalised in 1982) (Financial Times July 2, 1990 and May 17, 1991).

[4] In the early 1980's capital flight to foreign banks intensified as Mexican businesses faced a severe domestic recession and limited credit. Geographical proximity to the US, the overvalued dollar, and high interest rates attracted most of these funds -it is estimated that Mexican citizens still hold about US$50 billion abroad (The Economist April 27, 1991).

In the light of the later economic events in Mexico it is believed that the new locational pattern will not only consolidate in the Northern Border and interior of the country but will constitute one of the corner-stones of the export-led growth strategy to be implemented by the Mexican government. Recently with regard to the opening up of the economy, the regulations on foreign investment have been still more relaxed to attract more foreign capital[5]. It is estimated that about 60 per cent of the Mexican economy would be open to foreign participation as a result of the broad revision of Mexico's foreign investment law of 1973 (Financial Times, May 17, 1989).

In this way, Mexico will be more integrated in the world production and it can take advantage of this fact by means of an appropriate industrial policy. For example, as Grunwald suggests (1985) a system of incentives for establishing in-bond plants (which mainly locate in the Northern Border) in the interior of the country could benefit the national integration of this kind of industry. Plant location in the interior could increase the content of domestic materials and consequently the participation of national firms with the resulting impact in the regional economy.

The negotiation between United States, Mexico and Canada to form a North American Free Trade Area

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[5] By 1984 Mexico still had extensive restrictions on foreign investment (including the maximum of 49 per cent of foreign equity). Industries such as petroleum, basic petrochemicals, electricity, and railroads, are run exclusively by the state; others such as radio and television, urban transport, air and maritime transport, and gas distribution are reserved for Mexicans and Mexican companies. Some other sectors like electronics (considered strategic) were also reserved for Mexicans which led the public opinion, in the early 1980s, to great controversy about the IBM's plans of setting up a computer plant in the country. However, the importance of the electronics industry and the possibility of taking advantage of the new technologies led the government to the decision of allow, after protracted negotiations, IBM to establish a wholly owned personal computer plant despite the general bar on full foreign ownership in this branch (OECD, 1988:60). Thus exemptions were made to let IBM, Xerox and Ericsson industries to set up plants as well as other leading companies as Hewlett-Packard and Apple Computer, all US-based companies. For example, Hewlett-Packard has a wholly owned subsidiary which manufactures minicomputers as well as a joint venture to make personal computers. Apple established a joint venture to manufacture personal computers for the local and regional market and has contracted with an independent institute to write Spanish-language software programmes for its machines (O'Connor, 1985). These authorizations are normally granted for mainframe and mini-computer production, conditional on the use of minimum levels of domestically made components.

NAFTA) represent a positive prospect for the Mexican economy. However, the opinions in the United States are split. The west is for free trade, the east not. Some influential western Democrats like Bruce Babit, once governor of Arizona, and Roy Romer, the governor of Colorado are decisive advocates of free trade. They and the Californians know that they have no choice but to work closely with Mexico because -as President Salinas says- if Mexico cannot export its goods it will export its people. That is a good argument to convince the skeptics of the advantages of a revitalisation of the Mexican economy through a free trade agreement. Moreover, a report from the Business Roundtable released in 1990 by the two hundred top American Business leaders urges the US and Mexican government to negotiate a comprehensive free trade and investment agreement which would embrace all sectors of the economy and include agreements on tariff and non-tariff barriers, services, intellectual property, agriculture, investment and dispute settlement procedures. The prospect of a market of 100m Mexican consumers before the year 2000 constitutes an incentive for the US industrialists now that US exports have been rising sharply as the Mexican economy recovers (Financial Times, June 11, 1990). Quite apart from the market opportunities for the US in Mexico, free trade could further shift labour intensive production south of the border. This would give US greater flexibility in competing against Japan and the Asian NICs. From the Mexican perspective, in spite of the so-called danger of being exposed to US competition and lost of sovereignty, the agreement would provide an stimuli for the economy which will bring about stability for economic, monetary and fiscal policy, apart from the flow of investment, creation of employment, etc.

However, as one commentator says, these changes in policy imply the need to modernise Mexican industrial firms, which traditionally have been only oriented to satisfy the domestic market, growing increasingly inefficient; they have lacked a export orientation and the capacity to modify their products to compete in different types of markets. That is why the country must look for a greater degree of cooperation and trade with modern firms from the developed countries (Trejo Reyes, 1987:95).

3. MEXICO'S INTERNATIONAL TRADE.

~~As mentioned before, due to the anti-export bias of the import substitution strategy, exports of manufactures were negligible for long in Mexico. In fact the import-substitution efforts relied in the decreasing foreign exchange provided by an agricultural sector which tended to stagnation.~~

Until the oil boom Mexico's participation in international trade was modest: imports and exports together represented the equivalent of 13 per cent of GDP in 1965, ~~and by 1978 this was still~~ no more than 14 per cent in 1978. After the oil boom the percentage increased to 18 in 1980. In the 1960s and 1970s Mexico exported little of its manufacturing production. In 1974, for example, when manufactured exports registered a record high, exports were no more than 5 per cent of production. Only for some products like sugar, basic chemicals, fertilisers and insecticides was exported more than 10 per cent of production. Manufactured exports experienced a short boom between 1970 and 1974 when they made up 50 per cent of total exports - up from 10 per cent in the early 1960s. However the growing overvaluation of the peso contributed to an absolute decline in their level thereafter. The boom in the late 1970s with the consequent growth in domestic demand left little surplus to export (van Liemt, 1988). In his survey about trends of exports from developing countries Cline (1984) indicates that Mexico experienced major increases in the share of non-traditional goods in its exports from 31.6 per cent in 1969-1970 to 54.1 per cent in 1976-1978. The author suggests that perhaps, "Mexican assembly plants reexporting processed components to the United States were important (Cline W R, 1984:21). However, it is necessary to confirm the above statement through careful analysis of composition of exports from Mexico. Although the exports to United States grew as a percentage of total manufactured exports from 61.1 in 1969 to 81.6 in 1978, certainly not all of the exports could be from in-bond industry, the automotive and chemical industries were also a great exporter at the time. In the next sections it will be examined Mexico's main trading partners, its export profile and its performance in the international trade of electronic products and components to be able to evaluate the role the in-bond assembly industry has played in the growth of exports in general and electronic products and components in particular.

a) Main trading partners.

In the 1970's Mexico embarked in a diversification programme to reduce its political and economic dependence on its main trade partner, and lately its economic dependence on the oil revenues (Weintraub, 1984). This dependence on one market and one product made Mexico clearly exposed to externally induced fluctuations in demand and prices of their exports.
The US administration applauded the efforts of Mexico to diversify on the grounds that it was dangerous to depend on oil imports from a single source[6]. Likewise, Mexico's move to establish sound relations with another industrial countries could mean reduced demands on US financial resources.

However, as shown in table 3.4, US is still Mexico's main trade partner though reduced its share from 70.3 per cent in 1970 to 58.1 in 1984; the Latin American countries accounted for a small share of Mexico's exports throughout the period 1970-1984. In 1970, Argentina, Brazil, Canada, Chile, Colombia and Venezuela accounted for more than 1 per cent each one of Mexico's exports but by 1984 just Brazil and Canada took a significant share (more than 2 per cent each).

[6] Regarding the policy of diversification of oil exports, out of the scope of this part, see the work of Szekely (1989) which deals widely on the subject.

TABLE 3.4: Mexico: Trade by Principal Countries of Consignment
(Value in thousand of U.S. dollars)

COUNTRY	1970		1975		1980		1984	
WORLD	1205409	100	2993134	100	15307480	100	24053566	100
AMERICA	1954900	81.2	2278133	76.2	11128679	72.8	15973167	66.5
USA-PR.	846821	70.3	1844765	61.6	10072067	65.8	13971721	58.1
Argentina	14056	1.2	35037	1.2	44301	0.3	44780	0.2
Bahamas	2114	0.2	3125	0.1	1485	0	24469	0.1
Brazil	14675	1.2	91176	3	405411	2.6	561426	2.3
Canada	12026	1	43755	1.5	116874	0.8	494488	2.1
Chile	15741	1.3	16751	0.6	27153	0.2	15832	0.1
Colombia	12993	1.1	23520	0.8	47714	0.3	69175	0.3
Costa Rica	5043	0.4	26559	0.9	96353	0.6	60351	0.3
Cuba	66	0	30025	1	26757	0.2	81076	0.3
Dominican Rep	1209	0.1	6643	0.2	10212	0.1	162575	0.7
Ecuador	1812	0.2	9598	0.3	38905	0.3	39384	0.2
El Salvador	3184	0.3	13760	0.5	18583	0.1	76991	0.3
Guatemala	8807	0.7	24478	0.8	59201	0.4	102632	0.4
Nicaragua	2439	0.2	8145	0.3	53749	0.4	68616	0.3
Panama Ex.CZ	6513	0.5	14202	0.5	21948	0.1	150873	0.6
Peru	8093	0.7	29299	1	26194	0.2	14087	0.1
Venezuela	21858	1.8	57295	1.9	61772	0.4	34689	0.1
EUROPE	129510	10.6	363138	12.1	2144892	14.1	4112846	17
Belgium-Lux	3008	0.2	35389	1.2	77277	0.5	82368	0.3
France	8770	0.7	38599	1.3	566781	3.7	928171	3.9
Germany FR	27819	2.3	87346	2.9		0		0
Italy	19734	1.6	43290	1.4	100586	0.7	304988	1.3
Netherlands	18667	1.5	48338	1.6	76295	0.5	34622	0.1
Spain	14161	1.2	20504	0.7	1238123	8.1	1702554	7.1
Sweden	1187	0.1	10950	0.4	19221	0.1	7952	0
Switzerland	25553	2.1	42597	1.4	23106	0.2	32749	0.1
Unit Kingdom	10611	0.9	36125	1.2	43503	0.3	1019442	4.2
ASIA	69544	5.8	233621	7.8	1411658	9.2	2455981	10.2
China	0	0	33679	1.1	93415	0.6	91907	0.4
India	657	0.1	12139	0.4	6107	0	10035	0
Israel	0	0	43634	1.5	640989	4.2	486021	2
Japan	68887	5.7	144169	4.8	671147	4.4	1868018	7.8
Australia	2867	0.2	3827	0.1	8268	0.1	9467	0

SOURCE: United Nations, 1976, 1980, 1988.

On the other hand, European and Asian countries increased steadily their shares during the period, mainly due to their increasing demand for oil. Since the outbreak of hostilities between Iran and Iraq, Mexico has been a major source for Japan and Israel (supplying over two-thirds of the latter in the 1980s). Likewise, Spain, France and Britain are Mexico's main customers in Europe. Specially the governments of the first two countries, which lack oil have been more concerned with secure oil sources, and have therefore actively encouraged business deals with Mexico (Szekely:1989:1790).

As it is shown in table 3.5, Mexico has held a positive trade balance with its main trade partners, US, Japan and the EC (with the exception of its trade balance with US in 1988 and

1989), mainly due to the oil exports. It is estimated that 85 per cent of Mexico's exports to the EC are oil, so that if this is not taken into account in the total, it would mean that the country's exports are minimal. Moreover, apart from oil exports, Mexico's positive trade balance is due to the strict adjustment process imposed by the government throughout the 1980's in response to the economic crisis with a consequent reduction in imports (De Mateo, 1987).

TABLE 3.5: Mexico's main trade partners, 1985-1989 (US$bn).

	TRADE BALANCE		
MEXICO-US	EXPORTS	IMPORTS	BALANCE
1985	13.3	9.8	3.5
1986	10.4	8.3	2.2
1987	12.6	8.5	4.1
1988	12.5	13.1	-0.5
1989	15.7	17.8	-2.2
MEXICO-EC	EXPORTS	IMPORTS	BALANCE
1985	4	1.9	2.1
1986	0.6	1.9	0.4
1987	3.8	1.7	2.2
1988	3.8	2.5	1.2
1989	3.9	3.5	0.5
MEXICO-JAPAN	EXPORTS	IMPORTS	BALANCE
1985	1.7	0.8	0.9
1986	1.1	0.8	0.3
1987	1.6	0.7	0.9
1988	1.6	1.1	0.6
1989	1.8	1.4	0.3

SOURCE: Financial Times June 11, 1990.

The inability of Mexico to increase the volume of non-US exports is due basically to two factors. On the one hand, there has been little interest on the part of the EC to increase its trade links with Mexico in spite of the economic progress Mexico has made since 1985 and the campaign to promote closer ties, President Salinas de Gortari undertook in early 1990. The democratisation of Eastern Europe and the preparations for 1992 made the Europeans uninterested in a closer integration with Mexico (Financial Times June 11, 1990; The Economist, June 16, 1990).

On the other hand, for the major part of the last decade the US dollar was overvalued in relation to other European currencies. Since the peso slides according to the dollar, it became overvalued in relation to the EC currencies. Thus, Mexico's exports of some products to this market were reduced (De Mateo, 1987).

These factors made Mexico reverse the diversification policy and engage in negotiations for closer links with the United States and Canada and, eventually, the formation of a free-trade area which will make a market of close 400 million people. In any case, in spite of the diversification efforts of the Mexican government, the US accounts for about 88 per cent (US$23bn) of Mexico's annual trade (see figure 3.2) and Mexico is the US's third biggest trading partner. Likewise, US accounts for two thirds of total foreign direct investment in Mexico of US$23 bn.

b) Export profile.

As can be seen in tables 3.6 and 3.7, in 1976 manufacturing was the biggest earner of foreign exchange constituting almost fifty per cent of Mexico's exports (with food products, machinery and parts and chemicals in the lead) followed by agricultural products and cattle (32.1 per cent of total exports). Oil represented only 15 per cent of total exports.

By 1980 the panorama had completely changed, oil exports accounted almost 67 per cent of the total, manufactured products declined to 17 per cent and agriculture and cattle to 9.8 per cent. The decline in non-oil exports is explained not only by the increase in oil exports but the government's neglect of the agriculture and also by the expansion in the domestic demand which left little surplus to export as mentioned earlier.

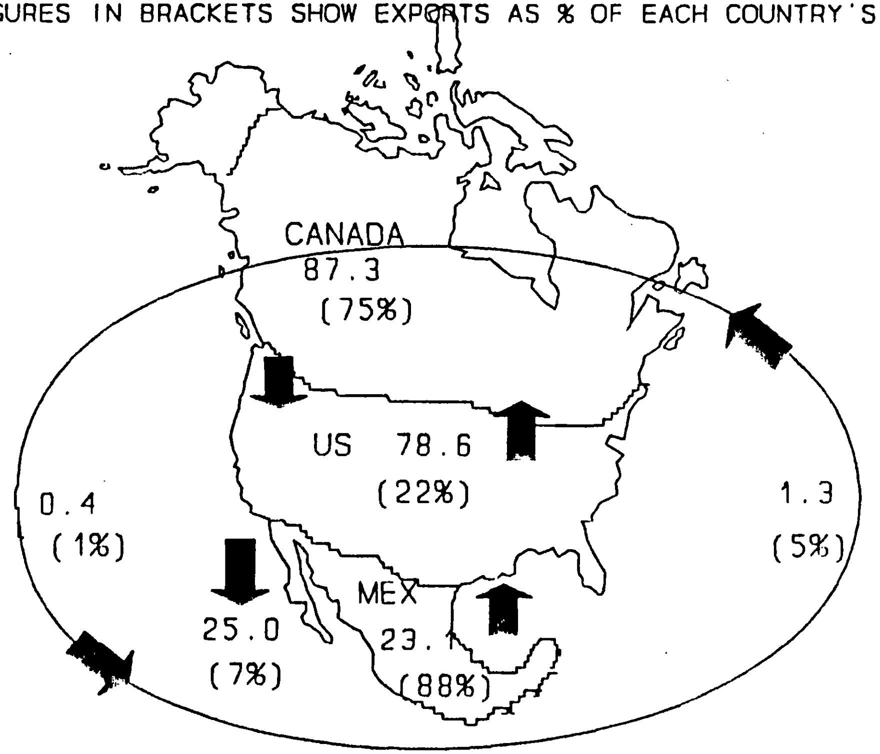
This pattern continued up to 1985 when, due to the decline in the international prices of oil, the government undertook a policy of export diversification to boost non-oil exports and obtain the foreign currency necessary to service the debt.

FIGURE 2.3

NAFTA

VALUE OF INTRA-NORTH AMERICAN EXPORTS, 1989 US$ bn

(FIGURES IN BRACKETS SHOW EXPORTS AS % OF EACH COUNTRY'S TOTAL)



SOURCE: The Economist, June 16, 1990.

TABLE 3.6: Mexico: Exports, 1976, 1980-87 (million US dollars)

	1976	1980	1981	1982	1983	1984	1985	1986	1987
TOTAL EXPORTS	3655	15570	19646	21214	21819	24407	22108	16031	20656
NON-OIL	3092	5168	5072	4736	5654	7941	7341	10082	12250
Manufactures*	1708	2651	2688	3018	4582	5595	5267	7110	9894
Food Products	531	772	679	702	725	822	747	934	n.a
Textiles	182	185	181	150	191	275	207	354	558
Chemicals	236	395	457	442	628	756	676	831	1095
Steel Products	54	70	64	112	319	378	246	455	620
Machinery & parts	399	785	894	888	1663	2217	2336	3597	4000
Auto engines	56	33	61	214	603	983	1040	1155	1291
Auto parts	76	208	165	131	180	270	241	374	444
Electronics	60	109	110	91	180	227	285	363	n.a
Agriculture & Cattle	1175	1528	1481	1233	1189	1641	1323	2100	1549
Mining	209	512	677	502	524	539	510	510	807
OIL	563	10402	14574	16478	16165	16466	14767	5949	8406
Crude	540	9449	13305	15623	14821	14967	13309	5572	7870
Refined Products	16	384	589	261	866	1138	1351	532	412
Petrochemicals	7	120	153	116	123	128	107	29	124
Natural Gas	---	447	526	478	353	231	---	---	---

* Manufactures: disaggregated figures include only the most significant export categories. The oil industry's manufactured exports are shown separately below.

SOURCE: G. Szekely, 1989:Table 3.

TABLE 3.7: Mexico: Exports, 1976, 1980-87 (percentages)

	1976	1980	1981	1982	1983	1984	1985	1986	1987
TOTAL EXPORTS	100	100	100	100	100	100	100	100	100
NON-OIL	84.6	33.2	25.8	22.3	25.9	32.5	33.2	62.9	59.3
Manufactures*	46.7	17	13.7	14.2	21	22.9	23.8	44.4	47.9
Food Prod.	14.5	5	3.5	3.3	3.3	3.4	3.4	5.8	0
Textiles	5	1.2	0.9	0.7	0.9	1.1	0.9	2.2	2.7
Chemicals	6.5	2.5	2.3	2.1	2.9	3.1	3.1	5.2	5.3
Steel Prod.	1.5	0.4	0.3	0.5	1.5	1.5	1.1	2.8	3
Mach. & parts	10.9	5	4.6	4.2	7.6	9.1	10.6	22.4	19.4
Auto eng.	1.5	0.2	0.3	1	2.8	4	4.7	7.2	6.3
Auto parts	2.1	1.3	0.8	0.6	0.8	1.1	1.1	2.3	2.1
Electronics	1.6	0.7	0.6	0.4	0.8	0.9	1.3	2.3	n.a.
Agric. & Cattle	32.1	9.8	7.5	5.8	5.4	6.7	6	13.1	7.5
Mining	5.7	3.3	3.4	2.4	2.4	2.2	2.3	3.2	3.9
OIL	15.4	66.8	74.2	77.7	74.1	67.5	66.8	37.1	40.7
Crude	14.8	60.7	67.7	73.6	67.9	61.3	60.2	34.8	38.1
Refined Prod.	0.4	2.5	3	1.2	4	4.7	6.1	3.3	2
Petrochemicals	0.2	0.8	0.8	0.5	0.6	0.5	0.5	0.2	0.6
Natural Gas	0	2.9	2.7	2.3	1.6	0.9	0	0	0

SOURCE: Table 3.6.

As shown in the table 3.7, the policy of diversification succeeded in increasing the share of non-oil exports to almost 63 per cent in 1986, with manufacturing taking the lead with 44 per cent share of total exports (machinery and parts exports were bigger than agricultural products and cattle exports). Again in 1987, manufactured products had the biggest share in total exports above of oil exports. Regarding the export of electronic products, though rising, they have not been significant in terms of exports throughout the period. However, it is my belief that given the geographical position of Mexico (strategic for Japan) and the prospects of the free-trade area, it will become an important sector in the years to come.

c) Exports of electronic products and components.

As mentioned in chapter II, the share of Mexico in the international trade of electronics products is not very significant. The main bulk of electronic products exports comes from the in-bond assembly plants located mainly in the Northern Border (though lately it can be observed a trend in locating these plants in the interior of the country) which will be dealt with more extensively in the next chapter. Apart from the in-bond industry the Mexican electronics industry has been geared towards the domestic market which boomed before the economic crisis of the early 1980s.

> "This industry suffers, however, from its heavy concentration on consumer electronics and its dependence on imports since it consists in assembling imported components. Moreover, certain products (such as medium-sized and large computers) are traditionally imported. The electronics industry carries a heavy deficit, which amounted in 1984, despite the recession-induced fall in imports, to 329 million (this figure includes also electrical engineering). The strategy of the authorities is to expand this industry but to ensure that firms increase their purchases from domestic supplies and thus help to reduce the shortage of foreign exchange. The microcomputer market is likely to develop rapidly and several American companies have set up in Mexico since the crisis..." (OECD, 1988:60).

The minor role played by the Mexican electronics in-bond industry in the world trade is due, among others, to the economic effects of the expansionary policies followed by the government. Although economic growth accelerated, domestic inflation and overvaluation of the currency made exports more expensive and offset the labour cost advantage for setting up in-bond plants. As shown in tables 3.8 and 3.9, from 1980 to 1985 Mexico performed poorly in the international trade of computers compared with Hong Kong, South Korea and Singapore which increased their shares. In the case of TV sets, as mentioned in chapter II, from 1975 to 1985 the DCs lost their TV sets production to Japan and the Asian NICs, South Korea, Hong Kong and Singapore. Mexico increased its share from nothing to 1.4 per cent in this period.

Radio sets is the only product in which Mexico seems to have and advantage but, again, in a lesser degree than the Asian NICs but greater than some of the European countries. Regarding sound recorders, phonographs, semiconductors (transistors, valves and etc), again Mexico performs badly in comparison with the Asian NICs.

TABLE 3.8: Exports of main electronic products by country, 1975 and 1985.
(thousand US dollars)

	COMPUTERS		TV SETS		RADIO SETS		SOUND RECORDERS & PHONOGRAPHS		TV IMAGE, SOUND RECORDERS, ETC		TRANSISTORS VALVES, ETC	
COUNTRIES	1980	1985	1975	1985	1975	1985	1975	1985	1980	1985	1975	1985
WORLD MKT EC	2188393	4260629	2517999	6534817	2697965	6050941	1717705	11342508	2367194	8204377	4242658	22514799
OECD COUNTRIES	2014123	3948251	2144706	4487727	2056170	3512485	1464997	10162949	2299970	7678852	3441502	15918201
France	40951	109719	27984	39317	45514	94125	45706	168226	18190	23557	304491	995543
Japan	136493	387472	783685	2815339	1325391	2654439	700227	8704137	1981376	6622119	1351012	4753395
Germany Fed Rep	324641	553032	436512	641323	232701	229857	190330	230885	99072	532562	434121	1451341
Ireland	207151	1030487	1942	1992	4523	11957			547	1215	15395	156379
Italy	15875	2576	164066	127738	27472	11341	36699	45840	3688	2591	127734	532785
Netherlands	79332	216840	136437	94844	197560	47253	102406	345458	33752	79770	412309	650014
United Kingdom	278814	111713	152078	160146	27873	41099	133708	136384	54756	183610	199350	1298791
USA-Puerto Rico	918972	1519395	185165	245288	51054	218323	130998	135221	83313	176224	443344	5318983
NICS	7173	248907	107681	1349313	510477	2310754	112420	274766	49253	481684	668207	5896792
Brazil	2668	18742	4674	6730	41950	223752	2668	289			14321	95572
Hong Kong	n.a.	79777	12654	244722	306706	537443	18664	6589	18581	167239	101446	904350
Korea Rep	76	74442	31363	591090	50374	499905	62471	9979	197	206562	206614	1136908
Malaysia	96	1010	2969	108749	13655	199739			46	6096	9328	1868343
Mexico	2183	10701	0	88611	270	349220	525	385	380	366	7773	187337
Singapore	1957	64001	55140	308347	95447	497484	26847	244186	29864	101402	310658	1385788

SOURCE: Tables 2.4, 2.8, 2.9, 2.10, 2.11 and UNIDO, 1976, 1986, 1988.

TABLE 3.9: Exports of main electronic products by country, 1975 and 1985.
(percentages)

COUNTRIES	COMPUTERS 1980	COMPUTERS 1985	TV SETS 1975	TV SETS 1985	RADIO SETS 1975	RADIO SETS 1985	SOUND RECORDERS & PHONOGRAPHS 1975	SOUND RECORDERS & PHONOGRAPHS 1985	TV IMAGE, SOUND RECORDERS, ETC 1980	TV IMAGE, SOUND RECORDERS, ETC 1985	TRANSISTORS VALVES, ETC 1975	TRANSISTORS VALVES, ETC 1985
WORLD MKT EC	100	100	100	100	100	100	100	100	100	100	100	100
TOTAL	92	92.7	85.2	68.7	76.2	58	85.3	89.6	97.2	93.6	81.1	70.7
France	1.9	2.6	1.1	0.6	1.7	1.6	2.7	1.5	0.8	0.3	7.2	4.4
Japan	6.2	9.1	31.1	43.1	49.1	43.9	40.8	76.7	83.7	80.7	31.8	21.1
Germany Fed Rep	14.8	13	17.3	9.8	8.6	3.8	11.1	2	4.2	6.5	10.2	6.4
Ireland	9.5	24.2	0.1	0	0.2	0.2	0	0	0	0	0.4	0.7
Italy	0.7	0.1	6.5	2	1	0.2	2.1	0.4	0.2	0	3	2.4
Netherlands	3.6	5.1	5.4	1.5	7.3	0.8	6	3	1.4	1	9.7	2.9
United Kingdom	12.7	2.6	6	2.5	1	0.7	7.8	1.2	2.3	2.2	4.7	5.8
USA-Puerto Rico	42	35.7	7.4	3.8	1.9	3.6	7.6	1.2	3.5	2.1	10.4	23.6
TOTAL	0.3	5.8	4.3	20.6	18.9	38.2	6.5	2.4	2.1	5.9	15.7	26.2
Brazil	0.1	0.4	0.2	0.1	1.6	3.7	0.2	0	0	0	0.3	0.4
Hong Kong	0	1.9	0.5	3.7	11.4	8.9	1.1	0.1	0.8	2	2.4	4
Korea Rep	0	1.7	1.2	9	1.9	8.3	3.6	0.1	0	2.5	4.9	5
Malaysia	0	0	0.1	1.7	0.5	3.3	0	0	0	0.1	0.2	8.3
Mexico	0.1	0.3	0	1.4	0	5.8	0	0	0	0	0.2	0.8
Singapore	0.1	1.5	2.2	4.7	3.5	8.2	1.6	2.2	1.3	1.2	7.3	6.2

SOURCE: Table 3.8.

Regarding the geographical distribution of Mexico's exports of electronic products and components, in 1985, the main bulk went to America (mainly the United States) and Asia (mainly Japan). Considering by product, all the exports go mainly to United States with the exception of accounting machines and computers which went to Argentina, Brazil, Belgium-Lux, France and Germany. In this case, it may be that the US-based firms are assembling these products in Mexico to send them directly to those markets.

In the case of products like TV and radio sets, sound recorders, US- and Japanese- firms assemble in Mexico to send the final products to the main consumer market, in this case United States (see tables 3.10 and 3.11). With respect to telecom equipment and semiconductors it is known that once assembled this devices are re-exported back to United States in some cases to belater assembled in products in some of the New-NICs which have advantage over Mexico in terms of labour costs in less-sophisticated products.

Grunwald (1985) affirms that the rank of Mexico in television and radio receivers imported into the U.S. under items 806/807 (these items allowed the reimport of articles whose manufacturing process began in the U.S., and were processed abroad and duty was to be paid only on the value-added abroad) increased from 2nd place to 1st between 1970 and 1980. In semiconductors, Mexico lost its advantage in comparison with other countries such as Malaysia, for instance. He also argues that between 1970 and 1980, Mexico decreased in importance from the 1st place to the 7th in exports of semiconductors and parts into U.S. under items 806/807 as a result of the increase in labour costs and unions activities within the in-bond assembly plants (Grunwald J, 1985) but as Sklair (1989) affirms it is also necessary to take in account the impact of the world slump (1974-1975).

TABLE 3.10. Mexico: Exports of electronic products by country, 1985
(thousand US dollars)

COUNTRY	OFFICE MACHINES TOTAL	Type-Writers	Accting. Machs. Computers	Statist. Machs.	Office Machines NES	TELECOMMUNICATION EQUIPMENT TOTAL	TV Sets	Radio Sets	Sound Recorders etc.	Tele-Comm. Eq. nes	TRANSIST. VALVES ETC.
WORLD	271733	28551	2939	74739	165113	665883	56962	215642	43742	349537	264632
ASIA	23128	5320	0	17304	113	0	0	0	0	0	951
Japan	9307	1912	0	7282	113	0	0	0	0	0	0
Hong Kong	2929	1022	0	1907	0	0	0	0	0	0	0
Indonesia	1903	0	0	1903	0	0	0	0	0	0	0
South Korea	740	0	0	740	0	0	0	0	0	0	329
Malaysia	1198	0	0	1198	0	0	0	0	0	0	0
Singapore	2424	449	0	1975	0	0	0	0	0	0	0
Thailand	2616	1337	0	1279	0	0	0	0	0	0	0
China	1354	482	0	872	0	0	0	0	0	0	587
Other Asia	266	118	0	148	0	0	0	0	0	0	35
AMERICA	221553	13125	1192	43135	164101	665380	56962	215642	43531	349245	258255
Canada	3126	0	0	2211	915	154	0	0	0	154	179
USA	193774	3881	134	26948	162811	654608	56756	215640	43296	338916	254753
Argentina	7636	1854	441	5341	0	118	0	0	118	0	450
Brazil	1427	975	293	159	0	1076	206	0	0	870	477
Chile	1902	636	0	1266	0	0	0	0	0	0	0
Colombia	1900	1142	0	758	0	0	0	0	0	0	0
Peru	2189	1219	0	970	0	0	0	0	0	0	0
Venezuela	3867	940	324	2603	0	0	0	0	0	0	2202
Other America	5732	2478	0	2879	375	9424	0	2	117	9305	194

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TABLE 3.10 (Continued)...

EUROPE	13271	7051	1747	3744	729	503	0	0	211	292	5426
Belgium-Lux	580	140	440	0	0	0	0	0	0	0	0
France	1572	166	552	743	111	0	0	0	0	0	5353
Germany	8854	5449	727	2449	229	0	0	0	0	0	0
Italy	417	417	0	0	0	0	0	0	0	0	0
Netherlands	416	243	0	0	173	0	0	0	0	0	0
Spain	420	241	0	0	179	0	0	0	0	0	0
UK	639	235	0	404	0	0	0	0	0	0	0
Austria	106	106	0	0	0	0	0	0	0	0	0
Other Europe	267	54	28	148	37	0	0	0	0	0	73
OCEANIA	13781	3055	0	10556	170	0	0	0	0	0	0
Australia	11116	2502	0	8458	156	0	0	0	0	0	0
New Zeland	2652	553	0	2099	0	0	0	0	0	0	0

SOURCE: United Nations, 1988.

TABLE 3.11. Mexico: Exports of electronic products by country
1985, (percentages)

COUNTRY	OFFICE MACHINES TOTAL	Type-Writers	Accting. Machs. Computers	Statist. Machs.	Office Machines NES	TELECOMMUNICATION EQUIPMENT TOTAL	TV Sets	Radio Sets	Sound Recorders etc.	Tele-Comm. Eq. nes	TRANSIST. VALVES ETC.
WORLD	100	100	100	100	100	100	100	100	100	100	100
ASIA	8.5	18.6	0	23.6	0.1	0	0	0	0	0	0.5
Japan	3.4	6.7	0	9.7	0.1	0	0	0	0	0	0
Hong Kong	1.1	3.6	0	2.5	0	0	0	0	0	0	0
Indonesia	0.7	0	0	2.5	0	0	0	0	0	0	0
South Korea	0.3	0	0	1	0	0	0	0	0	0	0.1
Malaysia	0.4	0	0	1.6	0	0	0	0	0	0	0
Singapore	0.9	1.6	0	2.6	0	0	0	0	0	0	0
Thailand	1	4.7	0	1.7	0	0	0	0	0	0	0
China	0.5	1.7	0	1.2	0	0	0	0	0	0	0.2
Other Asia	0.1	0.4	0	0.2	0	0	0	0	0	0	0
AMERICA	81.5	46	40.6	57.4	99.4	99.9	100	100	99.5	99.9	97.4
Canada	1.2	0	0	2.9	0.6	0	0	0	0	0	0.1
USA	71.3	13.6	4.6	35.9	98.6	98.3	99.6	100	99	97	96.1
Argentina	2.8	6.5	15	7.1	0	0	0	0	0.3	0	0.2
Brazil	0.5	3.4	10	0.2	0	0.2	0.4	0	0	0.2	0.2
Chile	0.7	2.2	0	1.7	0	0	0	0	0	0	0
Colombia	0.7	4	0	1	0	0	0	0	0	0	0
Peru	0.8	4.3	0	1.3	0	0	0	0	0	0	0
Venezuela	1.4	3.3	11	3.5	0	0	0	0	0	0	0.8
Other America	2.1	8.7	0	3.8	0.2	1.4	0	0	0.2	2.7	0

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TABLE 3.10 (Continues)...

EUROPE	4.9	24.7	59.4	5	0.4	0.1	0	0	0.5	0.1	2
Belgium-Lux	0.2	0.5	15	0	0	0	0	0	0	0	0
France	0.6	0.6	18.8	1	0.1	0	0	0	0	0	2
Germany	3.3	19.1	24.7	3.3	0.1	0	0	0	0	0	0
Italy	0.2	1.5	0	0	0	0	0	0	0	0	0
Netherlands	0.2	0.9	0	0	0.1	0	0	0	0	0	0
UK	0.2	0.8	0	0.5	0	0	0	0	0	0	0
Other Europe	0.2	1.3	0.9	0.2	0.1	0.1	0	0	0.5	0.1	0
OCEANIA	5.1	10.7	0	14.1	0.1	0	0	0	0	0	0
Australia	4.1	8.8	0	11.3	0.1	0	0	0	0	0	0
New Zeland	1	1.9	0	2.8	0	0	0	0	0	0	0

SOURCE: Table 3.10.

Table 3.12 shows that, by 1976 Mexico was in the fifth place in exports of semiconductors behind the Asian NICs with 9.6 per cent of the total of US$1064.2 million exports from these countries.

TABLE 3.12: Semiconductor Exports from the NICs, 1976.

COUNTRY	US$MILLION	%
Singapore	339.5	31.9
South Korea	298.6	28
Taiwan	197.7	18.6
Hong Kong	126.2	11.9
Mexico	102.5	9.6
TOTAL	1064.2	100

SOURCE: P Dicken, 1988:Table 10.1.

Loosely 40 per cent of the total number of in-bond plants were in electronic production in the late sixties. Television receivers and parts, the most important single group in in-bond operations, in the mid-eighties made up about a quarter of the total in-bond plants. Likewise, semiconductors and parts, which, with more than 16 per cent of the total, were almost as important as the television group in 1969, accounted for less than 6 per cent in 1980 (Grunwald J, 1985:146).

As world competition increased in the electronics industry, firms were pushed to look for still more cheaper labour-force while productivity levels remained the same. In the Mexico's case the overvaluation of the currency (peso) and high inflation levels made it too expensive to perform the assembly operations in the semiconductors production. Therefore, firms moved to South-East Asia. Nonetheless, this movement of industrial capacity did not mean a reduction of in-bond operations in Mexico but, it seems, a shift from traditional assembly operations to more skill-intensive operations with higher value-added.

As can be seen in table 3.13, in 1983, Mexico was the biggest exporter to United States under items 806.3 and 807, ahead of the Asian NICs and New-NICs, with an amount of US$1908.7 million in exports. Today, many in-bond plants incorporate the most modern equipment and sophisticated technology. Electronics and electrical machinery (as well as autoparts) remain the growing sectors.

TABLE 3.13: Value of electronic component products exported to US under items 806/807 by Country, 1969 and 1983. (US million dollars)

1969		1983	
1. Malaysia	0.1	1. Colombia	20
2. Dominican Rep.	0.1	2. Brazil	27.4
3. Colombia	0.2	3. El Salvador	45.3
4. Haiti	2.4	4. Germany	58.9
5. Brazil	2.5	5. Hong Kong	72.2
6. Philippines	3.5	6. Taiwan	100.7
7. Singapore	3.8	7. Dominican Rep.	111.6
8. Germany	11.6	8. Haiti	139.4
9. South Korea	15.9	9. Japan	175.5
10. Taiwan	23.8	10. Singapore	275.9
11. Japan	25.4	11. South Korea	340.4
12. Hong Kong	51.3	12. Philippines	455.6
13. Mexico	97.9	13. Canada	467
14. Canada	118.7	14. Malaysia	695.7
		15. Mexico	1908.7

SOURCE: N Clement and S R Jenner, 1987.

Despite the great size of employment in the Mexican in-bond assembly industry in its Northern Border[7], Mexico has not achieved high levels of competitiveness in electronics production as in the Hong Kong, South Korea, Taiwan and Singapore cases. These countries have had a superior performance in terms of exports:

> "The electronics field is dominated by the Asian suppliers who specialise in the production of sound recorders, television and radio sets; in 1978 Asian LDCs respectively accounted for 18.55 and 13 per cent of world production in each of these categories... Foremost among the exporters are Hong Kong, Singapore, South Korea and Taiwan" (Ballance R and Sinclair S, 1985:140).

In this respect, Mexico still has to make many improvements in terms of productivity of labour to be able to catch up with the Asian NICs and also to take advantage of the free-trade

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[7] On some estimates, 500 000 Mexicans now work in the in-bond assembly industry (The Economist April 20, 1991).

agreement with the United States. The initial advantage Mexico would enjoy in a movement to free trade with the United States would result from Mexico's lower wages, compensating many industries for lower Mexican productivity. This initial advantage can be overshadowed if measures are no taken in advance to avoid bottlenecks in public services and housing in border cities (already the fastest in urban growth in Mexico) and to improve and expand educational establishments suitable for the expected demand of a diversity of qualifications.

d) Conclusions.

From the brief examination of the performance of Mexico in international trade some preliminary conclusions can be drawn. Mexico became an exporter of industrial products on the NIC scale in part because it had become a successful producer of manufactures for its own market, but also because of the existence of special arrangements with the United States as in the case of the in-bond assembly industry.

The policy of import substitution inhibited the exports of manufactures in first instance. Later, an overvalued currency, the expansion of domestic demand and the oil boom further inhibited the export of manufactures. These developments discouraged the inefficient industry to modernise and adapt to circumstances of strong competition unlike the Asian NICs.

[illegible] thanks to the drastic reduction in the international prices of petroleum the Mexican government realised the need of taking steps away from the one-product export profile and engage in an export diversification strategy. In consequence exports of manufactured goods increased steadily throughout the 1980s with food products, chemicals and machinery parts (mainly automotive parts) in the lead. However, in the case of market diversification external factors as the democratisation of Eastern Europe, the plans for 1992 of the EEC and the overvaluation of the US dollar overshadowed the efforts of the Mexican government in that respect. Moreover, there exists already an integration with the economy of the United States in terms of finance, trade and foreign direct investment in manufacturing activities like the in-bond assembly industry.

Regarding the international trade of electronic products and components it can be seen that Mexico has an advantage in consumer electronics. Unfortunately due to the overvaluation of the currency many labour processes were located and re-located in the New-NICs losing, then, the opportunity to catch up with the Asian NICs, spite of its strategic geographical position.

5. CONCLUSIONS.

From this analysis on the performance of Mexico in the last two decades in economic terms and international trade and more specifically in terms of electronics industry some conclusions can be suggested. Contrary to the widely held view that the role of the nation-states is that of simple providers of the optimum conditions for the successful performance of the TNCs, it is suggested that the nation-states actively influence the geographical distribution of the industry (whether local or foreign) and the emergence of new patterns of location. The series of factors frequently adduced as influencing the growth of exports from the NICs and the New-NICs, (infrastructure, labour productivity, educative and health services, incentives, tax reliefs, cheap raw material, repressive political regime, etc)[8] are result of active interventionism in fostering economic growth from the part of goverments. Thus, those companies in the DCs compelled by strong competition seek to cut unit cost of production locate some or all the phases of the production process in those countries which offer advantageous incentives.

[8] Some of the less democratic of the regimes in the Asian NICs and New-NICs are the most successful in achieve sustained rates of growth of GDP and exports. For example, China which between 1981 and 1990 achieved 10.0 per cent growth of GDP and 13.1 growth of exports between 1981 and 1990; Singapore (6.3 and 7.3, respectively); South Korea (9.9 and 11.6); Taiwan (8.5 and 12.1) and Thailand (7.8 and 12.7) (The Economist June 29, 1991).

In the case of Mexico, due to its market size, natural and resources, etc, the opening of the economy was delayed a bit longer than in the Asian NICs which, with exception perhaps of South Korea, had no other alternative than export. Although it is argued that the oil-boom and the expansion of the domestic market further delayed the integration to the world economy. However, the establishment in 19[illegible] of the BIP and the in-bond industry regulations (and later, in 1972, reforms to these regulations) proves that the Mexican government was already envisaging an strategy alternative to the ISI.

The debt and foreign currency constraints constituted further incentives for the Mexican government to take measures for a full opening of the economy thus exposing the inefficient and protected local industry to foreign competition. The measures (reduction of budget deficit and inflation, privatisation of the government holdings, liberalisation of the economy, among others) implemented under the advise of the IMF first, during the De la Madrid Administration (1982-1988) and in the Salinas de Gortari Administration (1988-1994) had, as a result, positive consequences for the economy, about 4 per cent growth of GDP in 1990 and 3.6 per cent in the first half of 1991 (this is the highest figure for a decade) and 2.6 in 1992, reduction of inflation, increase in DFI, increase in exports[9], above of all a major integration of Mexico to the world economy.

he negotiations of a free trade agreement with United States and Canada should bring further advantages to all the parties[10], in spite of criticisms, and specially to Mexico in terms of an increase in investment (foreign and domestic) and employment.

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[9] "In the first half of 1990, manufacturing exports grew by just 0.8 per cent compared to the same period in 1989; in the second half they were up by 20.9 per cent, to give a growth rate for the year of 10.9 per cent" (Financial Times March 12, 1991).

[10] "Indeed, as Rudiger Dornbusch from MIT points out, the United States'non-oil trade with Mexico swung from a deficit of US$1.2 billion in 1986 to a surplus of US$2.1 billion in 1989. Using the latest rule of thumb -US$1 m-worth of net exports equals 30 jobs- that means that the swing in the bilateral-trade balance has already created more than 100,000 jobs in the United States" (The Economist April 20th 1991).

Not all manufacturing industry was inefficient and unable to compete at the world level. Indeed, there were some few sectors that performed outstandingly well throughout all the period considered, including machinery and parts, specially automotive parts and the in-bond assembly industry located, mainly in the Northern Border. In particular, the in-bond industry has become second only to the petroleum sector, as an earner of foreign currency. Likewise, it is a big generator of employment, in 19 it provide an estimated of 500 000 jobs for Mexicans.

Although it performs poorly in the international trade, the most important sector within these border industries is the assembly of electronic products and components.In 1985, for example, the electronics production share 36 per cent in number of plants, 47 per cent in employment and the most important generator of value-added with 44.6 per cent. Likewise it provided 40.3% of the total foreign exchange earnt by in-bond industry (INEGI, 1989). The low labour costs at given levels of productivity, combined with devaluation, were responsible for such dynamic growth.

Mexico is now seeking new credits to implement a five-year programme aimed at satisfying development requirements in border towns to ease bottlenecks in the expansion of in-bond industries. Likewise, it is going to change the tax regime of in-bond industry to incentive this kind of industry which is estimated to have grown 13-15 per cent in 1990 with a 10 per cent rise in foreign exchange earnings to US$3.1bn (Financial Times March 29, 1990).

It can be concluded that changes in policy favouring more export-oriented strategies have led to the emergence of a new locational pattern in the Northern Border different to that of the heavy industrial concentrations in the three metropolitan areas of Mexico City, Guadalajara and Monterrey. This new locational pattern merged in the way of in-bond plants mentioned above. The assembly of electronic products and components is a good example of this shift in Mexican industry, It is heavily concentrated in the Northern Border Region though the interior region is gaining importance in terms of the location of in-bond industry due to wage differentials, labour shortages and bottlenecks in the supply of public services and infrastructure in the Northern Border plants.

It is undeniable that the incentives provided by the Border Industrialisation Programme had influenced the location of the in-bond plants. But it is also the case that this area designated by the government provided the kind of low-cost labour suitable for routine and assembly-line tasks required by the firms and with the required levels of productivity. Also the geographical proximity to United States provided an additional stimuli. These can be considered as factors internal to the country as opposed to those external factors examinated in the previous chapter, competition between capitals, technological developments in the industry, the role of the governments in the home countries as well as some other more specific factors as rise in the cost of land (in Silicon Valley, for example) and labour unions (in some parts of the East-US).

The amount and extension of the foreign direct investment (mainly from U.S.) in electronic production is very important in Mexico unlike other NICs as South Korea and Taiwan where a major part of the industry is locally owned (e.g. Samsung, Gold Star and Hyunday from South Korea and Tatung from Taiwan). However, Mexican local capital involved in subcontracting operations could be important though it is possible it is underrepresented. It is necessary to deepen the analysis of available data in further stages of the research before to draw any conclusion in this aspect. As a result of the foreign investment from US firms the main market for Mexican electronics exports is US but as foreign investment diversify (from Japan, for example) other markets could gain importance.

Mexico seems to have advantages in the assembly of consumer electronics rather than components as semiconductors. But negative factors in the Mexican economy, mainly inflation, and overvaluation of the currency offset the advantages for setting up certain kind of in-bond plants in Mexico. That means some assembly operations were lost to poorer countries. For instance, 'less-sophisticated labour-intensive phases of production processes are being performed in the so-called New-NICs as Malaysia, Thailand, Philippines, etc.

IV. THE IN-BOND ELECTRONICS INDUSTRY, 1965 - 1990.

INTRODUCTION.

As indicated in chapter III, the establishment of in-bond[1] assembly plants in Mexico as a result of the implementation of the Border Industrialisation Progamme in Mexico led to the emergence of a new locational pattern of the industry away from the old industrial concentrations. The cities located along the Mexican Northern Border (see figure 4.1)[2] have boomed due to the number of in-bond plants devoted to the assembly of several types of products for export has been increasing there since the middle 1960s. Also, there are some other establishments located in the interior of the country.

There are few studies of the locational pattern of both the electronics industry and in-bond plants in Mexico. In particular, the bulk of research on in-bond plants emphasizes the type of labour force employed, the impact on the regional economy, as well as the social and family consequences. Other main concerns are on unionism and the working class and so on (Carrillo, 1986)[3].

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[1] These plants were first identified as "in-bond" plants due to the fact that they should operate under Mexican law (or in-bond) as long as they are inside the Mexican territory. As mentioned in chapter 1 (footnote 20) they have become better known by their Spanish name *maquiladoras* or in the abbreviated form *maquilas.*

> "In colonial times, the *maquila* was the portion of flour that the miller kept after grinding the corn. The U.S. companies provide the corn (for example, cut cloth or electronic components), Mexico keeps its portion (U.S. dollars changed into pesos for wages and production costs), and the assembled goods (garments or TVs or auto parts) return to the U.S..." (Sklair, 1989:10).

[2] The border region is made up of thirty-five municipalities located in the six states bordering the United States (Baja California Norte, Chihuahua, Coahuila, Sonora and Tamaulipas, since Baja California Sur is free zone is also included in the statistics). Almost a third of the border population is concentrated in Tijuana and Mexicali -on the Californian border- and almost a quarter in the largest border city Cd. Juarez, the twin city of El Paso Texas according to the 1980 population census.

[3] "...from 428 publications and documents about maquiladoras in the Mexican Northern Border, written between 1969 and 1981, 357 dealt with the Border Industrialisation Programme and development in the border; 17 dealt with the general characteristics of the labour force; 15 dealt with gender relations; 7 were about the social impact in the female workers families; 20 about working conditions; 4 on unionism and 8 case studies on workers' struggles..." (Carrillo, 1986:46).

However, on the verge of an important realignment in the world market due to the formation of several trade blocks as the EC, the NAFTA and other trade blocks in Latinamerica, the incorporation of the Eastern Europe and the republics of the former Soviet Union as market economies and the growing importance of the Asian NICs as investors and the New-NICs as locations, it is of great importance to study the location of this kind of plants and its impact in the host economies.

There have been a number of studies on the subject which highlight the relevance of this kind of industry for the economies involved (see chapter I). Apart from their somewhat one-sided view, they are in general, devoted to comparisons either between countries or between industrial branches; some other country-specific studies tend to examine the whole industrial sector or the role of the economic actors involved in the current process of redistribution of world industrial capacity as the state, the TNCs, etc. Without denying their important contribution to the subject it is considered that the study of particular industrial subsectors on particular locations yields fruitful results, as the analysis of Henderson (1989) and Salih **et.al.** among others, demonstrate.

Thus, the purpose of the present chapter is to examine the electronics in-bond industry. Its well defined location in the Mexican Northern Border constitutes a new locational pattern of industry which, as mentioned earlier, is spreading inside the country overlapping with the dominant pattern of location of great concentration in the three main cities, Mexico City, Monterrey and Guadalajara. It is important to mention that, with the exception of the in-bond industry regime (the BIP), the trend towards great concentration continued (though it should be recognised that at lower pace in the last years) after several plans and costly projects[4]

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[4] Like the heavy-industry complex Lazaro Cardenas-Las Truchas in the Pacific coast (see figure 3.1), the costly programme of new towns and industrial estates (Garza, et.al., 1988), or middle-size cities among others.

FIGURE 4.1

The Mexico–United States Border Area
CALIFORNIA
ARIZONA
NEW MEXICO
TEXAS
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
BAJA CALIFORNIA
Colorado River
Salton Sea
Salt River
Gila River
Gila River
Pecos River
Rio Grande
Rio Grande
Rio Bravo
Nueces River
Gulf of California
Pacific Ocean
Gulf of Mexico
San Diego
Tijuana
El Centro
Calexico
Mexicali
Yuma
San Luis
Tecate
Ensenada
Tucson
Nogales
Nogales
Douglas
Agua Prieta
Deming
Columbus
Palomas
Las Cruces
El Paso
Ciudad Juárez
Hermosillo
Ojinaga
Presidio
Chihuahua
Del Rio
Ciudad Acuña
Eagle Pass
Piedras Negras
San Antonio
Nuevo Laredo
Laredo
Rio Grande City
McAllen
Harlingen
Brownsville
Ciudad Camargo
Reynosa
Monterrey
Matamoros

made by the Mexican government to deconcentrate the industrial sector and, ergo, the urban population out of the main cities.

I will examine in part 1 the antecedents of the Border Industrialisation Programme (BIP) and the BIP in its first phase from its creation in 1965, up to 1974. The second part is concerned with the growth and main characteristics of the in-bond assembly plants with special reference to the electronics subsector, economic crisis and its impact in the in-bond industry in the 1980s patterns of specialisation. Part 3 gives the pros and cons adduced by politicians, academics and businessmen in US and Mexico and the prospects for the industry whereas in part 4 some preliminary conclusions are drawn.

1. THE BORDER INDUSTRIALISATION PROGRAMME, 1965-1970.

a) Antecedents.

The relations between Mexico and US have been often marked by suspicion and distrust by the Mexicans, who hardly forget the annexation of half the country in the last century and see their Northern neighbour as a powerful giant always looking to take advantage of its small and weak neighbour which sees as its backyard. On the other side the US have seen with distrust the nationalist policies of Mexico like the nationalisation and distribution to peasants of large landholdings after the Mexican Revolution and during the administration of Lazaro Cardenas (1934-1940) as well as the nationalisation of natural resources and strategic foreign owned sectors as electric energy distribution, oil[5], railroads, mining, sugar refining, etc.

After the outbreak of World War II, economic and political relations improved considerably. Mexico joined the US in the war. Moreover both countries signed a commercial agreement by

[5] The oil industry was mainly in hands of American companies until 1938 when President Lazaro Cardenas nationalised the industry. As a result the U.S. imposed an embargo on Mexican oil until 1942 when the American oil companies and the Mexican government reached an agreement on compensation (Perlo Cohen, 1987:144).

which trade barriers were lowered and Mexico was soon exporting oil, cattle, beer, ore and agricultural products to the US (Perlo Cohen, 1987).

In addition to expanding foreign trade, investment and credit, the two governments agreed on the creation of a migrant labour programme, the Bracero programme to alleviate the labour shortages in agricultural and other activities that the war caused in the US. Mexicans have always come across the border, legally or illegally, to seek work. The Bracero programme gave legal basis to this migration. In short, the programme provided for shared control over the hiring, transportation and protection of Mexican workers in jobs in US agriculture and railroads involving over four million Mexican workers until it was unilaterally canceled by US in 1964 (Sklair, 1989:28).

Due to the proximity to the US, border population has generally grown at a faster pace than the Mexican population as a whole (see tables 4.1 and 4.2). The fast urban growth was in many cases not matched with a proper economic base in the cities which could have facilitated the local supply of those products too expensive to "import" from the interior of Mexico. Thus the Mexican government implemented a serious regional development strategy in the late 1930s establishing a Free Zone along the border. The zone permitted the duty-free import of raw materials and other industrial inputs from the US for further processing in Mexico. However, instead of stimulating local production the zone stimulated the import of great quantities of US finished goods.

In terms of population, the Northern Border had the highest rate of urban growth in the country between 1940 and 1960. The great demand for raw materials and labour to the US during the World War II and the Bracero programme triggered the growth inthe cities which improved their positions as commercial centers due to increasing flow of products and workers.

TABLE 4.1. Mexico: Population of the Border States and the Most Important Cities along the Border, 1900-1980

	1900	1910	1921	1930	1940	1950	1960	1970	1980
MEXICO	13607259	15160369	14334096	16552644	19649162	25779254	34923129	48381547	66846833
BORDER STATES	1400872	1657733	1717082	2054345	2617721	3762963	5541100	7848169	10691887
BORDER CITIES	36563	42108	87644	140723	178861	468459	1017306	1702517	2233102
Tijuana	242	733	1028	8384	16486	59952	152473	341067	429500
Mexicali	-	462	6782	14842	18775	65749	179539	276167	341559
San Luis Rio Col.	-	-	175	910	558	4079	28545	51118	76684
Nogales	2738	3177	13475	14061	13866	24478	37657	53119	65603
Agua Prieta	-	656	3236	4674	4106	10471	15339	21017	28862
Ciudad Juarez	8218	10621	19457	39669	48881	122566	262119	414908	544496
Villa Acuna	667	933	2423	5350	5607	11372	20048	30838	38898
Piedras Negras	7888	8518	14233	15878	15663	27581	44992	40885(a)	67455
Nuevo Laredo	6548	8143	14998	21636	28872	57668	92627	152325	201371
Reynosa	1915	1475	2107	4840	9412	34087	74140	140480	194693
Rio Bravo	515	746	936	4610	17500	39933	55236		
Matamoros	8347	7390	9215	9733	15699	45846	92327	140660	188745

(a) A data mistake
SOURCE: M Perlo Cohen, 1987:Table 3.

TABLE 4.2. Mexico: Population growth of the border states and the most important cities along the border (Annual rate of growth)(a).

	1900/30	1930/50	1950/60	1960/70	1970/80
MEXICO	0.7	2.2	3	3.2	3.2
BORDER STATES	1.3	3	3.6	3.4	3
BORDER CITIES	4.4	5.8	7.5	5	2.7
Tijuana	11.1	9.4	8.9	7.7	2.3
Mexicali	100	7.2	9.6	4.2	2.1
San Luis Rio Colorado	100	7.2	17.7	5.7	4
Nogales	5.3	2.7	4.2	3.4	2.1
Agua Prieta	100	4	3.7	3.1	3.1
Ciudad Juarez	5.1	5.5	7.3	4.5	2.7
Villa Acuna	6.7	3.7	5.5	4.2	2.3
Piedras Negras	2.3	2.7	4.8	-1	4.9
Nuevo Laredo	3.9	4.8	4.6	4.9	2.6
Reynosa	3	9.3	7.5	6.2	3.2
Rio Bravo	100	8.7	12.5	7.9	3.2
Matamoros	0.5	7.5	6.8	4.1	2.9

(a) Annual rate of growth was calculated using the following expression: $r = 1 - (Po/Pf)^{1/n}$ where Po and Pf are the population at the beginning and the end of the period considered, respectively, and n is the number of years.
SOURCE: Own calculations from Table 4.1.

Between 1940 and 1950, Matamoros, Ciudad Juarez, Mexicali and Tijuana tripled in size and Reynosa quadrupled. In the period between 1950 and 1960 the average annual increase in population in the border cities was 7.5 percent. High growth rates were found in Tijuana (8.9 percent), Mexicali (9.6), Ciudad Juarez (7.3) and Reynosa (7.5) (see table 4.2 and figure 4.1)[6]. In the next decades the pace of urban growth lowered and even experienced a drastic fall in their growth (though Tijuana, San Luis Rio Colorado and Reynosa doubled in size) due, it is argued, to a fall in migration to the region particularly in the 1970s (Perlo Cohen, 1987:156).

Later, realising that the bracero programme could stop at any time and under the combined stress of demographic explosion and economic deterioration the government initiated another attempt to develop local industry in the Northern Border. The National Border Programme (PRONAF), precursor of the BIP, which began in 1961 with the political aim of tying the Northern Border to the Central Valley. Some improvements in infrastructure, building roads, industrial parks with electricity and water were introduced. This infrastructure was

[6] We bypassed San Luis Rio Colorado (17.7 per cent) and Rio Bravo (12.5 per cent) because of the lower base-population they had in 1950.

designed to be a platform for the development of import-substitution manufacture and tourism in the Norther Border. The programme met with some success at the beginning but it soon became apparent that it was not enough to solve the regional problems. In 1964, when US closed the bracero programme 200 000 farm workers were suddenly jobless. It is estimated that unemployment reached 50 per cent among manual laborers in border cities like Mexicali and Ciudad Juarez.

> "The Mexican government, anxious for a solution reacted enthusiastically when the Mexican secretary of industry and commerce was invited to visit United States assembly plants in Hong Kong and Taiwan. United States industrialists proposed the creation of a free trade zone on the United State/Mexican Border that would both fulfill United States manufacturer's need for cheap labour and create jobs for Mexico's unemployed..." (Fuentes A and Ehrenreich B, 1987:210).

Thus in 1965, the Mexican government implemented the Border Industrialization Programme (BIP) as an effort to integrate the unevenly developed Northern region with the rest of the country and which came into full operation in 1967[7]. The main goals of the BIP were officially to generate employment for the unemployed and underemployed. The advantages of the programme were seen as the following: a) creation of jobs with the resulting larger incomes and increased living standards; b) the transference of technology as modern methods of manufacturing were introduced; c) impact in Mexican economy as backward linkages merged. The mechanisms for achieving these goals were:

> "To allow duty-free imports of machinery, equipment, raw materials, and components into plants located inside a 20 kilometre strip (plus free zones) of the border region. The commitment was that the entire output was exported" (Clement and Jenner, 1987:8).

[7] See the works of Fernandez, 1973; Clement and Jenner, 1987; Wong, 1988; Grunwald, 1983, 1985; Harris, 1986.

The firms could enjoy exemption from the law which laid down foreign companies must be 49 per cent maximum equity. Moreover, unprecedented financial incentives were granted to foreign companies by the Mexican government; low taxes on profits and sales with some Mexican states giving full tax exemption; land could be purchased or leased on favourable terms and -unofficially- corporations were given *carte blanche* to conduct their business and labour affairs without government interference. Additionally, the in-bond plants were exempted from a prohibition on land ownership by foreigners in border and coastal zones, that is they were allowed to establish anywhere in the country, subject to approval by the authorities. The main cities, Mexico City, Monterrey and Guadalajara were intended to be off the limits because of pollution problems and the often-sought goals of deconcentrate the industrial activity out of these areas. However, special permission was granted for the establishments of several plants there. Also some incentives were offered for the establishment of plants in other locations. Likewise, to further attract the in-bond industry industrial states have been promoted along the border and in the interior (see Garza, Ibarra and Aguilar, 1988).

As can be seen in-bond plants constitute a variation on the concept of FPZs (Goldsmith, 1984). In Taiwan, Thailand, South Korea, Singapore and Malaysia the FPZs were sited near airports and seaports where there were low-wage, semi-skilled labour surplus zones. Thesezones were meant for production of cheap, labour-intensive, manufacturing goods for export to developed countries.

The bulk of exports could be imported into the US the regulations of the Tariff Schedule of the United States, items 806.30 and 807.00. As noted in the previous chapters, these items allowed the reimport of articles whose manufacturing process began in the US, and were processed abroad and duty was to be paid only on the value-added abroad. Item 807.00 accounts for over 90 per cent of US offshore assembly provisions (OAPs) and provides for duty-free re-entry only of those components which do not lose their physical identity in the assembled article. Likewise the provision is available to foreign firms (which, as will be seen in the case of Japanese companies constitutes a great advantage) who buy US components for assembly into products for sale in the US, that is it is not limited to domestic firms as in the case of the European countries OAPs (Finger, 1975:365)[8].

b) <u>Importance of In-bond Plants.</u>

The importance of the in-bond plants is not restricted to Mexico. American firms rapidly realised the advantage that in-bond plants constituted. As mentioned in chapter I, Sklair argues that it is expensive to to ship equipment and components To Asia. Moreover, in the 1960s, wage differentials were so substantial that US firms began to buy their materials and components in Asia (Japan and NICs), given that the savings outweighed the advantages of items 806.30 and 807.00 (1989:11). Mexican proximity to the US meant considerable savings in transport costs due to the transport network existent between both countries which added to items 806.30 and 807.00 and the facilities offered by the BIP represented an attraction hard to ignore. For example, Fairchild one of the first plants to go offshore (in 1962 it established an assembly facility for semiconductors in Hong Kong) opened a component assembly facility in Tijuana in 1966 although it already had in Hong Kong, South Korea and other low-wage locations. Sklair reports that a Fairchild official said that wages in the Far East were lower than in Tijuana but on heavier components where freight cost is important Mexico outweighs the low-cost advantage of the Asian countries (1989:79).

[8] By 1972 the main items imported under OAPs by US from all the countries were electronic products and components, 18 per cent; machinery, 27 per cent; and, motor vehicles (including aircraft), 39 per cent. From developing countries in particular the shares were electronic products and components, 56 per cent; machinery, 13 per cent; and, misc. metal products, 11 per cent (Finger, 1975:Table II).

> "During the mid 1960s, when data on 806/807 trade first became available, Hong Kong was more than five times as important and Taiwan as important as Mexico in the processing and assembling of US components for reexport to the United States. By the end of that decade, Mexican operations were nearly twice as large as those of Hong Kong and about four times as large as those of Taiwan. This shift took place despite the fact that wages were higher in Mexico" (Grunwald, 1985:137).

The original conception of the in-bond plants was the concept of "twin plants" (or "production sharing" as Sklair defines it). US firms would establish two plants under a single management one on each side of the border, in this way US plants would perform the capital-intensive phases of the production processes supplying its Mexican counterpart with the necessary components to carry on with the labour-intensive phases returning the finished products to the US side for further processing, testing packaging or whatever and sale. The savings in terms of administration, transport, inventories, repair and maintenance, technical support and etc. are thought to be substantial. However, the number of real twin plants is considered insignificant, since most of the plants in the US side are mainly warehouses. The great majority of the US suppliers of the in-bond plants are distant from the border (Midwest, East and far West) (Grunwald, 1985; Sklair, 1989).

Since 1967, when the BIP came into full operation the number of plants and employees have been growing each year, that year 73 plants (with 4 000 workers) were established generating value-added of 925 millions of pesos (table 4.3)[9].

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[9] "The administration of the BIP was in the hands of several different ministries so startups and closures were deficiently recorded. Moreover, since Baja California was already a free zone many plants did not register under the in-bond scheme until 1972 when in-bond plants were obliged to register under in-bond legislation. In consequence the data available for the period up to 1974 is scarce and insecure in many cases. It was until the 1980s that *Instituto Nacional de Estadistica Geografia e Informatica* (INEGI), got the responsibility for recording in-bond industry data that uniformity has been introduced" (Sklair, 1989:75). Table 4.3 is taken from the estimations made by Sklair (1989).

TABLE 4.3. Mexico: In-bond Industry by Plants, Employees, Labour Costs and Value-added, 1967-1973

YEAR	NUMBER OF PLANTS	EMPLOYEES	LABOUR COSTS	VALUE ADDED
1967	72	4000	n.a	925
1968	112	10927	n.a	975
1969	149	15900	n.a	973
1970	160	20327	n.a	1035
1971	205	28483	16460	1227
1972	339	48060	17388	1820
1973	400	64330	17808	2415

NOTE: Labour costs are average annual costs per employee in pesos; value-added is annual total in millions of pesos.
SOURCE: L Sklair, 1989:Table 3.1.

In 1973, there were 400 plants employing about 64 330 people and value-added of 2415 millions of pesos. That means an average annual rate of 25 per cent in number of plants, 37 per cent in number of workers and almost 15 per cent in value - added for the period between 1967 and 1973. Soon the in-bond assembly industry became the most important employer in the border region and an important earner of foreign exchange. Since 1973 the exports of in-bond products have earned for Mexico between 30 and 45 per cent as much as total Mexican manufacturing exports (Grunwald, 1985:144). Big corporations like RCA, Zenith, General Motors and General Electric came to establish in-bond plants in the Northern border.

> "Of 147 plants authorized in mid-1969, 103 were in actual operation. The heaviest concentration was Baja California, where over 70 plants were assembling US-made components. Of these, 68 were in Tijuana and Mexicali. The remainder were mainly in Cd. Juarez, Nuevo Laredo, and Matamoros. Presently, the concentration is heaviest in electronic products and textiles, but there are many other lines including dismantling of scrap railroad cars, food processing and packaging and assembly of medical instruments, boats and caskets. In terms of employment however, fully 80 percent of the workers are in the electronics and textile plants" (Fernandez, 1973:44).

Although the early performance of the in-bond plants is impressive, it was soon realised that it hardly get at the main problem, the growing unemployment in border cities. So the BIP came under attack from several sources, mainly academics pointed out that the major cause of unemployment in the border was the heavy migration into the area. The main argument was that the attraction of high wages (relative to wages in the interior) was further stimulating this migration so employment situation was going to get worse (Fernandez, 1973). Surveys of in-bond plants in Mexico show that under normal circumstances they offer wage rates from 5 to 30 per cent above the official minimum wages (which are already high in the border region as Sklair, 1989, and Perlo, 1987, show) which would give place to internal migration to Northern Mexico and international migration to US (Rivera-Batiz, 1987:263).

The Mexican government, which had considered the BIP as a temporary response to the critical situation of the ending of the Bracero programme and rising unemployment, soon realised the advantages of the programme so, in 1972, made a reform in the in-bond plant regulations. They were allowed to locate in the interior of Mexico (but not in the major industrial cities). Also they were allowed to sell limited quantities of assembled goods domestically if they did not compete with those domestically produced (Clement and Jenner, 1987).

The lack of information about electronics production in in-bond plants makes it too difficult to evaluate its importance between 1967 and 1974 in both the worldwide and national electronics production in order to identify if patterns of specialization were emerging. W. Cline (1984:145) shows that in the early seventies Mexico, South Korea, Hong Kong, Taiwan, Singapore and Malaysia were important in radio, T.V. and communication equipment into US but, its study does not tell anything about the existence of specializations among these countries.

In Mexico, approximately 40 per cent of the total number of in-bond plants were in electronic production in the late sixties. Television receivers and parts was the most important single group in in-bond operations. Likewise, semiconductors and parts, with more than 16 per cent of the total, were almost as important as the television group in 1969 (Grunwald J, 1985:146). It should be recalled from tables 3.12 and 3.13 that in 1969 Mexico exported components and parts to US (under items 807.00) with a value of US$97.9 million dollars -well ahead of the Asian NICs- but by 1976 the total exported was US$102.5 lagging behind the Asian NICs.

As world competition increased in the electronics industry, firms were pushed to look for still cheaper labour while productivity levels remained the same. In the 1970s the overvaluation of the peso and high inflation levels made it so expensive to perform the assembly operations in some branches as semiconductors production. Therefore, firms moved to South-East Asia. Nonetheless, this movement of industrial capacity did not mean a reduction of in-bond operations in Mexico but a shift to more skill-intensive operations with higher value-added in the Northern Border and a relocation towards the interior of the country, were the wages are lower for those less sophisticated processes. Table 4.4 shows that in 1975 the average wage in the border was 79 US cents per hour whereas in the interior of the country was 63 cents -and the national average, 78 cents- with Tijuana and Ciudad Juarez with the highest wage levels (94 and 80 cents respectively).

By 1980, with the overvalued currency, the average wage in the border increased to US$1.03 per hour and 85 cents in the interior. After the 1982 devaluation, the wages diminished to levels below those of 1975 increasing the competitiveness of the industry.

TABLE 4.4. Mexico: In-bond Industry Border and Interior Average Operative Wages, 1975, 1980, 1985.

CITY/AREA	1975	1980 (U.S CENTS PER HOUR)	1985
Tijuana	94	1.12	79
Ciudad Juarez	80	1.00	75
Reynosa	66	96	67
Matamoros	71	1.03	84
Border	79	1.03	76
Interior	63	85	60
National Average	78	1.01	74

SOURCE: L Sklair, 1989:Table 7.1.

Likewise, assembly plants costs diminished to levels even smaller than those in the Asian NICs and New-NICs. As can be seen in table 4.5, land and buildings, electric energy costs were higher in Singapore, Malaysia and Hong Kong. Malaysia retained its labour-cost advantage over Mexico by almost half the cost.

TABLE 4.5. Assembly Plants Costs, International Comparison, 1983

CATEGORY OF COST	MEXICO	SINGAPORE	MALAYSIA	HONG KONG	USA
Land and buildings (dollars per ft2)	25-30	35-45	36-46	50-60	30-40
Electric energy (cents per kw/hr.)	4-5	10-12	7.5	n.d.	4.1
Labour costs (dollars per hour)	0.91	1.75	0.49	1.45	8-13

SOURCE: M Luna, 1984:Table 1.

According to Carrillo (1986), from the statements of high level officers within the government it is clear that in-bond assembly activities are considered not only an stable activity but one which could be a key-factor in the Northern border industrial development. In 1980, in-bond industry was the most important generator of employment in the border, occupying 88.3 per cent of manufacturing labour force in Ciudad Juarez, 99.4 per cent in Matamoros and 45.6 in Tijuana (p. 48). Also is the sector with highest growth in employment in the country as a whole. It is estimated that between 1975 and 1985 employment in the manufacturing industry grew at a yearly average rate of 4.4 per cent (see table 3.3), in the in-bond industry the rate of growth was 8.7 between 1975-1982 and 16.1 between 1982-1987 (see table 4.8.B in Appendix II).

The impact in employment and income in the border cities has led the local governments to establish industrial parks and offer incentives to the location of the industry. Moreover, there are what Sklair calls "the private facilitators", a very important group of people who appeared with the first in-bond plants, and realising the great profits which could be obtained, operate within the industry without actually owning in-bond plants in the normal way. "They typically offer a variety of subcontracting or legal services to those manufacturers who wish to use a maquila but do not which to own one directly" (1989:14). These group of people organised as either Mexican or US firms and with important connections on both sides of the border, are not only an important part of the of the in-bond industry in terms of their subcontracting operations but also in terms of their promotion activities in the US side. One example is "Assemble in Mexico" (AIM) founded in 1980.

> "AIM is organised as a California corporation in association with a wholly owned Mexican subsidiary which owns several corporations in Mexico, and these are the companies that are legally responsible in Mexico for the shelter and subcontract operations. AIM takes out long leases on industrial buildings in and around Tijuana, mostly as the contracts are won, but sometimes speculatively in anticipation of prospective business. Factories suitable for maquilas have been in short supply in Tijuana since the flood of new maquilas began in 1985, so facilitators now have to take rather more risks than was once the case to ensure that they are not caught without facilities when lucrative contracts appear on the horizon" (1989:88).

Two of the AIM's post-1985 boom clients, for example, are an in-bond plant which started operations in 1986 on contract for a New York based electronics company, (a Fortune 500 one) which fabricates an electronic training device for the US army. The other is a small high-tech company at the leading edge of dot matrix printer technology, with no plants in the US. This firm relocated its headquarters from Silicon Valley to San Diego and its production facilities from Puerto Rico to Mexico (Tijuana) due to the lower labour costs.

Since many corporations require very rapid startups, the experience of the facilitators can more or less guarantee this. Although the costs are relatively high the certainty which gives to operate through a facilitator is worthy the cost allowing the client to concentrate on production problems rather than in administrative, legal and bureaucratic matters. The excellent services offered by the facilitators have attracted big companies as Honeywell and General Electric to start in shelter plants (subcontracting) and after, they 'graduated' in the in-bond operations, they have, now wholly owned in-bond plants on their own (Sklair, 1989:89).

In August 1983, the Mexican government issued a new decree regarding in-bond industry which confirms its importance for the economic well-being of the country. The decree states the need of surveillance, regulation and control of the in-bond industry without disturbing its performance. Also, it highlights its importance in employment generation, training, income distribution and strengthening of the domestic market. One of the most important features of the decree is that allows in-bond plants, specially those with idle capacity, to sell their products in the domestic market up to 20 per cent of their annual output (or even more in some cases) as long as they do not harm the domestic industry. That is, it is possible to sell those products which are not supplied by domestic industry, if on-bond plants satisfy local content requirements (very lax, certainly), maintain a positive balance of foreign exchange and provide technical assistance to local suppliers. The main goal of these regulations is to generate advantages and incentives for the establishment of high-tech industries like electronics in the country (Luna, 1984:41-44).

It is still too early to understand the impacts of the changes in regulations on the geographical distribution of the in-bond electronics industry in Mexico. Yet Table 5.1 (please see chapter V, pages 222-223) shows the distribution by States of the number of plants and of employment both in manufacturing as a whole and in the electronics industry. According to the data, in 1989 the centrally-located Distrito Federal and the States of Mexico, Nuevo Leon and Jalisco together concentrated 36.1 percent of all plants and 49.8 percent of all employment in Mexico's entire manufacturing system, thus highlighting the locational importance of nodal access to the domestic market for industry as a whole. However, as will be elaborated in detail in chapter V, a new industrial location pattern is taking hold in the Northern Border region where the States of Baja California Norte, Coahuila, Chihuahua, Sonora and Tamaulipas, which adjoin the U.S.A., localized a significant 9.1 percent of the number of plants and 20 percent of employment in all manufacturing in 1989.

In that year the electronics industry (including in-bond activities) accounted for only 0.4 percent of all manufacturing plants and approximately 4 percent of all manufacturing employment in Mexico (Table 5.1 p.222). The Table shows, however, that the electronics industry is much more highly concentrated in the northern border states as the States of Baja California Norte, Coahuila, Chihuahua, Sonora and Tamaulipas localized 200 plants or 33 percent of the electronics industry, employing 76,274 workers. If we also include the adjacent State of Nuevo Leon, the northern region accounted for 270 plants (40.3 percent) with 78,065 workers (77 percent) in electronics production (calculations from Table 5.1). Although the importance of the Distrito Federal and the State of Mexico appears to be overwhelming in terms of electronics plants, 280 or 42 percent of the total, these only employ some 18,870 workers (or 18.7 percent of the employment in electronics).This is because the average plant size in that central region is only about 53 workers per plant whereas the average plant in the entire electronics industry (Table 5.2, page 225) employs 151 workers. This may be due to the fact that the industrial census includes also small repairing workshops employing few workers on contracts while the in-bond electronics industry located in the North comprises some plants engaging as many as 1,500 workers (see Table 5.15A, page 248).

A closer look at electronics sub-sectors indicates that the most important subsector in Mexico is the Telecommunications and Sound Recording and Reproducing Apparatus Equipment industry which accounts for 80 percent of the number of plants and 85 percent of the employment in the electronics industry. This particular sub-sector is very heavily concentrated in Baja California Norte, Chihuahua and Tamaulipas where 58,117 workers or 67.5 of the employment in that sector or 57.5 percent of the employment in the electronics industry are localized. Therefore Table 5.1 confirms that the growth of electronics industries is creating a new industrial location pattern in Mexico as a result of its expansion in the Northern Border region and hence away from the traditional industrial concentrations in the central regions of the Distrito Federal and the States of Mexico, Jalisco and Nuevo Leon.

2. GROWTH AND CHARACTERISTICS OF THE IN-BOND ELECTRONICS INDUSTRY, 1970-1990.

a) Number of Plants, Employment and Value-added.

By the early 1970 s it became clear the success of the BIP, as more labour-intensive phases of production processes were located in Mexican Northern Border as in-bond plants, a new locational pattern was emerging in the North. Moreover, some firms preferred locations in the interior of the country.

In terms of products assembled table 4.6 shows that in 1970/71, Mexico ranked the highest in the exports, under items 806/807, of semiconductors and parts (1), textile products (1) and equipment for electronic circuits (1); the second for television receivers and parts and the third in motor vehicle parts and office machines. By 1980 it had diversified the product mix but lost the production of semiconductors to other countries.

TABLE 4.6. Rank of Mexico among Countries from which the United Sates Imports Assembled Manufactured Products under Tariff Items 807.00/806.30, by Selected ITC Category, 1970-71 and 1980.

PRODUCT CATEGORY	1970/71	1980
Television receivers and parts	2	1
Semiconductors and parts	1	7
Textile products	1	1
Office machines	3	3
Motor vehicle parts	3	2
Equipments for electric circuits	1	1
Electric motors and generators	(a)	1
Electrical conductors	(a)	1
Capacitors	(a)	1
Miscellaneous other electrical products	(a)	1
Radio apparatus and parts	(a)	3
Recording media	(a)	1
Luggage and handbags	(a)	1
Toys and dolls	(a)	1
Lumber and paper products	(a)	1
Scientific components	(a)	1

(a) Less than third place
SOURCE: J Grunwald, 1985:Table 4.4.

Between 1974 and 1980 value-added grew from 3945.5 to 17 728.8 million pesos (+449.0 per cent increase); the employment from 75 974 to 119 546 (+157.3 per cent). The number of plants grew from 455 to 620 (+136.2 per cent) (see graphs 4.1, 4.2 and 4.3 after page 167). That means a yearly rate of growth of 22.2 per cent in value-added[10], 13.6 per cent in employment and 10.6 in number of plants for the period under consideration (see tables 4.7.A, 4.8.A and 4.9.A for absolutes and tables 4.7.B, 4.8.B and 4.9.B for rates of growth in Appendix II).

Electronics has been the single most important sector since the beginning of the BIP though its share in the total has decreased. Tables 4.7, 4.8. and 4.9. show that in 1974, electronics production accounted by 70 per cent of the value-added, 67 per cent of employment and about 45 per cent of number of plants. By 1988, these shares had diminished to 41 per cent, 39 per cent and 28 per cent, respectively.

TABLE 4.7: Mexico: Value-Added in the In-Bond Industry, 1974-1989. (percentages)

YEAR	SHARE OF NATIONAL TOTAL					SHARE: ELECTR. REGION = 100		SHARE: ELECTR. SECTOR = 100	
	Border States (a)	Interior States (b)	Electronic Subsector	Electr. in Border	Electr. in Int.	Elec.in Border	Elec.in Interior	Elec.in Border % of Tot Electr.	Elec.in Interior % of Tot Electr.
1974	91.6	8.4	69	62.1	6.9	67.8	82.9	89.9	10.1
1975	90.3	9.7	64.8	58.2	6.6	64.4	68.3	89.8	10.2
1976	89.3	10.7	63.3	57.1	6.2	64	57.4	90.3	9.7
1977	87.8	12.3	62.6	54.9	7.6	62.6	62.3	87.8	12.2
1978	88.1	11.9	61.4	54.4	7	61.7	59.4	88.5	11.5
1979	84.6	15.4	62	53.3	8.7	63	56.5	86	14
1980	85.8	14.2	56.8	48.6	8.2	56.7	57.4	85.6	14.4
1981	86.6	13.4	55.5	48	7.6	55.4	56.2	86.4	13.6
1982	86.7	13.3	54.4	46.1	8.3	53.2	61.9	84.8	15.2
1983	87.1	12.9	50	41.4	8.7	47.5	67.4	82.6	17.4
1984	86.5	13.5	49.8	42.1	7.7	48.6	57	84.6	15.4
1985	87	13	44.7	37.5	7.2	43.1	54.9	84	16
1986	84.6	15.4	45	38	7	44.9	45.7	84.4	15.6
1987	80.7	19.3	42.4	34.8	7.6	43.2	39.2	82.1	17.9
1988	79.9	20.1	41.4	33.2	8.2	41.5	41	80.1	19.9
1989(c)	88.7	11.3	40.9	—	—	—	—	—	—

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuhua, Sonora and Tamaulipas.
(b) Corresponds to electrical and electronic machinery, equipment, apparatus, parts and accessories.
(c) Corresponds to the period January-August, 1989.
SOURCE: Table 4.7.A.

[10] This high rate is due to the fact that value-added is in current prices.

TABLE 4.8: Mexico: Employment in the In-Bond Industry, 1974-1989.
(percentages)

YEAR	SHARE OF NATIONAL TOTAL					SHARE: ELECTR. REGION = 100		SHARE: ELECTR. SECTOR = 100	
	Border States (a)	Interior States (b)	Electronic Subsector	Electr. in Border	Electr. in Int.	Elec.in Border	Elec.in Interior	Elec.in Border % of Tot Electr.	Elec.in Interior % of Tot Electr.
1974	93.6	6.4	67.1	62.1	5	66.3	78.3	92.5	7.5
1975	92.5	7.5	63	58	5.1	62.7	67.1	92	8
1976	90.7	9.3	63.1	57.4	5.7	63.3	61.1	90.9	9.1
1977	90.1	9.9	61.6	55.7	5.9	61.9	59.6	90.4	9.6
1978	90.8	9.2	62	56.4	5.5	62.1	60.4	91.1	8.9
1979	90.3	9.7	62.7	57.1	5.6	63.3	57.7	91.1	8.9
1980	89.2	10.8	58.1	52	6.1	58.3	56.2	89.5	10.5
1981	88.9	11.1	58.2	52.5	5.7	59	51.3	90.2	9.8
1982	89.1	10.9	58.3	52.3	6	58.7	55.6	89.6	10.4
1983	89.4	10.6	54.8	48.6	6.3	54.3	59.1	88.6	11.4
1984	88.6	11.4	54.3	47.6	6.8	53.7	59.3	87.5	12.5
1985	83.4	12.3	47.6	41.5	6.1	49.7	49.8	87.2	12.8
1986	85	15	45.3	38.6	6.6	45.5	44.2	85.3	14.7
1987	82.4	17.6	44.1	36	8.1	43.7	45.9	81.6	18.4
1988	80.9	19.1	43.6	34.5	9.1	42.6	47.7	79.1	20.9
1989	80	20	38.6	—	—	—	—	—	—

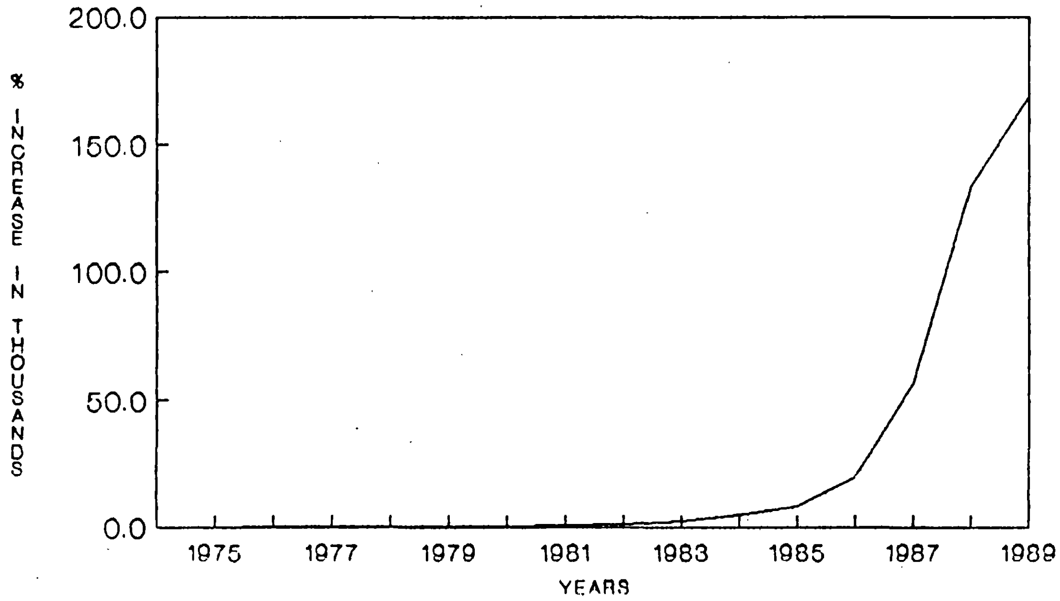
(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuhua, Sonora and Tamaulipas.
(b) Corresponds to electrical and electronic machinery, equipment, apparatus, parts and accessories.
(c) Corresponds to the period January-August, 1989.
SOURCE: Table 4.8.A.

TABLE 4.9: Mexico: Number of Plants in the In-Bond Industry, 1974-1989.
(percentages)

YEAR	SHARE OF NATIONAL TOTAL					SHARE: ELECTR. REGION = 100		SHARE: ELECTR. SECTOR = 100	
	Border States (a)	Interior States (b)	Electronic Subsector	Electr. in Border	Electr. in Int.	Elec.in Border	Elec.in Interior	Elec.in Border % of Tot Electr.	Elec.in Interior % of Tot Electr.
1974	94.3	5.7	44.8	41.5	3.3	44.1	57.7	92.6	7.4
1975	92.1	7.9	43.4	39.4	4	42.8	50	90.9	9.1
1976	90.6	9.4	40	35.9	4	39.7	42.9	89.9	10.1
1977	89.8	10.2	38.4	34.5	3.8	38.4	37.8	90	10
1978	91.9	8.1	38.1	35	3.1	38.1	37.8	92	8
1979	88.9	11.1	36.9	33.7	3.1	37.9	28.3	91.5	8.5
1980	88.9	11.1	36	32.3	3.7	36.3	33.3	89.7	10.3
1981	88.1	11.9	38	33.9	4.1	38.5	34.7	89.1	10.9
1982	87.9	12.1	38.1	33.8	4.3	38.5	35.2	88.8	11.2
1983	88.8	11.2	37.3	33.5	3.8	37.7	34.3	89.7	10.3
1984	88.5	11.5	36.3	32.6	3.7	36.8	32.5	89.8	10.2
1985	88.4	11.6	36.1	32.9	3.2	37.2	27.3	91.2	8.8
1986	92.7	7.3	30.5	27.2	3.3	29.3	45.8	89	11
1987	90.4	9.6	29.7	26.4	3.3	29.2	34.3	88.9	11.1
1988	89.5	10.5	27.6	24	3.6	26.8	34.6	86.9	13.1
1989	87.8	12.2	27.8	—	—	—	—	—	—

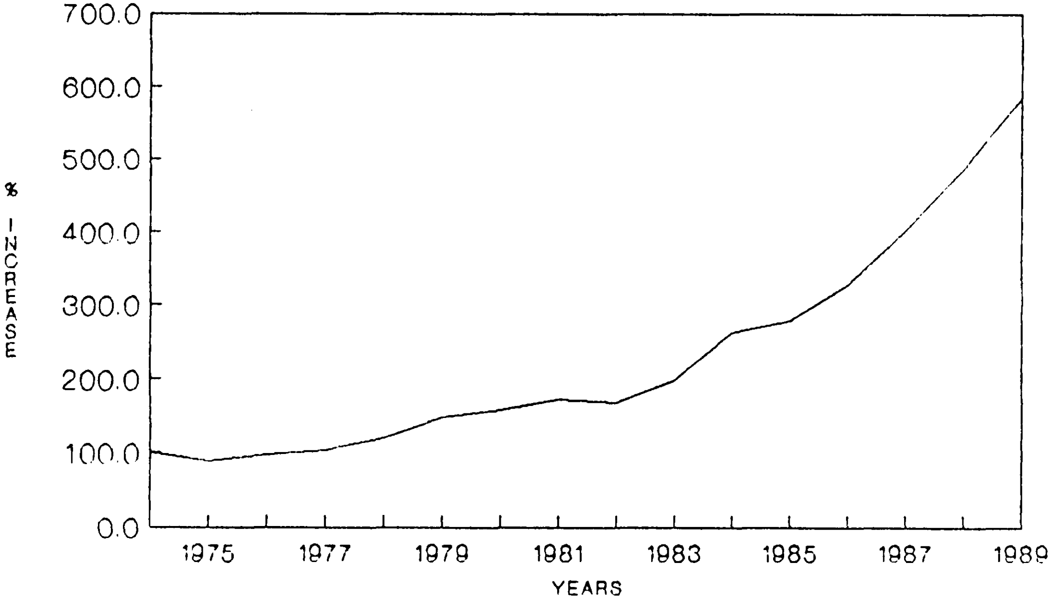
(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuhua, Sonora and Tamaulipas.
(b) Corresponds to electrical and electronic machinery, equipment, apparatus, parts and accessories.
(c) Corresponds to the period January-August, 1989.
SOURCE: Table 4.9.A.

GRAPH 4.1
MEXICO: IN-BOND INDUSTRY
% Increase in Value-Added, 1974-1989.



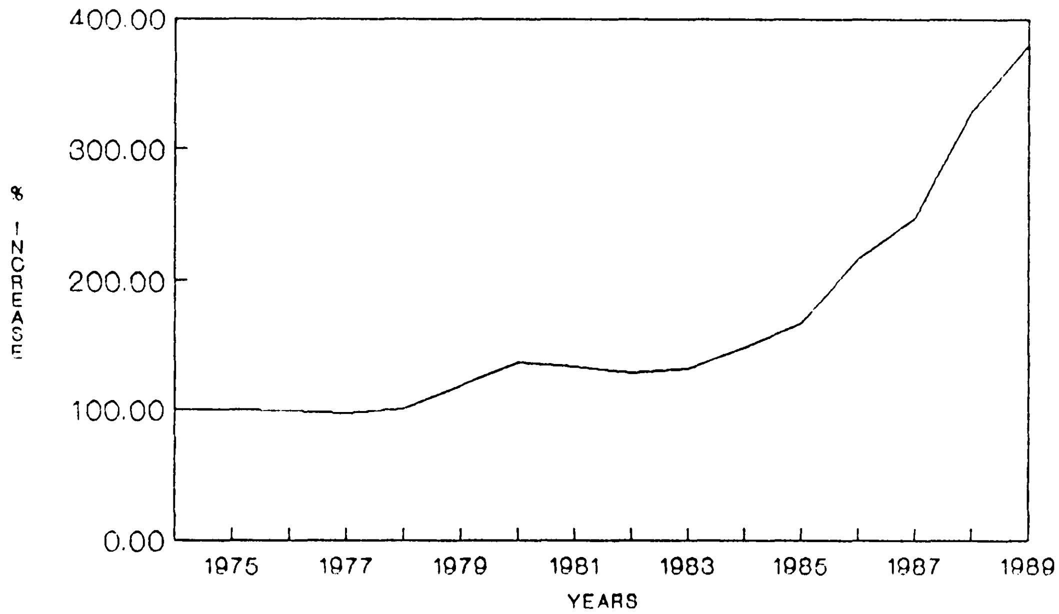
SOURCE: Table 4.7.A

GRAPH 4.2
MEXICO: IN-BOND INDUSTRY
% Increase in Employment, 1974-1989



SOURCE: Table 4.8.A

GRAPH 4.3
MEXICO: IN-BOND INDUSTRY.
% Increase in No. of Plants, 1974-1989.



SOURCE: Table 4.9.A

The growth of electronics production has been impressive by any standards though slightly below of that of the in-bond industry as a whole. Between 1974 and 1988 it recorded a yearly average growth rate of 38 per cent in value-added, 7.9 per cent in employment and 4.8 per cent in number of plants[11]. This rosy scene was soon threatened by one of the worst crisis of the in-bond industry in 1974-1975 when, it is argued, more than 34000 workers were laid off (Carrillo, 1986:48). Official data records a loss of about 9000 jobs and a reduction in the number of plants in that year (table 4.7 and 4.8). By 1975 the number of plants totaled 454 and the job total declined to around 67000. In 1976, employment recovered to 74496 and the number of plants decreased to 448 and 443 in 1977.Although employment increased during these years, the number of plants hardly increased. Sklair argues that average in-bond plant was employing more labour and the crisis had just shaken out many small and unstable firms gaining for the in-bond industry the fame of "runaway" or "footloose" industry.

During the oil boom, high inflation and overvaluation of the currency offset the advantages of Mexico as a location. Unlike the Far Eastern NICs (with the exemption of Singapore) which have by-and large followed the Japanese pattern relying on indigenous entrepreneurship, the Mexican in-bond industry relies on foreign direct investment (mainly from US). As foreign exchange changes offset the labour-cost advantage, firms found it too expensive to perform labour- intensive phases either with high skill or low-skill requirements. Likewise, world competition increased with the emergence of competitors from other NICs which have taken great advantage in the production of sophisticated devices such as semiconductors (South Korean firms) or the manufacturing of consumer electronics (as the local firms from Singapore and Taiwan) at lower cost than Mexican in-bond industry. Thereby, the firms were pushed to look for still lower -cost locations. It is the case of the so-called New-NICs, Thailand, Philippines, China, Indonesia

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11 Own calculations from tables 4.7.A, 4.8.A and 4.9.A.

which became better locations for low-skill processes and Malaysia for high-skill processes because they offered low labour-costs at given productivity levels[12]. Nonetheless, in-bond electronics industry remains as important subsector within Mexican in-bond industry with over one-third share in the total of all the variables considered.

Certainly, part of the reason for the plant closures are the fluctuations in the US economy which affect the performance of the in-bond industry. During the US recession years of 1975-1977 and 1981-1982, the number of plants decreased as well as the number of employees. Likewise, the increasing militancy of the labour force, mainly in the Northern Border affected the performance of the industry. However, the argument needs to be further clarified, Sklair points out that increasing militancy was, possibly, a response to the economic slump in the US market rather than being a cause of the crisis in the industry.

Between 1980 and 1982, the net receipts (to US $1 400 million) doubled despite the decrease in number of plants and employment (Liemt van, 1988:93). The most dramatic increase was after the devaluation of 1982. The number of plants grew from 585 in 1982 to 672 in 1984; employment from 127048 workers to 199684 in the same years. Unfortunately, it is difficult to analyze the changes in terms of value-added due to the absence of data in dollars.

From 1983 onwards the in-bond industry entered a dynamic phase of growth due to the devaluation of the currency. By the end of 1989, table 4.9 indicates that there were 1699 in-bond plants in operation. The annual growth of number of plants remained above 10 per cent (12.3 per cent between 1982-1987 and 18.6 between 1987-1989). Employment had almost the same behaviour. Also the plant size increased from around 192

[12] See Ballance and Sinclair, 1985; McMullen, 1982; Salih, et.al., 1988.

workers per plant in 1980 to 271 in 1986 at the national level. The same happened at the regional level.

The in-bond industry's share of total national industrial employment went from 5 per cent in 1975 to 10.5 in 1986. "The last three years showed the most dynamic increase in employment in the in-bond industry vis-a-vis total national industrial employment" (Banamex, RESM, Vol LXI, No. 721, Dec 1985:460).

With regard to the market, the in-bond industry's output is, mostly sent to US. In 1983 and 1984, Mexico was the most important supplier of items 806.30 and 807.00 of US tariff regulations. According to US Department of Commerce Statistics, total dutiable value imports under 806.30 and 807.00 were US$4.89 billion in 1983 and US$6.21 in 1984. Dutiable value imports from Mexico were US$1.79 billion (36.6 per cent) and US$2.26 billion (36.4 per cent) respectively. In 1984, Singapore was the closest competitor of Mexico (for the second year) with US$957 million in dutiable value imports into US and, in 1985 Mexico was, once again, in the top of the list (Business Mexico, February, 1986:92)[13].

b) Location and Size.

Regarding the location of the in-bond industry, most of the plants are located in the main border cities of the six states, above mentioned (Baja California Norte, Chihuahua, Coahuila, Sonora and Tamaulipas, and the free zone of Baja California Sur). These cities are Tijuana, Mexicali, Nogales, Agua Prieta, Ciudad Juarez, Matamoros, Nuevo Laredo and Reynosa (see figure 4.1).

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[13] "Maquila (in-bond industry) exports are included in the service category rather than the merchandise export category in Mexican balance-of-payments statistics. They therefore do not correspond to U.S. imports under tariff items 806 and 807. The former include U.S. and other non-Mexican components as well as the Mexican value-added. The dutiable value of 806/807 imports should reflect Mexican value-added plus the value of non-Mexican and non-U.S. components. Data concerning Mexican maquila [in-bond industry] exports include Mexican assembly exports to all distributions, not only to the United States" (Grunwald J, 1985:144 footnote 16).

In 1974, the Northern Border accounted for 94.2 per cent of the total of plants, whereas the interior accounted for only 5.7 per cent (tables 4.7, 4.8. and 4.9.). However, the number of plants in the border has been slightly decreasing in relative terms to about 89 per cent in 1980 that means in the interior they accounted for 11 per cent. In terms of the employment the interior's share has been increasing from 6.4 per cent in 1974 to about 11 per cent in 1980. Value-added in the interior plants has a little bit more importance, it grew from 8.4 per cent in 1974 to 14.2 in 1980 (tables 4.7, 4.8. and 4.9).

In terms of growth, in the three variables considered, the interior grew at a faster pace than the border region and the in-bond industry as a whole. Value-added increased at 28.7 per cent per year between 1974 and 1980 (which compares with 21.3 of the border region and 22.2 of the whole in-bond industry); employment at 15.1 (against 6.5 and 7.3) and number of plants at 15.0 per cent per year (against 4.1 of the border and 5.0 of the industry) (see tables 4.7.B, 4.8.B and 4.9.B in Appendix II).

With regard to the location of electronics and electrical production, the border zone accounted for more than a half of the total value-added and total employment of in-bond industry between 1974 and 1980 diminishing to about one third by 1988. In the case of electronics and electrical production located in the interior, it can be seen its increasing importance in value-added and employment. But it still has a small share of the overall in-bond industry. The number of plants shows more instability through the whole period (tables 4.7. and 4.8. and 4.9., fourth and fifth columns).

It should be noted that in-bond industry became more diversified within each region and at the national level. Despite increasing in absolute terms, electronics and electrical production decreased its share in the number of plants, employees and value-added in each region through the whole period. Employment, for instance, decreased its share in the border region from 66.3 per cent in 1974 to 42.6 per cent in 1989. In the interior plants, employment in electronics decreased from 78.3 per cent to 47.7 per cent in the same years (tables 4.7, 4.8. and 4.9, columns 6 and 7). The same happens in the other variables concerned. The surveys of Grunwald (1985) and Clement and Jenner (1987) note the same trend during the decade.

Although the Northern border is still the location *per excellence* of in-bond assembly plants, as the absolute figures show, it is clear that the new locational pattern has been slowly spreading into the country. The possible explanation of this fact must be focused not only in the relaxation in the regulations concerning in-bond plants. Because "the wage differentials are important for foreign assembly operations, the lower wages in the interior of Mexico provide a stronger attraction" (Grunwald, 1985:161). Given the labour characteristics of the industry, mostly female, single young, aged 24-26 with basic primary education and holding their first job, for performing such delicate assembly activities with the necessary attention and dexterity, it is not impossible that this kind of labour-force with the required levels of productivity exists in the interior. Thus, the new locational pattern would consolidate in the interior in the mid-term[14]. Additionally, there are other factors such as the high value/low weight of some products, transport costs decreasing, and so on. Anyway, it is necessary to determine if the characteristics of the labour force (skill/literate), use of local inputs, etc. are substantially different between the border plants and the interior plants before drawing any conclusion.

Apart from lower wage levels, there were other advantages for the foreign investor to locate in the interior. The

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[14] With regard to female education, the World Development Report of 1988 indicates that in Mexico 114 per cent of age group is enrolled in primary (basic education and 54 per cent in secondary (World Bank, 1988:table 30).

infrastructural capacity to service both in-bond plants and workers in the border was declining creating serious bottlenecks in public services, housing and education (though the government with the cooperation of some in-bond plants has tried to expand the supply of technical education schools according to the in-bond industry needs). Likewise, union activities in the early 1970s constituted a serious problem to the activities of in-bond plants. In the late 1970s, there appeared a serious shortage of labour force particularly in the biggest locations, Tijuana and Ciudad Juarez which reinforced the attractiveness of the interior. However, the main attraction of the interior is the lower wages, though the difference has been declining -Grunwald argues that as a result of deliberate government policy and weak labor unions at the border (1985:161).

We shall note that, as Grunwald (1985) argues, during the period 1974-1980 the size of the in-bond assembly plants was larger in the plants located in the border than in the interior. The largest plants tend to be located in modern industrial parks like those in Ciudad Juarez and Tijuana. As table 4.10 shows.

TABLE 4.10: Mexico: Plant Size in the In-Bond Industry, 1974-1989.

YEAR	PLANT SIZE National	Border States(a)	Interior States	Electr. Ind. (b)	Electr. in border	Electr.in interior
1974	167	166	187	250	250	253
1975	148	149	141	215	218	189
1976	166	166	166	263	266	237
1977	177	178	172	264	286	272
1978	198	196	225	323	320	359
1979	206	209	180	351	350	368
1980	193	193	188	311	311	317
1981	216	218	202	331	335	298
1982	217	220	195	332	335	307
1983	251	253	238	369	364	410
1984	297	297	296	445	434	541
1985	279	263	295	368	352	538
1986	253	232	521	376	360	503
1987	271	247	499	403	370	668
1988	248	224	453	392	357	624
1989	261	238	427	363	-	-

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuhua, Sonora and Tamaulipas.
(b) Corresponds to electrical and electronic machinery, equipment, apparatus, parts and accessories.
(c) Corresponds to the period January-August, 1989.
SOURCE: Tables 4.8.A and 4.9.A.

In 1974 the average size of the in-bond industry as a whole was 167 workers per establishment, 166 in the border states and 187 in the interior of the country.By 1980 the size had increased in the in-bond industry and in the border to 193 and had decreased to 180 in the interior after a peak of 225 workers per establishment in 1978. It can be pointed out that although the crisis of 1974-1975 had effects in the interior in terms of slow pace of startups, the data suggests that after the recovery of the US economy a few larger plants were attracted by the lower wages in the interior (see graph 4.4). These trend continued throughout the 1980s, as shown in table 4.10 plant size enormously increased in the interior states almost doubling that in the border by 1989. Plant size also varies with type of product, furniture assembly is generally done in small plants whereas garments and assembly of electrical and electronic machinery and equipment is done in large plants. Table 4.10 also shows that the number of workers per establishment in the electronics industry is larger than the national average for the industry.

c) Ownership.

The majority of the in-bond industry output is produced by foreign subsidiaries operating in the country. Since about 90 per cent of the assembly is for the US market, most of these subsidiaries are US-owned or controlled. Mexican capital, however, has been making inroads in the assembly operations. Table 4.11[15] indicates that in 1982, 351 plants were foreign majority-owned or foreign owned, that is 58 per cent of the total, 606 (96.5 per cent of that came from US). That means that there was substantial Mexican capital in almost half the in-bond plants in 1982, however, the proportion of capital invested in in-bond plants is smaller in Mexican in-bond plants. As can be seen in table 4.11, the capital invested by foreign firms amounted to 1899.7 million pesos or 63.2 per cent of the total invested.

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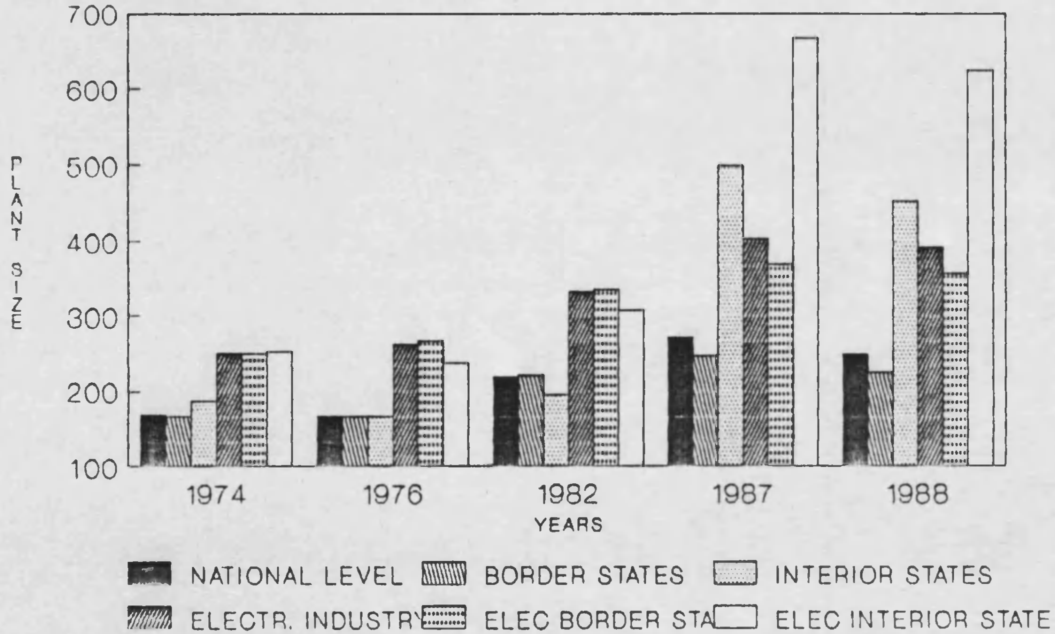
[15] Data may be slightly different from that in table 4.9 due to the different sources.

GRAPH 4.4
PLANT SIZE IN THE IN-BOND INDUSTRY
Selected years.



SOURCE: Table 4.10

According to the studies of Grunwald (1985) and Sklair (1989) the kind of enterprise has changed as well. At the beginning most of the US-controlled in-bond plants were subsidiaries of medium-sized TNCs. Later, some Fortune 500 corporations have established assembly operations in Mexico.

TABLE 4.11: Share of Foreign Capital in the Social Capital of the In-bond Industry, 1982. (million pesos)

	USA		MEXICO		JAPAN		OTHERS(a)		TOTAL	
CONCEPT	Plants	Amount	Plants	Amount	Plants	Amount	Plants	Amount	Plants	Amount
TOTAL	339	1752.4	255	1104.5	4	97.8	8	49.5	606	3004.2
Nat. Ownership	0	0	211	811	0	0	0	0	221	811
Maj. National O.	0	76.8	34	141.7	0	0	0	25.5	34	244
Maj. Foreign O.	90	544.6	0	151.8	1	51	4	16.8	95	764.2
Foreign O.	249	1131	0	0	3	46.8	4	7.2	256	1185

NOTE: Includes Germany (16.5%), Finland (8.8%), Bahamas (7.4%), Spain (6.8%), England (4.4%), Chile (1.0%), Panama (0.6%), Argentina (0.6%), Canada (0.5%), Italy (0.5%), Bermudas (0.5%), Holland (0.2%) and others (1.7%).
SOURCE: M Luna, 1984:Table 3.

It is interesting to note that also foreign control and amount invested varies in the different industrial branches. In 1982, 199 out of 339 US in-bond plants concentrated in the assembly of transport equipment, electrical and electronics machinery and equipments and electrical and electronic parts and accessories. With regard to the Mexican plants 171 out of 255 were in the assembly of garments, footwear and leather, furniture and miscellaneous, though it is important to note that there were 39 plants in the assembly of electrical and electronic parts and accessories. The heaviest investment were made in electrical and electronics machinery and equipment and electrical and electronic parts and accessories which accounted for almost half the total invested capital (1467.4 million pesos or 49 per cent, see table 4.12).

Nowadays one of the biggest issues regarding the ownership of in-bond assembly plants, is the great attractiveness of the Mexican Northern border for Japanese investors.

TABLE 4.12. Share of Foreign Capital in the In-bond Industry by Sector, 1982.
(million pesos)

SECTOR	USA Plants	USA Amount	MEXICO Plants	MEXICO Amount	JAPAN Plants	JAPAN Amount	OTHERS(a) Plants	OTHERS(a) Amount	TOTAL Plants	TOTAL Amount
TOTAL	339	1752.3	255	1104.6	4	97.8	8	49.5	606	3004.2
Food	6	107.7	4	37.9	-	-	-	8.6	10	154.2
Garments	23	51.5	64	168.7	-	-	1	0.6	88	220.8
Footwear and leather	13	6.1	24	147	-	-	-	-	37	153.1
Furniture	13	124	49	190.5	-	-	2	2	64	316.5
Chemical products	1	1	3	30.2	-	-	1	5	5	36.2
Transport Equipment	36	112.6	13	37.8	2	14.3	2	5.7	53	170.4
Machinery (non-electrical)	8	23.1	3	2.4	1	51	1	0.7	13	77.2
Electr. and electronic mach., equipment and parts	46	365.3	7	76.3	-	-	1	0.6	54	442.2
Electr.and electronic apparatus articles and accessories	117	820.9	39	194.7	-	-	-	9.6	156	1025.2
Toys and sport articles	18	17.9	8	2.4	-	-	-		26	20.3
Others	45	103.2	34	211.6	1	32.5	-	16.7	80	364
Services	13	19	7	5.1	-	-	-	-	20	24.1

SOURCE: M Luna, 1984:Table 4.

Among intense criticisms and debate from the part of US businessmen and congressmen, who see Japanese investment in Mexico as a way to circumvent protectionist barriers[16], cause of deindustrialisation and to economically invade their country, Japanese investment in in-bond plants has impressively grown in the last five years. Some sources estimate that before 1985 there were 5 Japanese in-bond plants in Tijuana and Ciudad Juarez and by 1987 there were 21 (Kerber and Ocaranza, 1989:836-838).

However, the criticisms from the part of US result rather exaggerated, the number of Japanese plants is still too small to represent a serious threat. In 1987 the 21 plants above mentioned constituted 1.8 per cent of the total number of in-bond plants; 1.9 per cent of employment; less than 1 per cent of social capital invested in the in-bond industry (which compares with 69.2 and 29 per cent invested by US and Mexican firms respectively); and 1.5 per cent of value-added. It is estimated that about half the Japanese plants are in the assembly of electronic products representing 3.6 per cent of employment in that branch. Among the firms located in the Northern border are, Hitachi, Matsushita, Sanyo, Sony, Toshiba, Video-tec and Kuron (Kerber and Ocaranza, 1989:838)[17].

The main reason to locate in Mexico is the closeness to California, one of the major receptors of Japanese investment in US. Likewise the increasing foreign exchange value of the yen motivated the investment in Mexico. It is estimated that Japanese investment in Mexico will increase in the coming years since some medium- and small- size Japanese suppliers of the big companies are being attracted by their customers since

16 Items 806.3 and 807 of the US Tariff Schedule are available to foreign firms thus constituting a great advantage for Japanese companies who import components from their US-based subsidiaries to be assembled in Mexico and then exported to US for further processing, testing, packaging and sale in the US market.

17 "Sony set up, in Tijuana, in-bond plants which produce refrigerators, televisions and other electrical house appliances. A twin plant in the US side gives the final touches to these products before sale. Also, Sanyo is planning to set up an assembly plant, US$40 millions to produce TV sets (El Imparcial, newspaper, June 16,1987).

the latter find it too difficult to rely on local suppliers given the high-quality standards and reliability of supplies they require. Also, companies from the Asian NICs -facing intensive protectionism from the part of the US- have showed great interest in establish assembly facilities in Mexico (El Imparcial, newspaper, June 7, 1987).

d) Use of Local Inputs.

Besides employment and ownership, one of the most controversial issues about in-bond assembly plants is that of local content. The share of materials and supplies provided is an important indicator of the linkages that in-bond activities have for the Mexican economy.

In the case of the in-bond assembly plants in Mexico, few linkages have developed with the rest of the economy, so the local content is almost negligible at the national level and varies according to geographical location and ownership of the plants. As table 4.13 shows, from the total value of output in the in-bond plants in the country 18 per cent corresponded to value-added, 80 per cent to foreign inputs and 2.2 to foreign packing. In the in-bond plants with national capital the shares are, 26.1 per cent for value-added and 72.7 per cent for foreign inputs.

TABLE 4.13. Share of National Value-added and Total Output in the Social Capital of the In-bond Industry, 1982. (million pesos)

SHARE	NATIONAL VALUE ADDED		FOREIGN INPUTS (Mat. & Comp.)		FOREIGN PACKAGING MATERIALS		FOREIGN ELECTR. ENERGY AND FUELS		TOTAL VALUE	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
TOTAL	29915.9	18	133031	79.9	3602.5	2.2	25.4	0	166574.8	100
Nat. Ownership	5399.7	26.1	15059.8	72.7	255	1.2	2.1	0	20716.6	100
Maj. National O.	1034	22.9	2412	53.4	52.5	1.2	17.7	0.4	4516.2	100
Maj. Foreign O.	5759.2	13.1	37808.1	86.1	366.9	0.8	0.6	0	43934.8	100
Foreign Ownership	17723	18.2	76751.1	78.8	2928.1	3	5	0	97407.2	100

SOURCE: M Luna, 1984:Table 13.

In the plants with foreign capital, 18.2 per cent of the total value was for value-added, 79 per cent foreign inputs and 3 per cent foreign packaging.It should be noted than in the case of national majority-owned plants the share of foreign inputs diminishes to 53.4 per cent and in the case of foreign majority-owned goes up to 86.1 per cent.

Regarding the geographical distribution of the in-bond plants table 4.14. (see table 4.14.A for absolutes in Appendix II) shows that the share of local inputs has been exceedingly small. With the exception of 1976, when the peso was devalued and the share of local inputs rose to 3 per cent, it has generally remained around 1.5 per cent in the in-bond industry as a whole. However, in the plants in the interior the use of local inputs has been considerably greater than in the border and the whole industry, ranging from 4 to 15 per cent of total inputs used (table 4.14).

TABLE 4.14. In-bond's Industry Inputs by Source and Geographical Location of Plants, 1975-1989 (percentages)

	NATIONAL TOTAL			BORDER STATES(a)			INTERIOR STATES		
YEAR	TOTAL	Foreign	National	TOTAL	Foreign	National	TOTAL	Foreign	National
1975	100	98.6	1.4	100	99.2	0.8	100	90.7	9.3
1976	100	97	3	100	97.9	2.1	100	85.5	14.5
1977	100	98.5	1.5	100	98.9	1.1	100	94.1	5.9
1978	100	98.2	1.5	100	98.6	1	100	93.4	6.6
1979	100	98.6	1.4	100	99.1	0.9	100	92.3	7.7
1980	100	98.3	1.7	100	99.2	0.8	100	90.3	9.7
1981	100	98.7	1.3	100	99.2	0.8	100	93.9	6.1
1982	100	98.7	1.3	100	99.2	0.8	100	93.6	6.4
1983	100	98.7	1.3	100	99	1	100	95.8	4.2
1984	100	98.7	1.3	100	98.9	1.1	100	96.5	3.5
1985	100	99.1	0.9	100	99.3	0.7	100	97	3
1986	100	98.8	0.8	100	99.2	0.4	100	96	4
1987	100	98.5	1.5	100	99.1	0.9	100	93.2	6.8
1988	100	98.3	1.7	100	99	1	100	93.9	6.1
1989(b)	100	98.5	1.5	100	99.1	0.9	100	86.5	13.5

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.

(b) Corresponds to the period January-August, 1989.

SOURCE: Table 4.14.A.

Grunwald warns that "given the differences in inflation rates between Mexico and the United States, it is difficult to interpret a change in proportion with the passage of time.If prices of Mexican materials rise more than the prices of materials imported from the United States and the rate of exchange remains fixed, then the proportion of local material used may go up in value without increasing in physical volume. The converse is true when a sharp devaluation takes place" (1985:161-162). This being illustrated in table 4.14 which shows the declines in the use of local inputs in the interior in the years following the devaluations of 1976 and 1982.

Since the majority of electronic assembly plants are foreign-owned (or foreign-majority owned)[18], the local content of inputs and materials is even lower than that of the in-bond industry taken as a whole (Table 4.15).

TABLE 4.15. In-bond Electronics Industry Inputs by Source and Geographical Location of Plants, 1979-1988 (percentages)(a)

	NATIONAL TOTAL			ELECTRONICS INDUSTRY			BORDER STATES(a)			INTERIOR STATES		
YEAR	TOTAL	Foreign	National	TOTAL	Foreign	National	TOTAL	Foreign	National	TOTAL	Foreign	National
1979	100	98.6	1.4	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
1980	100	98.3	1.7	100	99.4	0.6	100	99.8	0.2	100	95.2	4.8
1981	100	98.7	1.3	100	99.5	0.5	100	99.8	0.2	100	96.9	3.1
1982	100	98.7	1.3	100	99.5	0.5	100	99.9	0.1	100	96.1	3.9
1983	100	98.7	1.3	100	99.4	0.7	100	99.8	0.3	100	96.5	3.5
1984	100	98.7	1.3	100	99.7	0.3	100	99.8	0.2	100	99.2	0.8
1985	100	99.1	0.9	100	99.7	0.3	100	99.8	0.2	100	99	1
1986	100	98.8	0.8	100	99.4	0.6	100	99.6	0.4	100	98	2
1987	100	98.5	1.5	100	99.2	0.8	100	99.6	0.4	100	96.3	3.7
1988	100	98.3	1.7	100	99.1	0.9	100	99.5	0.5	100	96.6	3.3

(a) Corresponds to the sectors Electrical and electronic machinery, equipment and parts, and Electrical and electronic apparatus, articles and accessories.
(b) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.
SOURCE: Table 4.15.A.

18 According to table 4.12, 163 of the 210 plants engaged in the assembly of electrical and electronic machinery and apparatus and electrical and electronics parts and accessories, were US-owned or majority-owned in 1982, that id 77.6 per cent.

So, whereas the local content in-bond industry as a whole was in average 1.3 per cent from 1979 to 1989, that one in the electronics in-bond industry was in average 0.5 per cent. Likewise, the share of local inputs varies according to the geographical location, being lower in the border states (below 1 per cent for all the period considered) than in the interior states (which ranged from 1 per cent to almost 5 per cent). Actually, the share for the electronics in-bond plants in border and interior states is lower than that for the whole industry located in those regions.

Among the main reasons argued for this low local content of the industry are from the Mexican side, the low productive capacity, failure to meet rigorous specifications and lack of interest in doing business with the in-bond plants (since they are considered 'runaway') on the part of Mexican businessmen. On the US side, the use of Mexican components would force firms to pay higher duties which would increase the cost of assembly products in Mexico thus losing the advantage of cheaper labour-costs. Likewise, since in-bond plants are so close to the US, it is cheaper to use US inputs. Also, the restrictions on selling in the domestic market discouraged the assembly firms to use local inputs (Perlo, 1987:162). As noted before, one of the goals of the 1983 decree was increase the local content by allowing the in-bond plants to sell in the Mexican market.

Also, the kind of processes involved in electronics production is in many cases technically more sophisticated than the traditional assembly "sweatshops" of the late 1970s (as the increasing number of technicians seems to show). Thus it is very difficult, if not impossible, for the local businessmen to engage in the production of inputs (out of packaging materials) with the quality and price-competitiveness required to supply the assembly plants.

The high levels of quality (zero-error) required in an intensely competitive world market under the leadership of

Japanese companies suggests that such development is not likely to occur in Mexico in the short term. For example, Singapore's efforts to achieve an integrated production structure in the field of semiconductors led to a limited degree of forward integration (testing, packaging, direct shipping to the customer). The highly-sophisticated manufacture of wafers and masks did not take place in Singapore until 1986 when Hewlett-Packard established its wafer fabrication plant. Malaysia, the third largest semiconductors exporter, has also faced the same problems though in 1987 National Semiconductor announced a new wafer fabrication unit for Penang (lower-end wafer plant technology) and Intel and Hitachi planned to do the same, there is no local entrepreneurship which can forge the backward-forward linkages with the quality and price-competitiveness required, (Frobel, et.al., 1981; Salih, et.al., 1988). The size of Malaysian-owned electronic companies is still too small, estimated in about 9 per cent of the total fixed assets (Singh, 1988:81).

The Asian NICs are a longer way ahead in the field of consumer electronics, computers and semiconductors than Mexico. Crucial inputs to the manufacturing computer hardware and peripheral equipments are much cheaper in Asia. Particularly, the cost of assembly [illegible] labour and engineers is lower at high[illegible] levels of productivity (Ernst, 1985:339). More important, the Asian NICs count with local firms which already compete in the world market of consumer electronics and computers. As it was pointed out in chapter II, Taiwan and South Korea are leading exporters of terminals, Singapore is a major supplier of disk drives and Taiwan, South Korea and Hong Kong are expanding their shares in the world market for personal computers. In the field of semiconductors, according to Scott's (1987) study on South-East Asia, in 1985 there were 124 plants in the region, 63 US-owned and 61 locally-owned from which 17 were engaged in diffusion and assembly and 44 only in assembly. These diffusion facilities (i.e. wafer fabrication) were found only in Hong Kong, South Korea and Taiwan)[19].

This is not to deny the upgrading in the in-bond operations in Mexico. It is estimated that one third are involved in microelectronics production or component processing, and most of these are subsidiaries of big TNCs like General Instrument, General Electric, GTE-Sylvanna, RCA, Honeywell and Motorola. As noted above, and contrary to public belief, these plants are not traditional sweatshops. There are technologically advanced operations even in the context of intracorporate division of labour. Automated component insertion, soldering, and quality control technologies are common in the plants (Brown and Dominguez, 1989; Palomares and Mertens, 1987, 1988; Pena and Cardenas, 1988; Sklair, 1989).

e) Labour force: gender relations and skill.

As in the case of other FPZs in the world, one of the striking aspects of in-bond activities is the high proportion of females in the labour-force. In the case of Mexico as in East Asia, low wages are not the only reason to prefer women. There has been a good deal of research on this kind of industry, which, from an anti-TNC view perspective, analise the role of women in the NIDL[20]. These analyses generally focus their critics to assembly activities in a set of factors.

First, the hiring practices of assembly plant managers. Social and cultural stereotypes of docile and uncomplaining women apply here (see Frobel et.al, 1981; Fuentes and Ehrenreich, 1987; Kelly, 1986; Pena and Cardenas, 1988; Porpora et.al., 1989; Robert, 1983; Sassen, 1988; among others and the bibliography compiled by Sklair, 1988). These plants

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19 Japanese and European semiconductor plants were excluded from the study by the author, but is is estimated that there were about 25-30 in 1985.

20 See for example the works of Frobel et.al., 1981; Fuentes and Ehrenreich, 1987; Lim, 1987; Porpora, et.al., 1989; Robert, 1983; Sassen-Kobb, 1987; among others and the commentated bibliography elaborated by Sklair, 1988.

tend to select their women workers from the younger age groups, for the following reasons:

> "Women's economic weakness and social subordination make them easier to control than men. Female labour is considered to be more docile and subdued than male and better able to perform monotonous, repetitious and badly-paid activities. They are also less inclined to join trade unions. The criteria used in the selection of workers are quite unambiguous: 'the labour which is employed is that which demands the least remuneration, provides the maximum amount of energy (i.e. fresh labour which can be expected to work at high intensity) and which is predominantly unskilled or semiskilled" (Robert, 1983:28-29).

In the words of a electronics plant manager "the man in Mexico is still the man. This kind of job is not doing much for his macho image. It's just a little quirk of a different culture, They'd rather run a factory.." (quoted in Fuentes and Ehrenreich, 1987:211). This routinary, repetitive and delicate tasks which require great concentration and manual dexterity it is thought to be unsuitable for men's capabilities. Specifically, line speed up, characteristic of the Neo-Fordist organizational form, increases worker health problems and turnover rates. So, for the plant it is easier to control women through various mechanisms as the exploitation of traditionally defined attributes of femininity, passivity, submissiveness, sentimentality, and sexual desirability. On the one hand it is reported a pattern of sexual harassment to hire or maintain a worker in the job (see for example Kelly, 1986 and Pena and Cardenas, 1988). On the other hand, to increase company loyalty, productivity and avoid unified strength among female workers, plants seek to increase competitiveness through the organisation of beauty competitions and a wide range of social activities which in some cases include families (Sklair, 1989).

Second, the pronounced gender division of labour within plants leaves no place for an upgrading of the skill of the labour force, rather assembly productions causes the 'deskilling' of the workers. That is, there is a polarisation of the skill structure of the industry. Pena and Cardenas (1988) quote several studies on assembly activities. Regarding in-bond plants in Mexico, one of the studies identifies 13 basic job positions in the typical plant. The top eight positions (from mechanic to plant manager) are found to be dominated by male workers. On the contrary, women predominate in the two lowest job positions: "80-95 per cent of assembly line operator and 100 per cent of the soldering operator positions are occupied by women. These job positions are subject to the highest levels of speed up, continuous process supervision, and hazardous toxic and environmental stress exposure in the entire industry" (p. 95). With the low-wages, in many cases insufficient to cover the costs of basic subsistence; low contributions of employers to social security provisions; and the inadequate safety standards, the in-bond activities guarantee low production costs at high productivity levels at the expense of the female worker whose capabilities and energies become prematurely exhausted without the acquisition of relevant skills which may enable her to upgrade or maintain her position in the labour market (Robert, 1983:33).

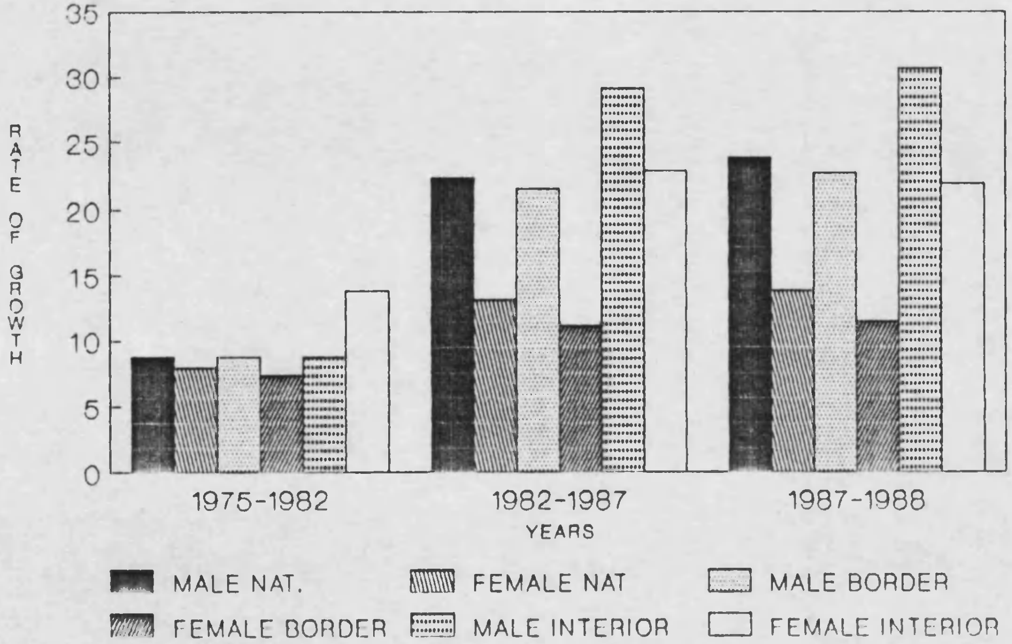
Third, the in-bond industry workers (and workers in other FPZs in general) are not drawn from the traditionally unemployed and underemployed but from a new pool of labour generated by the industry itself, that is the female workers. So the contribution of the industry to the generation of employment and lessening of internal and international migration, one of the main goals of the BIP has not been met with the establishment of in-bond plants. Sklair points out that "evidence around the world strongly leads to the conclusion that most of the young women who work in the assembly industries do so as their first experience of paid employment, and that there are practically no other jobs in manufacturing industry open to them" (1989:168). However, Sklair warns against the sophisticated image of the in-bond industry worker given by the propagandists, of young women spending their salaries in fashionable clothes and cosmetics in the US border cities. Actually, there is also evidence that many assembly workers in Mexico and other locations in the world are the sole wage earners in their families and have, in consequence, little or not remaining income for such expenditures (see for example, Kelly, 1986; Porpora et.al., 1989).

From table 4.16 can be seen that female operatives have accounted for almost two thirds of the employment in the in-bond industry as a whole and in the border and interior plants. However, as Grunwald (1985) and others affirm there is no basis for the assertion that women workers have greater manual dexterity than men for delicate assembly operations or that they are less combative than male workers. Sklair quotes some studies on the 'docility' image of the in-bond industry female workers which suggest that "they are prepared to take their complaints in substantial numbers, and presumably at some risk to themselves, to the authorities" (p. 173). Likewise, the steady increase in the number of male operatives within the industry shows that company managers are willing to employ male workers as well, as it is clear that they are as able as women to perform assembly activities (see graph 4.5).

With regard to the participation of women in the in-bond electronics industry, table 4.17 shows that is higher than in the in-bond industry as a whole though is also decreasing. In 1980 almost 70 per cent of work-force were females but by 1988 this share had decreased to 55 per cent (against 67 and 51 per cent for the in-bond industry as a whole for the same years, see table 4.16).

In the in-bond electronics industry located in the border states the share of females in the labour force is the same as in the electronics industry, 69 per cent in 1980 and 55 per cent in 1988, again higher than the in-bond industry located in the border.

GRAPH 4.5
FEMALE LABOUR IN THE IN-BOND INDUSTRY
Rates of growth, selected years.



SOURCE: Table 4.15.B (see Appendix II)

TABLE 4.16. Employment in the In-bond Industry by Geographical Location of Plants and Category, 1975-1988.
(percentages)

	NATIONAL TOTAL						BORDER STATES(a)						INTERIOR STATES					
		OPERATIVES			TECHNICIANS	STAFF		OPERATIVES			TECHNICIANS	STAFF		OPERATIVES			TECHNICIANS	STAFF
YEAR	TOTAL	Subtotal	Male	Female			TOTAL	Subtotal	Male	Female			TOTAL	Subtotal	Male	Female		
1975	100	86.1	18.7	67.4	8.8	5.1	100	86.5	18.7	67.8	8.4	5.1	100	80.7	18.4	62.4	13.7	5.5
1976	100	86.8	18.4	68.4	8.3	4.9	100	87.1	18.7	68.3	8.1	4.8	100	84.4	14.9	69.6	9.7	5.9
1977	100	86.9	19.1	67.8	8.1	5	100	87.3	19.7	67.6	8	4.7	100	83.4	13.9	69.5	9.3	7.3
1978	100	86.6	20.1	66.6	8.3	5.1	100	87	20.7	66.3	8.2	4.8	100	83.1	14.5	68.6	9.4	7.5
1979	100	86	19.7	66.3	8.6	5.4	100	86.5	20.1	66.3	8.5	5	100	82.3	16.1	66.2	9.3	8.5
1980	100	85.3	19.4	66	9.1	5.6	100	85.7	20.1	65.6	9	5.3	100	82.4	13.6	68.9	9.5	8.1
1981	100	84.5	19.1	65.4	9.6	5.9	100	85	19.7	65.2	9.5	5.6	100	80.9	13.9	67.1	10.5	8.6
1982	100	82.9	18.9	64.1	10.5	6.5	100	83.4	19.6	63.8	10.6	6	100	79.2	13.1	66.1	10.3	10.5
1983	100	83	21.2	61.8	10.8	6.1	100	83.4	22	61.4	11	5.7	100	80.4	15	65.5	9.7	9.9
1984	100	82.9	24.1	58.7	11.2	5.9	100	83	25.3	57.7	11.4	5.6	100	82.1	15.4	66.7	9.4	8.5
1985	100	82	25.4	56.6	11.8	6.2	100	82.1	26.7	55.4	12	5.9	100	81.7	16.7	64.9	10.3	8.1
1986	100	81.6	25.9	55.7	12.2	6.2	100	81.9	27.7	54.2	12.2	5.9	100	80.3	16.5	63.8	11.9	7.9
1987	100	81.5	27.7	53.8	12	6.5	100	81.7	29.7	52	12.1	6.2	100	80.5	18.6	61.9	11.7	7.9
1988	100	81.6	30	51.5	12	6.4	100	81.6	32.3	49.3	12.2	6.2	100	81.6	20.6	60.9	11.1	7.3

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.

SOURCE: Table 4.16.A.

TABLE 4.17. Employment in the In-bond Electronics Industry by Geographical Location of Plants and Category, 1975-1988(a).
(percentages)

YEAR	ELECTRONICS INDUSTRY TOTAL	OPERATIVES Subtotal	OPERATIVES Male	OPERATIVES Female	TECHNICIANS	STAFF	ELECTRONICS INDUSTRY IN BORDER STATES(a) TOTAL	OPERATIVES Subtotal	OPERATIVES Male	OPERATIVES Female	TECHNICIANS	STAFF	ELECTRONICS INDUSTRY IN INTERIOR STATES TOTAL	OPERATIVES Subtotal	OPERATIVES Male	OPERATIVES Female	TECHNICIANS	STAFF
1979	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
1980	100	83.8	14.8	69	10.2	6	100	84.4	15.1	69.3	10.1	5.5	100	79	12	67	11.3	9.7
1981	100	82.9	14.8	68	10.8	6.4	100	83.5	15	68.5	10.6	5.9	100	77.1	13.2	63.8	11.9	11
1982	100	80.7	14.4	66.3	12.2	7.1	100	81.3	14.8	66.4	12.3	6.4	100	76.1	11.2	64.8	11.2	12.7
1983	100	80.4	15.9	64.5	12.7	6.8	100	80.7	16.3	64.3	13.1	6.2	100	78.3	12.9	65.4	10.1	11.5
1984	100	82.9	18.7	64.3	13.4	6.5	100	80.7	19.2	61.4	13.6	5.8	100	103.5	13.6	89.9	12.4	12.6
1985	100	78.7	18.4	60.3	14.6	6.7	100	78.9	19.4	59.5	14.9	6.2	100	77.7	12.2	65.4	12.5	9.9
1986	100	78.7	19.4	59.2	14.7	6.6	100	78.9	20.2	58.7	14.9	6.2	100	77.3	15.2	62.1	13.4	9.2
1987	100	78.8	21.4	57.4	14.3	6.9	100	79.1	22.3	56.8	14.3	6.6	100	77	16.5	60.5	14.2	8.8
1988	100	79	23.5	55.4	14.1	6.9	100	79.4	24.4	55	14.1	6.5	100	76.7	19.3	57.4	14.1	9.2

(a) Corresponds to the sectors Electrical and electronic machinery, equipment and parts, and Electrical and electronic apparatus, articles and accessories.
(b) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.
SOURCE: Table 4.17.A.

However it is interesting to note that the utilisation of female labour force in the electronics in-bond industry located in the interior is lower than the in-bond industry located in the interior, in 1980 67 per cent of the work force in electronics was female and by 1988 decreased to 57.4 per cent (against 62 and 60 per cent for the same years in all the in-bond plants located in the interior).

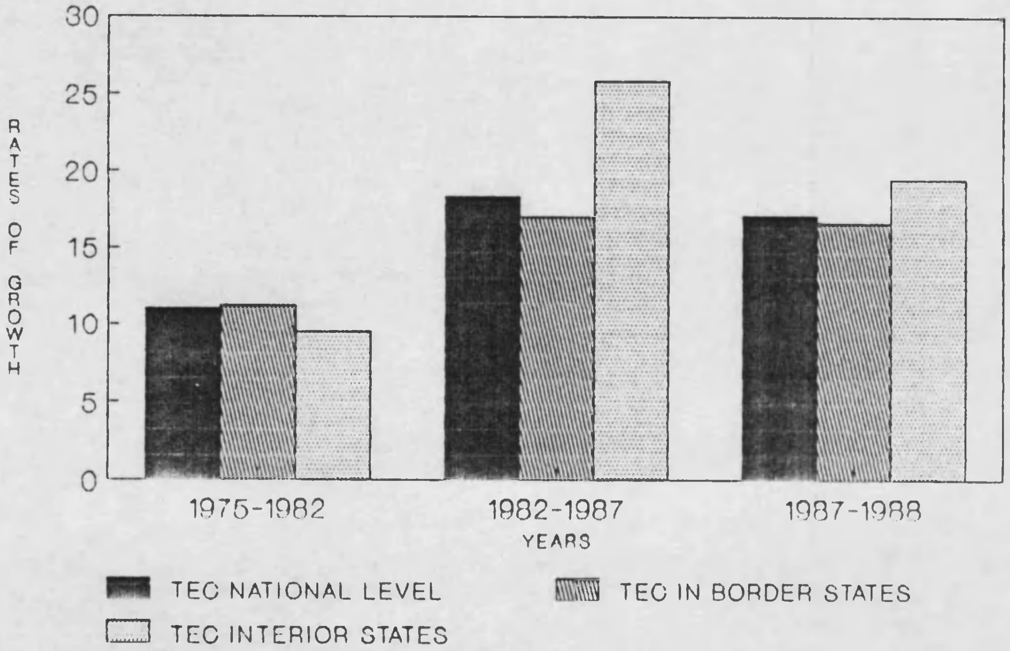
The decrease in female participation in electronics industry responds to the same trends noted with regard to the in-bond industry as a whole, an increase in male participation and increase in the number of technicians and staff (see graphs 4.6, 4.7 and 4.8). However, in terms of the dynamic of growth, the number of males and technicians in the electronics in-bond industry is increasing at a lower pace than in their counterparts in the industry as a whole.

For example, between 1982-1987 male participation in the in-bond industry grew at a yearly average rate of 22.3 per cent whereas in the electronics in-bond industry did it at 17.4 per cent (see tables 4.15.B and 4.17.B in Appendix II). Likewise, for the same years, number of technicians grew at a yearly average rate of 18.3 per cent in the in-bond industry as whole and 13.4 in the electronics subsector (see tables 4.15.C and 4.17.C in Appendix II).

Among the reasons argued regarding the increase in male workers is that the pool of female labour is drying up (so in-bond plants are forced to employ men) and that the expansion of metal products industries has increased the opportunities for male workers (Sklair, 1989:176). Thus the higher rate of growth in the in-bond industry than in the electronics sector.

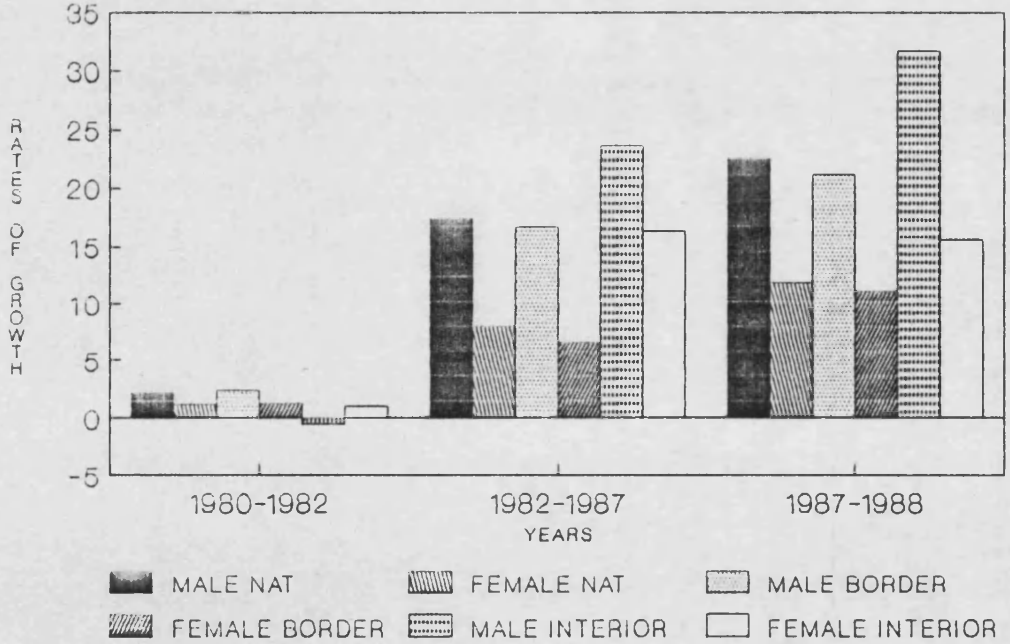
It is interesting to note that Rivera-Batiz (1987) holds the view that the higher male-female labor ratios in the border plants means that assembly plants are supplying jobs with some advancement opportunities and with non-menial tasks, different from the kind of jobs provided by traditional plants, thus

GRAPH 4.6
TECHNICIANS IN THE IN-BOND INDUSTRY
Rates of growth, selected years.



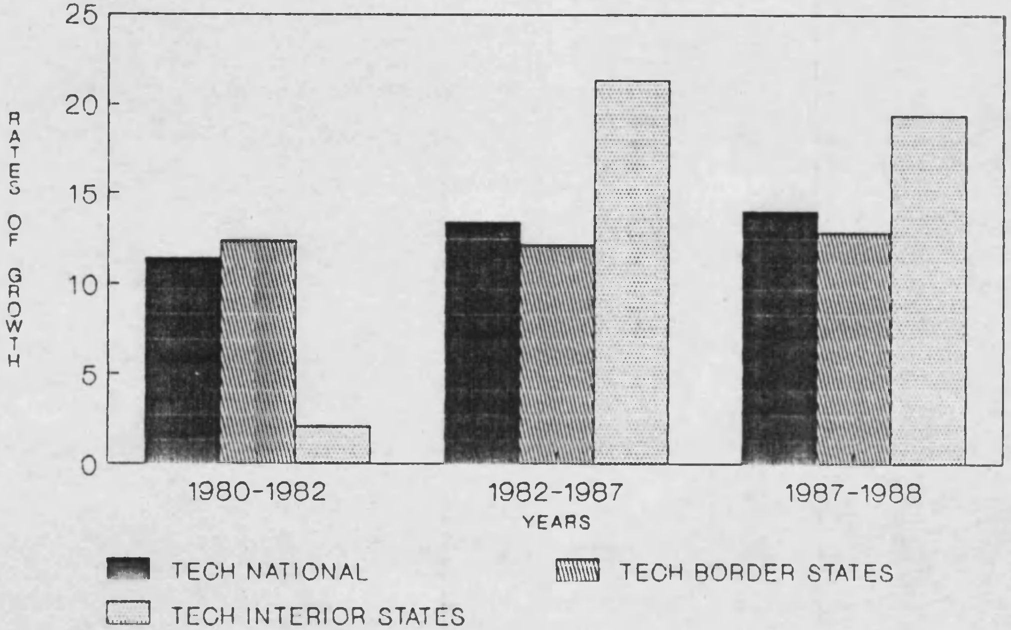
SOURCE: Table 4.15.C (see Appendix II)

GRAPH 4.7
FEMALE LABOUR IN THE ELECT. IN-BOND IND.
Rates of growth, selected years.



SOURCE: Table 4.17.B (see Appendix II)

GRAPH 4.8
TECHNICIANS IN THE ELEC. IN-BOND IND.
Rates of growth, selected years.



SOURCE: Table 4.17.C (see Appendix II)

increasing internal migration and discouraging international migration to US (p. 264). I cast a doubt on this aspect, since surveys on migration to the US show that the majority of the migrant workers are coming from rural areas, are unskilled and generally employed in agricultural seasonal jobs, service (maids, cleaners, etc) and other menial activities (see Sklair, 1989, chapter 8).

Another trend which is becoming apparent in the in-bond industry (apart from the rise in male workers) is the increasing participation of the technical and staff workers which implies that the industry is performing labour-intensive processes which require greater skill from the workers and more technical support. Table 4.16 above shows that from 1975 to 1989 technicians and staff have steadily increased in numbers and proportion (see also table 4.16.C in Appendix II for rates of growth). This growth being greater in the plants located in the interior (graph 4.6 above).

There is a great incentive to employ Mexican staff and technicians since they are much cheaper than the equivalent personnel in the home countries, they speak Spanish and are also more familiar with the environment. In the border cities, in-bond assembly plants have been responsible for a good deal in the upgrading of personnel through ' supporting and, in some cases, organising training courses in technical colleges. Also universities and other educational establishments have expanded their supply of technical and professional education according to the in-bond industry requirements. However, it is a fact that the booming border cities face, since the late 1970s, bottlenecks in infrastructure, public services and educational establishments which threaten the smooth growth of the industry in that region.

Regarding the electronics subsector, the participation of technicians is lower than in the in-bond industry as whole. It is possible that the type of labour processes involved in electronics production as well as the high requirements in terms of quality of inputs and products is preventing the firms from upgrading the production processes located in Mexico due to an unnumber of circumstances, specially shortage of technicians and engineers with the required skill and lack of specialised services (e.g. maintenance and repairment of sophisticated machinery and equipment) which itself requires qualified personnel. However, this is not to say that the production processes in the electronics in-bond industry are just mere assembly of devices and components. It is true that they not involve the sophistication levels found in the Asian NICS but they are upgrading. The study of Brown and Dominguez (1989) about new technologies in the in-bond industry reveals that, in a sample of 20 plants (half of it electronic plants), there were 286 units of microelectronic machinery; 37.5 percent were computerised numeric control units for soldering, moulding or injection of plastic materials; 40.2 per cent were robot for assembly and insertion and the rest robots for testing and handling of materials (p. 219).

d) Patterns of Specialization.

One important aspect in any study on industrial location is the existence of patterns of specialisation. As studies on the semiconductor industry in particular (Henderson, 1989; Scott, 1987) and on the electronics industry in general (Dicken, 1988a; Sawyer and Morgan, 1987; Todd, 1990) show:

> "the NIDL no longer consists of a simple bipartite division between the economies of the capitalist core and those of the world periphery. Rather, it has evolved into a complex spatial system with many different hierarchical levels and sub-regional articulations" (Scott, 1987:156).

In these analyses it can be found that the NICS and New-NICs have a combination of natural resource endowments, lower cost skilled labour and, in most of the cases, a widespread institutional support which places them at competitive advantage if specialised in given labour processes. Specialisation, in time, leads to upgrading of the production processes there performed. Therefore, the process of industrialisation is one of historical spread and emergence of specialisations inter- and intra-countries.

Moreover, despite all the arguments given by some analysts (Kaplinsky, 1984; Sanderson, et.al., 1987; among others), there is no evidence that automation of production processes in the electronics is resulting in the repatriation of production back home. As discussed in chapter II, manufacturing of electronic products will continue to expand in the NICs and the New-NICs and the use of computerized automation technologies is penetrating into a very select group of NICs (see Ernst, 1985 and 1987; Duncan, 1981 for semiconductors; the works of Scott, 1987 and Henderson, 1989 for the Asian NICs and Brown and Dominguez, 1989; Palomares and Mertens 1988 and Sklair, 1989 for Mexico).

Regarding the subject here, the existence of specialisations, it can be observed for instance that, "Hong Kong and Mexico have significant capacity for the assembly of discrete devices, whereas Malaysia, Philippines and Thailand concentrate heavily on the assembly of integrated circuits, especially advanced memory and microprocessor products" (Scott and Angel, 1988:1063). The analysis of Sanderson et. al., in which a model is developed, shows that "for the range of generally less-sophisticated products currently assembled there, Mexico retains its cost advantage for all volumes considered. However, for volumes exceeding 310 000 units per year, US flexible assembly begins to show lower unit costs than manual assembly in Singapore" (1987:140).

Unfortunately there is a lack of disaggregated data by product and cities in the official statistics of in-bond activities. Therefore I will have to rely on the analysis of Puebla (1988) who, according to data of 1986 obtained from the Flagstaff Institute in Arizona, affirms that from the 133 products assembled by the in-bond industry and imported by US under items 806/806, the electrical and electronic subsector had the highest share, with 58 products imported with a value-added of US$713.1 million dollars or 56.5 per cent (see tables 4.18 and 4.19).

TABLE 4.18: Mexico: In-Bond industry's most competitive products by customs district (USA) in 1986. (Value-Added in Items 806/807, millions of dollars)

PRODUCT	NO. OF COMPETIT. PRODUCTS	MEXICO TOTAL	CUSTOMS DISTRICT IN US-MEXICO BORDER SAN DIEGO	NOGALES	EL PASO	LAREDO
Clothing	20	15.3	7.6	1.7	5.5	0.5
Footwear	10	0.2		0.2		
Non-electrical mach.	3	6.4	0.2	3	1.6	1.6
Office equipment	24	63	17	28.3	5.1	12.6
Electrical and electronic	58	713.1	93.7	95.1	286.5	237.8
Transportation equipment	10	458.5			47.2	411.3
Others	8	4.7	3.9			0.8
TOTAL	133	1261.2	122.4	128.3	345.9	664.6

SOURCE: L F Puebla, 1988: Table 3.

TABLE 4.19: Mexico: In-Bond industry's most competitive products by customs district (USA) in 1986. (Value-Added in Items 806/807, percentages)

PRODUCT	NO. OF COMPETIT. PRODUCTS	MEXICO TOTAL	CUSTOMS DISTRICT IN US-MEXICO BORDER SAN DIEGO	NOGALES	EL PASO	LAREDO
Clothing	20	1.2	6.2	1.3	1.6	0.1
Footwear	10	0	0	0.2	0	0
Non-electrical mach.	3	0.5	0.2	2.3	0.5	0.2
Office equipment	24	5	13.9	22.1	1.5	1.9
Electrical and electronic	58	56.5	76.6	74.1	82.8	35.8
Transportation equipment	10	36.4	0	0	13.6	61.9
Others	8	0.4	3.2	0	0	0.1
TOTAL	133	100	100	100	100	100

SOURCE: L F Puebla, 1988: Table 4.

Each of the four US customs district along the Mexican Northern border, through which the products of in-bond go into US, is associated with one or more Mexican border city so it can be drawn an idea of the presence of specialisations in production along the border. However, the analysis should be taken with care since some products coming from locations in the interior (specially heavy, bulky ones) are exported to US through one of these border cities, specially Ciudad Juarez terminal point in Mexico of the Panamerican motorway.

San Diego customs district registers the value-added generated in Tijuana and Mexicali and other minor localities such as Tecate and Ensenada in Baja California state. Nogales district in Arizona mainly accounts for the value-added generated in Nogales and Agua Prieta in Sonora state. El Paso, Texas is associated with Ciudad Juarez in Chihuahua state (but also registers exports coming from Chihuahua City). Finally Laredo accounts for the value-added of Piedras Negras, Nuevo Laredo, Reynosa, Matamoros and other minor locations (see figure 4.1).

As can be seen in table 4.19, electrical and electronics products accounted for more than three quarters of value-added in the exports to US through San Diego, Nogales and El Paso customs districts, 76.6, 74.1 and 82.8 per cent respectively. However, considering the geographical distribution of value-added in the electrical and electronics subsector, El Paso and Laredo accounted for the highest shares (40.2 and 33.3 per cent respectively, table 4.20).

TABLE 4.20: Mexico: Geographical Distribution of Exports by product and customs district (USA) in 1986.
(Value-Added in Items 806/807, percentages)

PRODUCT	NO. OF COMPETIT. PRODUCTS	MEXICO TOTAL	CUSTOMS DISTRICT IN US-MEXICO BORDER SAN DIEGO	NOGALES	EL PASO	LAREDO
Clothing	20	100	49.7	11.1	35.9	3.3
Footwear	10	100	0	100	0	0
Non-electrical mach.	3	100	3.1	46.9	25	25
Office equipment	24	100	27	44.9	8.1	20
Electrical and electronic	58	100	13.1	13.3	40.2	33.3
Transportation equipment	10	100	0	0	10.3	89.7
Others	8	100	83	0	0	17
TOTAL	133	100	9.7	10.2	27.4	52.7

SOURCE: L F Puebla, 1988: Table 4.

According to Puebla (1988) Mexico has a competitive advantage in 133 products of the Tariff Schedule of the United Sates shown in table 4.18 in comparison to 30 other developing countries (p. 51). Table 4.21 shows (see table 22 in Appendix II for absolutes), within the electrical and electronics subsector, the overwhelming share of electrical ignition equipment for internal combustion engines, 23.6 per cent of the value-added generated by in-bond plants; rectifiers, 8.5 per cent; electrical insulated conductors, 8.0 per cent; radio-broadcasting transmitters-receivers, 8.1 per cent and to a lesser degree, TV sets (7.7 per cent) and mainboards for personal computers (7.35 per cent).

In San Diego the most important products in terms of value-added generated in that area (i.e. Tijuana and Mexicali) were electrical generators (10.52 per cent), rectifiers (14.9 per cent), telephonic terminals (7.8) and mainboards for PCs (7.3). In Nogales, the most important products were TV sets (20.5), radio sets (21.5) and electrical insulated conductors (25.7). In El Paso the most important single product was electrical ignition equipment for internal combustion engines (51.4 per cent) followed by rectifiers (9.9 per cent). In Laredo the most important products in terms of value-added generated in that area were radio-broadcasting transmitters-receivers (24.37 per cent) and mainboards for PCs (19 per cent) (table 4.21).

Although not quite conclusive the evidence points towards the incipient emergence of specialisations in the border cities. According to some analysts, the specialisations emerging in the electronics in-bond assembly plants along the Mexican Northern Border seem to be associated with the place of origin of the firms' headquarters in the US. Puebla affirms that the location of the in-bond plants established in Baja California state depends on decisions taken in San Diego and los Angeles California. The location of those in Nogales and Agua Prieta depends on decisions from Northern California whereas those in El Paso depend on decisions taken in the

TABLE 4.21: Mexico: In-Bond Industry, Value-Added in Electronics and Electrical Products by Customs District, 1986. (Items 806/807, percentages)

SITC CATEGORY (Rev.2)	TOTAL MEXICO	SAN DIEGO	NOGALES	EL PASO	LAREDO
TOTAL	100	100	100	100	100
1. Personal computers mainboards (752.4)	7.35	7.37	0	0	19.13
2. Television sets (761)	7.71	1.19	20.55	8.2	4.54
3. Radio-braodcast sets (762)	3.56	1.31	21.58	0.43	1
4. Telephonic terminals (764.1)	1.03	7.81	0	0	0
5. Telephonic apparatus (764.1)	0.39	0	0	0.97	0
6. Microphones (and stands therefor) Loudspeakers and audio-frequency electric amplifiers (764.2)	0.56	2.06	0.28	0.22	0.48
7. TV transmitter-receivers (764.3)	0.25	0	0	0	0.75
8. Radio-broadcasting transmitters-receivers (764.3)	8.13	0	0	0	24.37
9. Radiotelephonic and radiotelegraphic transmitters (764.3)	0.01	0.06	0.01	0	0
10. Other parts and accessories falling within heading 76 (764.9)	0.93	6.27	0.04	0.24	0
11. Tuning parts for TV sets (764.93)	3.15	0	0.16	1.82	7.2
12. Parts and accessories for sound recorders (764.99)	1.39	1.32	0.01	0	3.63
13. Parts and acc. elec. (764.9)	2.55	7.72	0.45	2.25	1.71
14. Cassetes (764.99)	0.16	0	1.17	0	0
15. Rectifiers (771.21)	8.55	14.98	3.52	9.87	6.43
16. Inductors (771.22)	2.84	3.14	3.72	3.12	2.03
17. Lightning arresters (772.1)	0.06	0.41	0	0	0.03
18. Control panels (772.1)	0.12	0.31	0	0.2	0
19. Switchboards (772.1)	2.2	0.3	0.13	1.55	4.56
20. Switches (772.1)	2.29	6.87	0.22	2.75	0.75
21. Other connectors (772.1)	1	4.92	0.08	0.81	0.04
22. Resistors (772.3)	1.57	7.81	0.01	1.21	0.17
23. Other electrical apparatus (772)	5.3	7.62	7.12	5.43	3.5
24. Electrical insulated conductors (773.1)	8.07	7.33	25.71	7.19	2.36
25. Light emmiting diodes (776.3)	0.04	0	0	0.11	0
26. Transistors and similar semiconductor devices (776.3)	1.22	0.42	7.47	0.42	0.01
27. Microprocessors, MOS (776.4)	0	0.01	0	0	0
28. Integrated circuits (776.4)	0	0	0	0	0
29. Piezo-electric crystals (776.8)	0.04	0.02	0	0	0.1
30. Parts of semiconductors (776.89)	0.01	0.03	0	0.02	0
31. Parts of cathode-ray (776.89)	0.69	0	0	0	2.08
32. Electrical Engines (778.31)	0.7	0.1	0	0.41	1.57
33. Electrical generators (778.31)	2.88	10.52	7.02	1.08	0.37
34. Electrical starting eq. (778.31)	1.67	0.08	0.2	0.22	4.62
35. Electrical ignition eq. for internal combustion engines (778.31)	23.62	0.02	0.55	51.48	8.57

SOURCE: L F Puebla, 1988: Table 16.

North-east states of United States (1988:55). However, the analysis of Clement and Jenner (1987) found that in the case of Baja California, in 1986, 79.3 per cent of the in-bond plants had headquarters in Southern California, 12.8 per cent from other states in the US and only 1.2 per cent had headquarters in Northern California. The latter case rather strange considering that half the employment in the electronics subsector is located in that area (mainly Silicon Valley) (p. 85). Sklair affirms that, according to a study of the commerce department of the State of California almost 8 out 10 US parent corporations of Baja California in-bond plants were, in fact, located in Southern California (1989:85). Puebla also quotes another analysis on the in-bond plants located in Sonora state which at the beginning of the BIP had close linkages with firms from Arizona which actually were from the North and North-east of US. From 1970 onwards the origin of the in-bond plants starts to diversify and nowadays there are plants with headquarters in Northern California, particularly Silicon Valley (1988:58-59).

3. <u>CRITICISMS AND PROSPECTS FOR THE IN-BOND INDUSTRY.</u>

As the in-bond industry consolidated in Mexico as important generator of employment and foreign currency, attention was focused on several aspects of its development. Since the early seventies, researchers, policy-makers and politicians have elaborated a sort of criticisms and forecasts trying to prevent or to attract the location of in-bond plants. It seems to me that it is unquestionable that the tendency of internationalization of capital will accentuate and with it the expansion of this kind of activities in Third World countries as noted in chapter III. Therefore, in as much as competition increases Mexico can take advantage of this process by improving its advantages in terms of location of in-bond industry and trying to avoid or to control the negative side of this kind of industry by an appropriate industrial policy.

Let me give an outline of the main criticisms and prospects for the in-bond industry before drawing some conclusions on the development of the in-bond electronics industry in Mexico.

a). Criticisms.

During the whole period, in-bond plants have received a lot of criticisms from both Mexican and US unions, politicians and academics. In general terms the main arguments are:

i) The absence of significant linkages of assembly activities to the Mexican economy;

ii) the effects on the labour force and society;

iii) the vulnerability of in-bond plants to swings in the US business cycle and their general dependency on decisions made outside of Mexico;

iv) the net loss of jobs in US plants because the opening of in-bond plants in Mexico.

In the case of (i) and (ii), it is argued that the in-bond industry is important for the Mexican economy, in as much as Mexican industrial suppliers, plant managers, technicians, supervisory personnel and workers take their improved skills and experience to firms in the national economy (Clement and Jenner , 1987:11). With regard to the transfer of technology issue, Sklair points out that

> "Each main maquila has its own examples of state-of-the- art technology where some genuine technology transfer appears to be taking place. The Matsushita TV maquila in Tijuana is said to be one of the most modern assembly facilities in the world, incorporating the most advanced techniques and processes. Emermex in Mexicali produces what are probably the most sophisticated transformers and uninterruptible power supply assemblies in Mexico. Elamex printed circuits has "UL" and "MILSPEC" approval, and with the introduction of surface mount technology, claims to be competitive for quality

> with any PC board manufacturer in the world. The Allied Bendix maquila, Aerotech Matamoros, assembles and fabricates rotating aircraft components to the most exacting standards. And in Chihuahua City, the Westinghouse maquila, Sistemas Electronicos, works to a complete system of military specifications" (1989:212).

Although the author does not consider this upgrading in the production processes performed by in-bond plants genuine transfer of technology, rather a relocation of technology, I shall point out that there has been an upgrading of production processes and some transfer of technology, if minor, may be taking place in the in-bond industry. The increasing number of technicians in in-bond plants as well as the number of microelectronic machinery (computerised numeric control units for soldering, moulding or injection of plastic materials; robots for assembly, insertion, testing and handling of materials), could, in time, have a positive impact in the Mexican industry in terms of the skills learned and technology.

However, it is impressive the failure of the Mexican industry, which by the late 1980's was operating at 60 per cent of capacity due to the recession, to supply the needs of in-bond plants along the US border. The share of domestic materials and supplies has been small, around 1.5 per cent of the total use of components and materials during the period 1975-1989, mainly due to the deficiency of Mexican suppliers (quality control, deliveries, production capacity, etc.) (Grunwald, 1985:161) and because Mexicans have not pursued the business opportunities in the exploding in-bond industry (Sklair, 1989; Szekely, 1989).

These problems could be solved in the mid-term since the prospects for the creation of a free-trade area with US and committing of Mexico to free-trade may force the Mexican industry to improve its efficiency. In addition, as noted before, there is idle industrial capacity which can undertake production to supply in-bond plants provided it is given the proper financial incentives and technical support. Also there were arguments about the advantages of in-bond plants, for instance, the amount of foreign currency, the multiplier effects on the regional economy (because of the expenditures on land, buildings, utilities, services, employees expenditures, etc) (Clement and Jenner, 1987:11).

In the case of (iii) and (iv), the arguments abound, for example the AFL-CIO, affirms that in-bond plants is a "pirating" of US jobs sanctioned by the Mexican government (La Jornada, newspaper, January 6, 1987). Some congressmen and the AFL-CIO have expressed their hostility to the BIP and to the eventual creation of a free-trade area between Mexico and US advocating protectionist measures arguing that there is a net loss of jobs in US as a result of the actual and potential US investment in Mexico's in-bond plants (El Financiero, newspaper, December 3, 1987; Financial Times June 11,1990).

It should be noted that these linear views are misleading. There are numerous factors influencing the location of in-bond plants. The fluctuations in the worldwide economy and trade, the search for increasing competitiveness and the development of new technologies in production processes, the Mexican exchange rates, and the relative profitability and pricing of the assembled products in the world trade, among others. This could lead to a redistribution of world production capacity with or without affecting jobs either in the US or in Mexico. Sklair points out that US defendants of a free-trade agreement with Mexico in general and of the in-bond activities in particular argue a set of reasons to promote these activities. First, those who established production or assembly facilities had not real alternative, it is survival, not super profits what was in play due to increased competition from low-wage areas, mainly from Asia. Second, the proximity of Mexico means that it makes a good sense to use US materials, equipment, components and services for the in-bond plants. Thus, third, far from causing job losses in the US the in-bond activities save US jobs that could otherwise be lost in the production of materials, equipment, components and services for in-bond plants (1989:47).

b). Prospects.

The prospects for the industry seem to be bright in the years to come. Several journalists as well as academics and politicians point out positive factors for the further development of the in-bond industry. Among the these factors are: "i) geographical proximity to the US, ii) entry level wage, iii) rapidly available American technical support, iv) increased Mexican managerial and technical capability, v) familiarity with an increasing flexibility of Mexican government operating procedures, and vi) continued application of US tariff items 806.3 and 807.00 as well as the expansion of US markets (Hodak D, 1984:69).

Despite the negative factors of the 1980's such as inflation, labour and infrastructure bottlenecks, in-bond plants steadily expanded throughout the period against some analysts forecasts which doubted about Mexico's capacity to attract companies Although, the increasing protectionism of US could cut down the expansion of in-bond industry in Mexico through eliminating all or part of the products under items 806.30 and 807.00 in the Tariff Schedule of the United States. As noted in previous chapters some fractions of U. S. Congress argue that in-bond plants mean a net loss of jobs in US. However, the American Chamber of Commerce defends in-bond activities under the following considerations:

i) A great amount of direct employment in U. S. depends on in-bond plants in Mexico[21].

ii) In-bond plants use around 65 average per cent of material and components produced in US. From 1984 to 1985

[21] See chapter III, footnote 10.

165 000 high-skilled jobs were created in US because the in-bond plants in Mexico (El Financiero, Dec 3, 1987).

iii) Mexico has an advantage in wage levels US$1.30 per hour while in US the average wage is from US$5.20 to $13.09 per hour and in Asia -Taiwan, South Korea, Hong Kong and Singapore- the average wage per hour is about US$2.3 (Punto Weekly Magazine, August 31, 1987).

The US defenders of the in-bond industry argue that if it is not allowed the expansion of their in-bond activities it would mean a net loss of US jobs. Also, US companies would be less competitive in comparison with Japan, South Korea, Hong Kong and so on (La Jornada, January 6, 1987). The controversy about in-bond plants could become even more tangled as a result of the proliferation of Japanese and, to a lesser extent, South Korean assembly plants on the border. Yet the US administration has a great interest in Mexico's economic stability and prosperity so it strongly pressed for the creation of the free-trade area (Financial Times, June 11, 1990).

Nonetheless, the prospects for the industry seem to be more positive than negative. Despite the declining of US investment in in-bond plants, today there is an increasing interest of companies from other countries as Japan, South Korea, United Kingdom, France and Finland to invest in-bond industry. For instance, Japanese companies want to establish in-bond plants in Mexico as a platform for entry to US markets. Among the main companies are Sanyo, Matsushita, Sony and Hitachi which choose the Pacific Mexican Coast as a best location. There are other companies which manufacture photographic equipment, cars and motorcycles and components and electronics. Actually, Japanese is the second Mexico's biggest investor, after the US and its stake is increasing rapidly. However, US is by large the major investor in Mexico in in-bond plants.

The Japanese interest is due to the great growth in the exchange rate of the yen related to the US currency. In 1987, there were 1545 in-bond plants, whose capital was 52 percent from US, 45 per cent local capital and 3 per cent from other countries (El Financiero, July 20, 1987). Likewise, Japanese firms want to take advantage of Mexican locations before the announced formation of a common market including US, Canada and Mexico. As noted earlier, Japanese firms are specially interested in the proximity of the State of California which has the major share of Japanese investment in the US (El Imparcial, newspaper, June 6, 1987).

4. CONCLUSIONS.

The preliminary conclusions of this examination on the Mexican electronics industry are the following:

The establishment of the Border Industrialsation Programme, with the concomitant implementation of the in-bond industry regime, in a time when some industrial branches were going through major changes in technology and location brought about changes in the composition of industrial output towards a more export-oriented production and the emergence of a new locational pattern different to that of the heavy industrial concentrations in the three metropolitan areas of Mexico City, Guadalajara and Monterrey. This new locational pattern merged in the Mexican Northern Border in the way of in-bond plants in which labour-intensive phases of production processes (assembly operations) are performed.

The assembly of electronic products and components is a good example of this shift in Mexican industry; it is heavily concentrated in the Northern Border. As this new location pattern consolidates the labour processes performed upgrade thus bringing about changes in the structure of the labour force. Data on the labour force in the in-bond industry in general and the electronics subsector in particular, shows the growing number of males among production workers (assembly lines), a post preeminently occupied by women. Labour shortages in the border cities are the main reason of this change in hiring practices. Also, the growing number of technicians (engineers and supervisors) reveals that the production processeses no longer consist of simple assembly tasks but of more complicated tasks which require the handling of sophisticated machinery and technical support such as control numeric machinery and robots for insertion of devices, bonding and testing, etc.). The winner in these changes is the interior of the country which is gaining some modest importance as a the location in-bond industry due to wage differentials, labour shortages and insufficient provision of public services and infrastructure in the Northern Border. The interior region offers a vast amount of unskilled cheap labour and thanks to a greater availability of universities, technical and other educative centers, a big pool of skilled and high-skilled labour. It also offers the major possibility of increasing the local content of the assembled products. plants located in the interior showed greater local content than those in the northern Border. The changes to the in-bond regime give in-bond plants the opportunity of selling a greater percentage of their output in the national market thus adding attractive to the locations in the interior.

The amount and extension of the foreign direct investment in electronic production is very important in Mexico unlike other NICs as South Korea and Taiwan where a major part of the industry is locally owned (e.g. Samsung, Gold Star and Hyunday from South Korea and Tatung from Taiwan). However, Mexican local capital involved in subcontracting operations could be important though it is possibly underrepresented in the statistics.

As a result of the foreign investment from US firms the main market for Mexican electronics exports is US. However, even if foreign investment diversify it is difficult to think in other markets gaining importance, since most non-US foreign investment in Mexico aims to circumvent US protectionism. The eventual creation of the NAFTA is a further stimuli for this investment.

Mexico seems to have advantages in the assembly of consumer electronics rather then components as semiconductors. But negative factors in the Mexican economy, mainly inflation, and overvaluation of the currency offset the advantages for setting up certain kind of in-bond plants in Mexico. That means some assembly operations were lost to poorer countries and some others could be gained from richer. For instance, 'less-sophisticated labour-intensive phase of production processes are being performed in the so-called New-NICs as Malaysia, Thailand Philippines, etc, where patterns of specialisations are merging between NICs and New-NICs.

In the light of the later economic events in Mexico the new locational pattern will be consolidated. The regulations on foreign investment have been made still more relaxed in order to attract more foreign capital. It is estimated that about 60 per cent of the Mexican economy would be open to foreign participation as a result of the broad revision of the regulation governing Mexico's foreign investment law of 1973 (Financial Times, May 17, 1989). Likewise, Mexico is to change the tax regime for in-bond plants, including a 4 per cent cut in corporation tax from 40 to 36 per cent. Also all Mexican sales to in-bond plants will be exempted from value-added tax - an incentive to raise local content. These changes follow provisions of a new decree, issued in December 1989, by which in-bond plants can sell to the domestic market up to 50 per cent of the value of their exports. These changes, intended to boost in-bond industry, come against a forecast growth of 13-15 per cent in the in-bond activities in 1991 and projected 10 per cent rise in foreign exchange earnings (Financial Times March 29, 1990).

In this way, Mexico will be more integrated into the world production and it can take advantage of this fact by an appropriate industrial policy. For example, as Grunwald suggests (1985) a system of incentives for establishing in-bond plants in the interior of the country could benefit the national integration of this kind of industry. Plant location in the interior could increase the content of domestic materials and consequently the participation of national firms with the resulting impact in the regional economy.

V. THE SURVEY: IN-BOND ELECTRONIC FIRMS IN MEXICO- CHARACTERISTICS AND LOCATION FACTORS.

INTRODUCTION.

As noted in chapter IV, in-bond industry in general, and the in-bond electronics industry in particular, have undergone several changes since their inception in the Mexican economy. Far from being the so-called "enclave" industry much criticised by some academics and politicians in many Third World country, this kind of industry can contribute to the process of economic development of the host country through sound economic policies.

The current dynamics of the world economy, with enormous pressures on TNCs to lower costs in the face of increasing international competition, leads to the organisational and spatial separation of production facilities from the decision-making, administrative and R&D activities of the firms. As production facilities move offshore, researchers look for the set of factors which influence the location decisions of firms. However, as Malecki (1985) points out, with reference to high-tech industries but in my opinion applicable to any other industry, conventional location theory proves to be quite limited for understanding the location of firms and industries because location theory underemphasizes labour as a location factor[1]. Nowadays, firms are forced to pay greater attention to labour which is segmented and each segment may be separated from one another. Consequently, need arises to analyse the factors contributing to the location of different activities in different labour markets and its dynamic.

In chapter I, a review of the main theoretical analyses on the current geographical redistribution of world production capacity was done with some important points to recall including a)

[1] It is out of the scope of this work to discuss the analysis of labour and underlying assumptions made by conventional locational theory. See the works of Alonso, 1964; Isard, 1956; Lloyd and Dicken, 1977; Smith, 1971 and Weber, 1929.

the role of technological innovation which allows for the spatial separation of the different phases of production processes; b) increasing capital-intensiveness of industry whilst retaining a considerable degree of labour intensity in certain phases of the production processes; c) intense competition at world scale with the corollary of the firms's quest for reducing costs per unit of product through several strategies, as innovation in processes, organisation, etc; d) the labour force as a "pull" factor in the host countries where production facilities are intensely relocated and last but, by no means least, e) the role of the nation-states in the home and host countries, in the former they fostered the development of technology and other circumstances which led to the internationalisation of production; in the later through sound economic and social policies they establish the conditions for the successful performance of the labour processes there relocated. In chapter II, this process was illustrated by the examination of the recent trend in the worldwide geographical redistribution of the electronics industry in which the most technologically sophisticated and capital-intensive phases of the production process are retained in DCs whereas the less technologically sophisticated and labour-intensive phases are relocated in the NICs and New-NICs. However, as shown in chapter III, and in contradiction with the NIDL theory, this is not a linear process, nor just a search for low-cost, unskilled labour force, it was necessary first that there were changes in the economies of those host NICs and New-NICs in order to perform those phases of production processes with the levels of productivity required to maintain or increase the firms' profitability. In the case of Mexico, there was a series of factors which gave her an advantage over other developing countries to attract production processes, relative abundance of a productive and cheap labour force, governments' industrial policies, infrastructure, political stability, etc, as well as the existence of special arrangements like the in-bond industry regime, etc. Thus, amid a period of relative economic instability, inflation, debt, devaluation and falling oil prices, those segments of the economy which were export oriented as Mexico's in-bond and car industries proved to be the most successful ones in terms of growth, employment and foreign exchange generation. The acute debt crises with falling oil revenues gave the Mexican government the last push towards the full opening of the economy.

In chapter IV, the Mexican in-bond industry was examined, with special reference to the electronics in-bond industry. It was found not only an impressive growth in terms of plants, employment and value-added but some interesting trends which reveal a) the consolidation of what I call a new locational pattern of industry in the Mexican Northern border; b) its slowly spreading into the interior of the country due to labour-force and infrastructural constraints in the border; c) the upgrading of the assembly processes performed (as the rise in the employment of technicians and staff and the presence of automated processes) and d) the appearance of specialisations among the main in-bond industry locations. To be able to confirm the above stated trends a questionnaire and some interviews were carried on in several in-bond electronic plants along the US-Mexican border during the months of September-November, 1990. Therefore the purpose of this chapter is to present the main findings appearing in the survey to draw in chapter VI some conclusions as to the viability of the in-bond industry in Mexico in particular, and assembly processes spread all over the world in general, to become an important contributor to the process of industrialisation and development of the host countries.

In part I, some characteristics of the electronics industry in each city are presented as well as the main characteristics of the plants visited are given as, production, location, size, starting of operations, ownership, etc. Part II deals with those factors thought to be determinants in the location of the industry in traditional location theory, market accessibility, inputs, labour and the role of governments, and how they truly operate in this kind of industry. The role of urbanisation economies is examined in the third part. Finally, some conclusions are drawn in part IV.

1. GENERAL CHARACTERISTICS OF THE FIRMS.

a) Selection of Firms.

Figure 4.1 (in chapter IV) identifies the main cities along the Mexican Northern Border. As it was seen in chapter IV, the main cities in the Mexican side correspond, in most cases, to important cities on the US side as San Diego, California or El Paso, Texas. The entire border comprises around 3200 km (2000 miles) from Tijuana in the extreme West to Matamoros in the Gulf of Mexico. Since there is no direct motorway all along the border among some of the cities, just the main cities were chosen for carry on the questionnaire: Tijuana, Mexicali, Nogales, Agua Prieta, Cd. Juarez, Nuevo Laredo, Reynosa and Matamoros[2].

As affirmed in chapter IV, one of the main issues in the in-bond electronics industry is the location in the interior of the country, so I found it necessary to collect some information from in-bond plants located there since official data was not enough disaggregated. Also for comparison purposes it was my intention to collect information from various electronic firms located in Mexico under non-in-bond regime. In the first place, a wide variety of published directories was consulted, including both trade directories and the yellow pages of telephone directories. However, it was not always possible to obtain a complete inventory of the locations of all electronics plants or to understand if they were under in-bond regime. In many cases the firm, otherwise registered as an assembly or manufacturing facility, turned ~~to~~ out be distributor, maintenance of equipment shop, software

[2] Once in the fieldwork factors out of our control led us to drop Tijuana, Mexicali and Nuevo Laredo from our list. However, we do not think this fact substantially affects our main findings.

facility or just a small family workshop dealing with repairments of TV and radio sets (important in an economy where not all the people can afford 1st hand sets).

However, it was possible to complete a list of the 70 most important firms manufacturers of consumer electronics, computers and peripheral equipment and semiconductors, and 30 in-bond electronic plants in non-border locations. All these firms were contacted by telephone and invited to participate in the survey. Some 40 plants (see Appendix III) reluctantly agreed to participate in the survey, and detailed questionnaires (including a stamped-self-addressed envelope) were mail-delivered[3] to all of them for later completion and return. After three months a total of 5 questionnaires was actually returned (3 returned without any answer, 1 turned to be a software design facility and the other, distributor of a major firm). All the participating plants were telephoned at frequent intervals to remind them of their agreement to fill out the questionnaire but unfortunately no further responses came.

The fieldwork in the Northern Border yielded positive results in terms of questionnaires and interviews with managerial staff in the in-bond plants (see appendix IV for the list of plants). In each city (Nogales, Agua Prieta, Cd. Juarez, Reynosa and Matamoros) the "Asociacion de Maquiladoras" (In-bond Plants Association) was contacted to obtain some support[4] and the names and addresses of the most important electronic plants as well as general information about the state of affairs in the in-bond industry in the locality. Afterwards, the firms were contacted by telephone and once explained about the survey were asked about the possibility of having an interview with the general manager. In most of the cases it was obtained an interview with the general manager and in a

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[3] Since it was out of my budget and time to do direct interviews in several cities in a country of about 2 million square kilometers.

[4] Unfortunately, the sensationalist work of some left-wing academics in the past has made many in-bond plant managers reluctant to give information or visit the facilities.

few cases with some other managerial staff like production manager, personnel manager or acquisitions manager. It was sought to make 5-6 interviews per city, but in some cases, once there, and despite of having been given an appointment, there was no disposition to answer the questions immediately but instead they asked to be left the questionnaire (for further scrutiny and answering) and either come back to pick it up or leave an address for later posting. Unfortunately, it was not possible to get those questionnaires back. So to fill some gaps of information and in order to compare, it is included information for the cities of Tijuana, Aguascalientes and Queretaro (and one plant of Cd. Juarez) from data from the questionnaires of the survey of Garza, Ibarra and Aguilar, "Urban Policy and Technological Development. The Case Study of the Industrial Estates Programme, 1952-1986" (Mexico, El Colegio de Mexico, Research Report for the International Development Research Centre IDRC, 1988). Thus there is a total of 20 plants in the basic sample used in the present analysis.

Since much of the information requested in the questionnaire is proprietary and confidential in nature (e.g. structure of costs), in many cases no answer was given to some questions. So in the following analysis the number of observations may differ from problem to problem. In spite of the limited number of plants (and the possibility of a bias), it is thought that the data obtained is quite reliable and presents a truthful view of the problem.

b) Some Characteristics of the Electronics Industry per City and State.

Before starting with the analysis of the firms surveyed, it is convenient to give a general overview if the electronics industry (in-bond and non-in-bond) in the main locations (states and cities), thus complementing the analysis in the previous chapter. The data was obtained from the industrial census of 1989 (preliminary results) and the in-bond industry monthly inquiry both carried on by the Instituto Nacional de

Geografia, Estadistica e Informatica, INEGI (National Institute of Geography, Statistics and Informatic). Unfortunately, as mentioned earlier, these sources do not offer data disaggregated at the city level. Moreover, they are not strictly comparable since both sources use different classifications.

Thus, on one hand the industrial census records two divisions in electronics industry, "Office Machinery, and Automatic Data Processing Machines" and "Telecommunications and Sound Recording and Reproducing Apparatus and Equipment". On the other hand, the in-bond industry monthly inquiry classifies the electronics in-bond industry as "Electrical and Electronic Machinery, Equipment, Apparatus and Appliances" and "Electrical and Electronic Materials, Components and Accessories". Likewise, though in-bond plants are included in the industrial census the level of aggregation makes impossible to know how many industrial plants are under the in-bond regime. Another problem is the different ways of recording the data, the industrial census is carried on every five years in a determined month in the year, whereas the data for in-bond plants is recorded every month throughout the year but the final data represents the yearly average. Nonetheless, it is thought that both sources can give a reliable view of the kind of production processes located in Mexico.

As to regard the industrial census of 1989, it records a total number of plants in the Mexican manufacturing of 162 976 with an employment of 2 677 229. The major concentration of industry is, as mentioned in chapter III, in the Central Region, that is the region compounded by the states of Hidalgo, Mexico, Morelos, Puebla, Queretaro and Tlaxcala and Mexico City (Distrito Federal), 36.3 per cent share in number of plants and 44.8 per cent in total employment (see table 5.1).

TABLE 5.1: Number of Plants and Employment in Manufacturing
and Electronics by State, 1989.

STATE	NUMBER OF PLANTS (1)	%	EMPLOYMENT (2)	%	ELECTRONICS INDUSTRY (SITC Rev. 2) Plants (3)	%	Employment (4)	%	Div. 75. Office Mach. and Automatic Data Processing Machines. Plants (5)	%	Employment (6)	%	Div. 76 Telecomm. and Sound Recording and Reproducing Apparatus and Equipment. Plants (7)	%	Employment (8)	%
TOTAL	162976	100	2677229	100	669	100	101230	100	133	100	15075	100	536	100	86155	100
Aguascalientes	1925	1.2	33208	1.2	4	0.6	193	0.2	-	0	-	0	4	0.7	193	0.2
Baja California	2706	1.7	85328	3.2	75	11.2	13709	13.5	18	13.5	1341	8.9	57	10.6	12368	14.4
Baja Calif. Sur	668	0.4	5872	0.2	-	0	-	0	-	0	-	0	-	0	-	0
Campeche	938	0.6	6320	0.2	-	0	-	0	-	0	-	0	-	0	-	0
Coahuila	3847	2.4	111788	4.2	25	3.7	5088	5	6	4.5	154	1	19	3.5	4934	5.7
Colima	803	0.5	4812	0.2	-	0	-	0	-	0	-	0	-	0	-	0
Chiapas	4384	2.7	15898	0.6	3	0.4	8	0	-	0	-	0	3	0.6	8	0
Chihuahua	4387	2.7	170509	6.4	57	8.5	25196	24.9	15	11.3	5611	37.2	42	7.8	19585	22.7
Distrito Federal	24331	14.9	577612	21.6	200	29.9	10677	10.5	35	26.3	2178	14.4	165	30.8	8499	9.9
Durango	2292	1.4	35545	1.3	4	0.6	122	0.1	-	0	-	0	4	0.7	122	0.1
Guanajuato	8789	5.4	112631	4.2	6	0.9	35	0	-	0	-	0	6	1.1	35	0
Guerrero	3813	2.3	14633	0.5	3	0.4	9	0	-	0	-	0	3	0.6	9	0
Hidalgo	2474	1.5	30931	1.2	-	0	-	0	-	0	-	0	-	0	-	0
Jalisco	12607	7.7	168393	6.3	42	6.3	2441	2.4	7	5.3	1210	8	35	6.5	1231	1.4
Mexico	14291	8.8	372492	13.9	80	12	8193	8.1	15	11.3	1268	8.4	65	12.1	6925	8
Michoacan	7522	4.6	53351	2	9	1.3	71	0.1	4	3	53	0.4	5	0.9	18	0
Morelos	2237	1.4	33262	1.2	-	0	-	0	-	0	-	0	-	0	-	0
Nayarit	1821	1.1	11888	0.4	-	0	-	0	-	0	-	0	-	0	-	0

Continues next page...

TABLE 5.1 (Continued)...

Nuevo Leon	7720	4.7	214016	8	50	7.5	1791	1.8	8	6	258	1.7	42	7.8	1533	1.8
Oaxaca	5404	3.3	25193	0.9	-	0	-	0	-	0	-	0	-	0	-	0
Puebla	12366	7.6	116906	4.4	16	2.4	1049	1	8	6	877	5.8	8	1.5	172	0.2
Queretaro	1692	1	47182	1.8	10	1.5	712	0.7	3	2.3	27	0.2	7	1.3	685	0.8
Quintana Roo	722	0.4	3339	0.1	-	0	-	0	-	0	-	0	-	0	-	0
San Luis Potosi	3852	2.4	48083	1.8	6	0.9	183	0.2	3	2.3	16	0.1	3	0.6	167	0.2
Sinaloa	2810	1.7	30611	1.1	5	0.7	223	0.2	5	3.8	223	1.5	-	0	-	0
Sonora	2883	1.8	64726	2.4	29	4.3	5734	5.7	6	4.5	1091	7.2	23	4.3	4643	5.4
Tabasco	1553	1	9087	0.3	-	0	-	0	-	0	-	0	-	0	-	0
Tamaulipas	3735	2.3	103112	3.9	34	5.1	26547	26.2	5	3.8	383	2.5	29	5.4	26164	30.4
Tlaxcala	1714	1.1	20028	0.7	5	0.7	727	0.7	-	0	-	0	5	0.9	727	0.8
Veracruz	9666	5.9	110827	4.1	8	1.2	60	0.1	3	2.3	15	0.1	5	0.9	45	0.1
Yucatan	3896	2.4	31915	1.2	3	0.4	59	0.1	-	0	-	0	3	0.6	59	0.1
Zacatecas	2128	1.3	7751	0.3	3	0.4	15	0	-	0	-	0	3	0.6	15	0

SOURCE: INEGI, 1989a:Tables 2 and 4.

In the electronics industry there were 669 plants and 101 230 employees with major concentrations in Baja California Norte, Coahuila, Chihuahua, Mexico City, Jalisco, Nuevo Leon, Puebla, Sonora and Tamaulipas.

In the case of Office Mach. and Automatic Data Processing Mach. the major concentrations of plants can be found in Baja California Norte (13.5 per cent), Chihuahua (11.3 per cent), Mexico City (26.3 per cent), and Mexico (11.3 per cent). In the case of employment, Chihuahua has the highest share with almost 40 per cent of total employment in this subsector.With regard to Telecomm. and Sound Recording and Reproducing Equip., it can be observed almost the same pattern in number of plants, the same states above mentioned had the highest shares. In terms of employment, Chihuahua and Tamaulipas account for more than fifty per cent of total employment (22.7 and 30.4 per cent respectively).

Unfortunately, the lack of data about the in-bond plants in the census prevent us from identifying those located in the interior states. As argued in chapter IV, plants locating under in-bond regime in the interior locate there to avoid labour shortages, bottle-necks in infrastructure and public services and in search of more qualified labour force. On the other hand, since the highest concentrations of electronics industry (apart from Northern Border States) is to be found in the main cities of the country, it is thought that non-in-bond plants located in the interior, locate there to gain access to those markets[5].

Plant size throws some light as to which are the main locations of the electronics industry in the country. Table 5.2 shows the plant size in the overall manufacturing industry and in the electronics industry. Plant size in the former was about 16.4 employees per plant, 151.3 in the overall

[5] It was until very recently (1989) that in-bond plants were allowed to sell up to 50 per cent of the value of their exports in the domestic market (Financial Times, March 29, 1990) to have an effect in the location in the interior recorded in the census.

electronics industry, 150.7 in Office Mach. and Automatic Data Processing Equip. and slightly higher in the Telecomm and Sound Recording Equip. (160.7). By state, the Northern Border states (Baja California Norte, Coahuila, Chihuahua, Sonora and Tamaulipas) and the most industrialised states (Jalisco, Mexico, Nuevo Leon, and Mexico City) have higher plant size than the manufacturing industry as a whole[6].

TABLE 5.2: Plant Size in the Manufacturing and Electronics Industry by State, 1989.

STATE	MANUFACTURING INDUSTRY	ELECTRONICS INDUSTRY (SITC Rev. 2)	Div. 75. Office Mach. and Automatic Data Processing Machines.	Div. 76 Telecomm. and Sound Rec.and Reprod. App.and Eq.
TOTAL	16.43	151.32	150.75	160.74
Aguascalientes	17.25	48.25		48.25
Baja California	31.53	182.79	99.11	216.98
Baja Calif. Sur	8.79			
Campeche	6.74			
Coahuila	29.06	203.52	34.15	259.68
Colima	5.99			
Chiapas	3.63	2.67		2.67
Chihuahua	38.87	442.04	497.43	466.31
Distrito Federal	23.74	53.39	82.75	51.51
Durango	15.51	30.5		30.5
Guanajuato	12.81	5.83		5.83
Guerrero	3.84	3		3
Hidalgo	12.5			
Jalisco	13.36	58.12	230.04	35.17
Mexico	26.06	102.41	112.41	106.54
Michoacan	7.09	7.89	17.61	3.6
Morelos	14.87			
Nayarit	6.53			
Nuevo Leon	27.72	35.82	42.86	36.5
Oaxaca	4.66			
Puebla	9.45	65.56	145.68	21.5
Queretaro	27.89	71.2	11.95	97.86
Quintana Roo	4.62			
San Luis Potosi	12.48	30.5	7.08	55.67
Sinaloa	10.89	44.6	59.31	
Sonora	22.45	197.72	241.91	201.87
Tabasco	5.85			
Tamaulipas	27.61	780.79	101.86	902.21
Tlaxcala	11.68	145.4		145.4
Veracruz	11.47	7.5	6.64	9
Yucatan	8.19	19.67		19.67
Zacatecas	3.64	5		5

SOURCE: Author's calculations from table 5.1.

6 The state of Aguascalientes has higher plant size also because of the textile and garments industry there located.

In the case of the electronics industry, as expected, the Northern Border states have a larger plant size with a preeminence of Chihuahua and Tamaulipas (442.0 and 780.7, respectively). Among the non-border states, Mexico and Tlaxcala show high plant sizes compared with the rest of the states. By subsector, it is found that the greater plant sizes are in the states of Chihuahua, Sonora and Jalisco in Office Mach, and Coahuila, Chihuahua, Sonora and Tamaulipas in Telecomm Equip.

Since the census records every kind of establishment, that is, manufacturing, assembly and reparation, it is thought that those very small establishments (smaller than the average size for the country) located in all the other states may be mere workshops[7]. However, this statement should not mislead the analysis since some firms locate in states like Puebla, and Queretaro, that is in the Central Region, away from the big industrial concentrations of the state of Mexico and Mexico City but still within the main market, the Central Region itself.

In the case of the in-bond industry in general, as table 5.3 shows, in 1988 the border states' share in number of plants was 82 per cent, 80.4 per cent in total employment and 80 per cent in value-added.

In number of plants, the state of Baja California Norte had the highest share (40 per cent), followed by Chihuahua which itself had the highest shares in employment and value added. With regard to the distribution per city, Tijuana and Cd. Juarez are the most important cities in all the variables considered followed by Mexicali, Nogales and Matamoros. The non-border states' share in all the variables is about one fifth of the total.

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7 Further analysis out of the scope of this work might confirm this statement.

TABLE 5.3: Characteristics of In-bond Industry by State and Locality, 1988.

LOCALITY	NUMBER OF PLANTS	%	EMPLOYMENT	%	VALUE-ADDED (million of pesos)	%
NATIONAL TOTAL	1396	100	369489	100	5263925	100
BORDER STATES	1146	82.1	297127	80.4	4204376	79.9
BAJA CALIFORNIA	569	40.8	75138	20.3	1098448	20.9
Ensenada	22	1.6	1359	0.4	10569	0.2
Mexicali	135	9.7	19558	5.3	311441	5.9
Tecate	57	4.1	4442	1.2	73128	1.4
Tijuana	355	25.4	49779	13.5	703310	13.4
BAJA CALIFORNIA S.	15	1.1	768	0.2	5296	0.1
La Paz	15	1.1	768	0.2	5296	0.1
COAHUILA	67	4.8	17605	4.8	150655	2.9
Cd. Acuna	35	2.5	10655	2.9	96718	1.8
Piedras Negras	32	2.3	6950	1.9	53937	1
CHIHUAHUA	248	17.8	110999	30	1581275	30
Cd. Juarez	248	17.8	110999	30	1581275	30
SONORA	88	6.3	29326	7.9	353999	6.7
Agua Prieta	27	1.9	6462	1.7	78955	1.5
Nogales	61	4.4	22864	6.2	275044	5.2
TAMAULIPAS	159	11.4	63291	17.1	1014703	19.3
Matamoros	72	5.2	32450	8.8	519148	9.9
Nuevo Laredo	44	3.2	11056	3	220433	4.2
Reynosa	43	3.1	19785	5.4	275122	5.2
NON-BORDER STATES	250	17.9	72362	19.6	1059549	20.1

SOURCE: INEGI, 1989b.

The electronics in-bond industry is more heavily concentrated in the Northern Border than the whole in-bond industry in terms of number of plants, as table 5.4 shows, in 1988 almost 87 per cent of the plants were in the Mexico-US border. However, in terms of employment and value added, the share of the non-border states in the electronics is again about one fifth. By industrial subsector, it can be observed that the assembly of Electronic Materials, Components and Accessories is more important in both locations than the assembly of Electronic Equip., Mach , Apparatus and Appliances.

Looking at the distribution of both subsectors in each location, it appears that, in terms of number of plants the assembly of Electronic Equip., Mach , Apparatus and Appliances is relatively more important in non-border states (with 37 per cent share) than in the border states (22.4 per cent).

TABLE 5.4: Characteristics of the In-bond Electronics Industry by Industrial Group and Geographical Location, 1988.

INDUSTRIAL GROUP\ LOCATION	NUMBER OF PLANTS	%	EMPLOYMENT	%	VALUE-ADDED (million of pesos)	%
TOTAL	411	100	161130	100	2179729	100
BORDER STATES(a)	357	86.9	127455	79.1	1745676	80.1
- Electrical and Electronic Mach., Equip., Apparatus and Appliances	80	19.5	47789	29.7	690836	31.7
- Electrical and Electronic Materials, Components and Accessories.	277	67.4	79666	49.4	1054840	48.4
NON-BORDER STATES	54	13.1	33675	20.9	434053	19.9
- Electrical and Electronic Mach., Equip., Apparatus and Appliances	20	4.9	12123	7.5	169709	7.8
- Electrical and Electronic Materials, Components and Accessories.	34	8.3	21552	13.4	264344	12.1

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.
SOURCE: INEGI, 1989b.

In terms of employment, it seems that the assembly of Electronic Materials, Components and Accessories generates more employment per plant in the Northern states than in the interior of the country. In terms of value- added, in both locations Electronic Equip , Mach., Apparatus and Appliances share is about 40 per cent and 60 per cent in Components and Materials.

The coefficients of localisation shown in table 5.5 give better view of the degree of importance of the electronics industry in each state. At the level of the whole electronics industry, the border states (Baja California Norte, Coahuila, Chihuahua, Sonora and Tamaulipas) show a localisation coefficient greater than one, that is, it does exist a degree of specialisation in electronics production in those states.

By subsector, in Office Mach., the states of Baja California Norte, Chihuahua and Sonora in the border and Jalisco, Puebla, Sinaloa in the interior of the country have coefficients

TABLE 5.5: Localisation Coefficients in the Electronics Industry by State.

STATE	ELECTRONICS INDUSTRY SITC Rev. 2	Div. 75. Off. Mach. and Aut. Auto. Data Process.Mach.	Div. 76 Telecom. and Sound Rec. and Reprod. App. and Equip.
Aguascalientes	0.154	0	0.181
Baja California	4.249	2.791	4.504
Baja Calif. Sur	0	0	0
Campeche	0	0	0
Coahuila	1.204	0.245	1.372
Colima	0	0	0
Chiapas	0.013	0	0.016
Chihuahua	3.908	5.844	3.569
Distrito Federal	0.489	0.67	0.457
Durango	0.091	0	0.107
Guanajuato	0.008	0	0.01
Guerrero	0.016	0	0.019
Hidalgo	0	0	0
Jalisco	0.363	1.276	0.227
Mexico	0.582	0.605	0.578
Michoacan	0.035	0.176	0.01
Morelos	0	0	0
Nayarit	0	0	0
Nuevo Leon	0.221	0.214	0.223
Oaxaca	0	0	0
Puebla	0.237	1.332	0.046
Queretaro	0.399	0.102	0.451
Quintana Roo	0	0	0
San Luis Potosi	0.101	0.059	0.108
Sinaloa	0.193	1.294	0
Sonora	2.343	2.993	2.229
Tabasco	0	0	0
Tamaulipas	6.809	0.66	7.885
Tlaxcala	0.96	0	1.128
Veracruz	0.014	0.024	0.013
Yucatan	0.049	0	0.057
Zacatecas	0.051	0	0.06

(a) The location coefficient (LQ) indicates the importance of the industrial group in any locality.
By means of LQ it is possible to asses the degree of specialisation of the locality towards a certain industrial activity. The magnitude of LQ in relation to the unity indicates the degree of specialisation as follows:
LQ > 1, High degree of specialisation;
LQ = 1, No specialisation;
LQ < 1, The locality does not have any incidence in the location of the industrial group.
To calculate LQ,

$$LQ = (ei/et)/(Ei/Et)$$

ei = Employment in the industrial group i in the state.
et = Employment in manufacturing in the state.
Ei = Employment in the industrial group i in the country
Et = Total Employment in manufacturing.

SOURCE: Own calculations from table 5.2.

greater than one, with Chihuahua in the lead with a coefficient of 5.8. With regard to Telecomm Equip. there are greater coefficients in the border states plus Tlaxcala in the Central Region. In this case Baja California Norte and Tamaulipas have the greater coefficients of specialisation (4.5 and 7.9, respectively). I should recall from chapter IV that in the San Diego customs district (through which assembled products from Baja California Norte go into US) the main products registered were telephonic terminals, microphones, radiotelephonic and radiotelegraphic transmitters (i.e. telecomm equip.). In the Laredo customs district (which registers goods assembled in Tamaulipas), the main products were TV sets and subassemblies, and parts and accessories for sound recorders (i.e. sound recording and reproducing apparatus and equipment).

The data above examined suggests that the electronics industry in Mexico, in general, is heavily concentrated in the Northern Border to take advantage of the location close to the US market and the advantages offered under the in-bond plants regime. However, a closer view indicates the existence of electronics industry in other states of the country mainly in the Central Region and in the other two main industrial cores of the country, the states of Jalisco and Nuevo Leon. In the main, these plants locate there to serve the domestic market and take advantage of the infrastructural facilities, labour market, etc. which are undoubtedly better in those areas of the country.

In this respect a study on the NICs published by the OECD (1988) affirms that apart from the in-bond plants, the Mexican electronics industry has been geared to the domestic market. "The industry suffers, however, from its heavy concentration on consumer electronics and its dependence on imports since it consists in assembling imported components" (OECD, 1988:60). In this sense, the non-in-bond electronics industry in Mexico would tend to locate close to the market to minimise costs in the transport of heavy and bulky products. Also, it is argued, the importance of after-sale services and customised design for some electronic products as computers will call for closer links with the customer. However, these kind of services are usually given by the distribution shops which not always are owned by the manufacturing firms, thus rendering unnecessary the location of production facilities close to the market. In this case the existence of skilled labour force is the most likely location factor.

In what follows, the general characteristics of the firms surveyed will be examined to proceed in part 2 to analise the main factors thought to influence the location of the in-bond electronics industry.

c) Production, Employment and Plant Size by Locality.

Although the intention was to get information from all the branches within the electronics industry in each city (i.e. Data Processing, Telecomm Equip., Consumer Electronics and Components) to be able to draw some comparisons among the different cities, it was not always possible to get the interviews sought. Nonetheless, the 20 firms in the survey produce a wide range of products which gives a good outlook of the industry in Mexico. For the sake of easiness plants are to be referred by their number (see appendix IV for the list of plants visited). As table 5.6 shows, among the firms there are 5 assemblers of consumer electronics, phonographs, TV sets and radio sets, 1 assembler of components for printers, 1 of discreet devices, integrated circuits and hybrid circuits; 2 firms engaged in the assembly of components for telecomm equipment and the rest assembles several electronic parts and components (including the three non-in-bond plants in Aguascalientes and Queretaro).

Most of the plants visited are devoted to the assembly of a single product, though some of them assembled more than one as the TV sets plant in Agua Prieta which assembles TV sets and power supplies for TV (firm 06); firm 12 in Reynosa assembles valves, control panels and thermostats; firm 14 (Reynosa) assembles parts and components for printers. Firm 15 also, in Reynosa, assembles discreet devices, integrated circuits and hybrid circuits and firm 16 in Matamoros, assembles power supplies and printed circuits.

TABLE 5.6: Number of Firms by Locality and Product, 1990.

LOCALITY	NUMBER OF FIRMS	PRODUCT (SITC, Rev.2)
TOTAL	20	
TIJUANA(a)	2	01. Electronic switches (772.1). 02. Phonographs (763.1).
NOGALES	1	03. Electronic switches (772.1) (for telecom. equip.).
AGUA PRIETA	3	04. Parts and components for micro-phones for telecomm. (764.92). 05. Transformers for radio and TV sets (764.9, 771.1). 06. Assembly of TV sets and power supplies (761, 764.9).
CD. JUAREZ	5	07. Wire harnesses for automobile industry (772) 08. Chassis for colour TV sets (761) 09. Wire harnesses for military vehicles (772). 10. Electric accumulators (778.1). 11. Radio sets (762)(a).
REYNOSA	4	12. Valves, control panels and thermostats (776.2, 772.1). 13. Colour TV sets (761). 14. Modular circuits, subassemblies for printers, (752.5); printing heads, printer ribbons and printed boards, (759.9). 15. Discrete transistors, (776.3); integrated circuits, (776.4); hybrid circuits, (776.3).
MATAMOROS	2	16. Power supplies, (764.8); printed circuits, (772). 17. Wire harnesses for automobile industry (772).
AGUASCALIENTES(a)	1	18. Electronics parts and comp. for vehicles (772).
QUERETARO(a)	2	19. Electronics parts and comp. for vehicles (772). 20. Electronics parts and comp. for vehicles (772).

(a). From Garza, Ibarra and Aguilar, 1988.
SOURCE: Field-work in the Mexican Northern Border, September-november, 1990.

The overall employment in the plants visited was 27953 employees amounting to a plant size of 1398 employees per plant (table 5.7). Despite of being a self-selected sample, the data shows a some concordance with the general trends in the in-bond industry.

TABLE 5.7: Employment and Plant Size by Locality, 1990

LOCALITY	NUMBER OF FIRMS	EMPLOYMENT	PLANT SIZE
TOTAL	20	27953	1398
Tijuana(a)	2	2101	1050.5
Nogales	1	69	69
Agua Prieta	3	1073	357.7
Cd. Juarez	5	11561	2312.2
Reynosa	4	10552	2638
Matamoros	2	1855	927.5
Aguas calientes(a)	1	105	105
Queretaro(a)	2	637	318.5

(a). From Garza, Ibarra and Aguilar, 1988.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

For example, in Tijuana and Ciudad Juarez, the most important locations for this kind of industry, the average plant size was the highest (1050.5 and 2312, respectively) together with Reynosa (2638 employees per plant) in the state of Matamoros. It should be recalled from section (b) that this state had the highest localisation coefficient in the production of Telecomm Equip., Sound Recording and Reproducing App. and Equip. Nonetheless, these plant sizes are more greater than those for the in-bond industry as a whole and the in-bond electronics industry which in 1988 amounted to 248 and 392, respectively (see table 4.10, chap IV). The firms in Aguascalientes and Queretaro, have also greater plant sizes than the average for the Mexican manufacturing industry.

d) <u>Start of Production, Ownership and Location of Headquarters.</u>

As table 5.8 shows, most of the in-bond plants visited located in Mexico after the first crisis (1974-1975) in the in-bond industry, 6 during the oil boom (1975-1982) and 7 during the subsequent economic crises and recovery (1983-1990). The firms in Aguascalientes and Queretaro located also after 1975.

TABLE 5.9: Firms by Kind of Ownership and Locality, 1990.

LOCALITY/FIRM	KIND OF ESTABL.	TYPE OF PROCESS	KIND OF OWNERSHIP
TIJUANA*			
01	Branch	Assembly	TFO(a)
02	Branch	Assembly	TFO
NOGALES			
03	Branch	Assembly	TFO
AGUA PRIETA			
04	Branch	Assembly	JV(b)
05	Branch	Assembly	TFO
06	Branch	Assembly	TFO
CD. JUAREZ			
07	Branch	Assembly	TFO
08	Branch	Assembly	TFO
09	Branch	Assembly	TFO
10	Branch	Assembly	TFO
11*	Branch	Assembly	TFO
REYNOSA			
12	Branch	Assembly	TFO
13	Branch	Assembly	TFO
14	Branch	Assembly	TFO
15	Branch	Assembly	TFO
MATAMOROS			
16	Branch	Assembly	TFO
17	Branch	Assembly	TFO
AGUASCALIENTES*			
18	UE(c)	Manufacture	TNO(d)
QUERETARO*			
19	Branch	Manufacture	JV
20	UE	Manufacture	TNO

* From Garza, Ibarra and Aguilar, 1988.
(a). Totally Foreign-owned.
(b). Joint-venture.
(c). Unique establishment.
(d). Totally National-owned.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

The general belief regarding the location of the headquarters of in-bond plants is that they are mainly in the states along the US-Mexican border. In Chapter IV it was stated that, according to some analysts, the headquarters of those plants in Baja California state (mainly in the cities of Tijuana and Mexicali) are generally located in the state of California, in the US, side. For those plants in the state of Sonora (in Nogales and Agua Prieta) the headquarters, though supposed to be in Arizona state, were actually in states in the North and North-east of the United States. As table 5.10 shows the headquarters of the plants visited are located not only in the states along the border.

TABLE 5.8: Date of Start of Production by Locality, 1990.

LOCALITY	1965/74	1975/82	1983/90	NO. OF ANSWERS
TOTAL	3	8	8	19
Tijuana(a)	-	1	1	2
Nogales	-	-	1	1
Agua Prieta	1	1	1	3
Cd. Juarez(b)	1	1	2	4
Reynosa	-	3	1	4
Matamoros	1	-	1	2
Aguascalientes(a)	-	1	-	1
Queretaro(a)	-	1	1	2

(a). From Garza, Ibarra and Aguilar, 1986.
(b) In one of the firms the interviewed person did not know the start of production date.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

Regarding the kind of establishment and ownership, table 5.9 shows that all the in-bond plants are branches of foreign firms and are totally-owned by the parent firms with the exception of plant 04 in Agua Prieta which is a joint-venture between a foreign and a national firm.

Regarding the non-in-bond firms, firm 18 in Aguascalientes is a unique establishment and is totally national-owned. In Queretaro one of the firms is a branch plant jointly owned by a foreign firm and a national firm (firm 19); firm 20 is an unique establishment totally national-owned.

All the in-bond firms visited defined the production processes imprecisely: "inspection and checking of parts and components received from the parent firm, assembly, testing, quality control, packaging and sending either to the parent firm or to the market" (from one of the questionnaires). However, assembly of parts and components, as it will be seen when dealing with employment, implies more than the traditional labour-intensive assembly of parts and components. In fact, as Mertens and Palomares affirm (1987, 1988), the insertion of new automated technologies requires not only of more skilled labour force but also a new attitude from the worker towards his/her activities within the workplace.

TABLE 5.10: Location of Headquarters by Firm and Locality, 1990.

LOCALITY/FIRM	HEADQUARTERS' LOCATION
TIJUANA(a)	
01	USA
02	JAPAN
NOGALES	
03	North Carolina, USA.
AGUA PRIETA	
04	Chicago, Illinois, USA
05	Douglas, Ariz. USA.
06	Chicago, Illinois, USA
CD. JUAREZ	
07	Ohio, USA.
08	Indianapolis, Indiana, USA
09	St. Luis, Illinois, USA.
10	USA
11(a)	USA
REYNOSA	
12	Milwaukee, Wisconsin, USA.
13	Chicago, Illinois, USA.
14	Virginia, USA.
15	Corpus Christi, Texas, USA.
MATAMOROS	
16	New York, USA.
17	Auburn, Alabama, USA.
AGUASCALIENTES(a)	
18	-
QUERETARO(a)	
19	CANADA
20	-

(a). From Garza, Ibarra and Aguilar, 1988.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

For example, from the plants located in Agua Prieta just one has headquarters in Arizona, the other two have headquarters in Chicago, Illinois, that is in the North-east of USA. This being also the case in Ciudad Juarez where the three plants which give information have headquarters in the states of Ohio, Indiana and Illinois.

In the case of Reynosa there is more diversity, two of the plants have headquarters in the North (Wisconsin and Illinois), one in the East (Virginia) and one in the adjacent state of Texas. The plants in Matamoros have headquarters in the South-eastern state of Alabama and as far as the state of

New York. Finally, one of the firms in Queretaro has headquarters in Canada.

2. MARKETS, INPUTS, LABOUR AND LABOUR-PROCESSES.

Although it is widely thought that the in-bond plants only locate in Mexico to take advantage of the cheap labour-force, the purpose of this part is to examine in deep specifical characteristics of the firms thought to have an influence in the location or re-location of the different plants visited. For the sake of clarity, the organisation of information and data was done according to the geographical location of markets, origin of inputs and characteristics of the labour-force and labour processes. As it will be seen, to better understand the current redistribution of world production capacity it is necessary to take in account some other factors beyond of the scope of the above mentioned factors and much discussed throughout all the previous chapters.

a) Products and the Importance of Markets.

According to the product-cycle approach the output of industries follow a pattern of introduction, expansion, maturity and eventual decline. As the market grows, product standardisation increases, and production is routinised and mechanised. Thus, as factor demands change specially that of labour which switches in favour of lower skill levels, so do the locational requirements which lead to a search of locational possibilities (routinisation and standardisation of external transactions) in places with lower factor prices in peripheral regions (Storper, 1988).

However, as pointed out in chapter I, the product-cycle approach is/ of questionable/ value today's firms adopt more than one strategy to remain competitive [illegible] Products no longer are made as a whole in one unique production site as the product-cycle approach implies, technology allows for the segmentation of production processes in several phases which can be performed in different places. Likewise, transactions are no longer done at arm's length, today's international trade is increasingly trade among firms. Thus, in many cases, market considerations are out of the scope in the production targeting of individual offshore plants. In the case of the in-bond plants visited it was found that from 20 plants, 8 send their production to the parent firm (table 5.11), 4 to other firms and 8 to the consumer market. The persons interviewed were asked if they had knowledge as to what was the location of the main markets of their final products. Those plants located in the interior of the country (3) sell all their production in the national market whereas those located in the border (17) affirmed the final products w ,ere destined for the US market (table 5.12).

TABLE 5.11: Destination of Production by Locality, 1990.

LOCALITY	HEADQUARTERS	OTHER FIRMS	CONSUMER MARKET	NO. OF ANSWERS
TOTAL	7	5	8	20
Tijuana(a)	-	-	2	2
Nogales	1	-	-	1
Agua Prieta	-	3	-	3
Cd. Juarez	3	1	2	5
Reynosa	2	-	1	4
Matamoros	1	1	-	2
Aguascalientes(a)	-	-	1	1
Queretaro(a)	-	-	2	2

(a). From Garza, Ibarra and Aguilar.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

TABLE 5.12: Geographical Location of Main Markets, 1990(a).

LOCALITY	MEXICO	USA	NO. OF ANSWERS
TOTAL	3	17	20
Tijuana(b)	-	2	2
Nogales	-	1	1
Agua Prieta	-	3(c)	3
Cd. Juarez	-	5	5
Reynosa	-	4(d)	4
Matamoros	-	2	2
Aguascalientes(b)	1	-	1
Queretaro(b)	2	-	2

(a). More than 75% of production.
(b). From Garza, Ibarra and Aguilar, 1988.
(c). One plant sells 10% in Mexico.
(d). One plant sells 15% in Europe and 5% in Japan.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

With regard to the destination of output by kind of product it was not found a consistent pattern in the plants. That is, it was expected that final goods, as TV or radio sets, to go directly to the US market and components to the parent firms or another firm either within the corporation or not. But four out of five consumer goods assemblers send their output to the parent firm (the exception being the plant in Tijuana which assembles phonographs). Therefore, the two plants in Tijuana (phonographs and electronic switches send their output to the consumer market); two in Cd. Juarez (electrical accumulators and radio sets); and the assembler of discreet transistors, integrated and hybrid circuits. In all this cases, however, I was told that the marketing functions were performed by the parent firm.

With regard to the characteristics of the products assembled (weight, value, etc.), 8 out of 20 plants gave the requested information which appears in table 5.13.

TABLE 5.13: Main Characteristics of the Products, 1990.

LOCALITY	PRODUCT (SITC, Rev.2)	WEIGHT	VALUE (a)	DESTINATION	TRANSPORT
NOGALES	03. Electronic switches	50 gr	\$2.00 - \$12.00	USA (Radio Shack)	truck
AGUA PRIETA	05. Transformers for radio and TV sets.	30 gr	\$1.50	Kansas, USA	truck
	06. TV sets.	94 gr	-	Arizona, USA	truck
	power supplies.	1.6 kg	-	Arizona, USA	truck
CD. JUAREZ	07. Wire harnesses for for automobile industry.	1.8 kg	-	Michigan, USA (General Motors)	truck
	08. Chassis for colour TV sets.	1.4 kg	-	Indiana, USA (Thompson Elec.)	truck
	09. Wire harnesses for military vehicles.	20 gr - 10 kg	-	St. Louis USA (Emerson)	plane /truck
REYNOSA	12. Valves, control panels and thermostats.	0.5 - 1.8 kg	-	USA	truck
	14. Modular circuits,	60 gr	\$12.37	USA	truck
	Subassemblies for printers,	510 gr	\$152.87	USA	truck
	printing heads,	30 gr	\$39.02	USA	truck
	printer ribbons,	30 gr	\$4.45	USA	truck

(a) Retail price in the main market.
SOURCE: Field-work in the Mexican Northern Border, September-november, 1990.

All the plants send their output by truck to places as far away as the state of Michigan. Unfortunately the few answers obtained about the value of the products do not allow for the construction of a weight/value ratio to test the assertion that for high-value/low-weight products the Asian NICs had an advantage over Mexican assembly plants.

However, the relative high weight of the products seems to confirm the findings of Sklair (1989) that for heavy products the substantial transport costs savings made up for the lesser productivity of the in-bond assembly plants.

b) Sources of Input Supply.

As stated in chapter IV, a recurrent criticism of the in-bond is the lack of backward linkages with the rest of the economies, the utilisation of local materials has been minimal (as seen in chapter IV about 1.5 per cent average for the whole period considered) and limited to ancillary goods as packing materials and stationery and services. Thus, it is argued, external control over the local and regional economies renders them vulnerable to outside decisions made on the basis of the changing economic conditions at a global scale.

In the case of the plants visited it was found that a great portion of the inputs (parts, components and subassemblies) were of foreign origin coming from either the parent firm or other firms within the organisation. One of the repeated arguments was that this was a policy of the firm so the managers did not even look for those materials in the local/regional/national market nor even knew if they were produced at all. The next most mentioned argument was that the input on question was not locally produced but one wonders if, for instance, copperwire is not locally produced for instance, why it cannot be supplied by the regional or national market. In one case the interviewed person mentioned unreliability in supplies, low quality and unreasonably high prices as the reasons importing all the inputs. However, when asked about his willingness to acquire those inputs in the local/regional/national market should the negative factors disappear he affirmed that in that case the savings may outweigh the additional tax on value-added charged by the US under items 806/807. As shown in table 5.14 just in one case, the firm which produces electronic switches in Nogales, one of the inputs (bobbins) is locally acquired while the rest of the inputs are imported on the grounds that they are not produced in the locality.

It is interesting to note what can be the presence of specialisations in the production of electronics, two firms get their inputs from Asia (Japan, Taiwan and South Korea) for assembly, testing and packing in Mexico of the final product which will be shipped back to the United States. In this case of intra-firm trade the inputs are thought to be sophisticated and, hence, not produced in Mexico (as in the case of integrated circuits). However, it is important to recall from table 5.6 the existence of a firm which assembles discreet transistors, integrated circuits and hybrid circuits and from chapter IV the existence of plants which assemble those very components, capacitors, transistors, and resistors thus contradicting the "It is not produced" answers given in the interviews and the findings of Sanderson et.al (1987) who affirm that for less-sophisticated products Mexico has an advantage over the Asian NICs.

At this respect Scott and Angel suggest that "the kinds of devices typically assembled at any given location seem to depend more on the time at which the investments on assembly were made there (that is, on world market conditions), than on local level of economic development" (1988:1063).

Actually, the uncertainty about quality and reliability of supplies essential for the electronics industry reduces the scope for domestic linkages.

TABLE 5.14: Main Characteristics of the Inputs, 1990.

LOCALITY	PRODUCT (SITC, Rev.2)	INPUTS	ORIGIN	QUANTITY (per unit of output)	WEIGHT	VALUE (US$)	IF NOT DOMESTIC WHY?
NOGALES	03. Electronic switches	1. Bobins	Locality	1	11 gr	$0.24	-
		2. Armours	USA	1	5 gr	$0.15	It is not produced
		3. Pile-up	USA	1	-	$0.71	It is not produced
		4. Wire reels	USA/Japan	1	-	-	It is not produced
AGUA PRIETA	04. Parts and components for microphones for telecomm	1. Plugs for - communicat. wires	South Korea	-	-	-	Firm's policy
		2. Chassis for comm. cartridge	South Korea	-	-	-	Firm's policy
	05. Transformers for radio and TV sets.	1. Plastic bobins	USA	1	30 gr	$0.12	It is not produced
		2. Iron laminations	USA	20	0.06 gr	$9.00	It is not produced
		3. Copperwire		-	0.03 gr	$1.50	It is not produced
		4. Tape		5.5 m	30 gr	$0.08	It is not produced
	06. TV sets.	1. Capacitors	Taiwan	200 - 400	20 gr	$0.06	It is not produced
		2. Resistors	Japan	100 - 400	9 gr	$0.01	It is not produced
		3. Transistors	USA	-	7 gr	$0.15	It is not produced
	and	4. Integrated Circuits	USA	600	10 gr	$0.83	It is not produced
	06. Power supplies.	1. Transistors	USA	-	7 gr	$0.15	It is not produced
		2. Resistors	Japan	-	9 gr	$0.01	It is not produced
		3. Capacitors	Taiwan	-	20 gr	$0.06	It is not produced
CD. JUAREZ	07. Wire harnesses for automobile industry.	1. Wire	USA	27 m		-	Firm's policy
		2. Plastic connections	USA	17	200 gr	-	Firm's policy
		3. Tape	USA	21 m		-	Firm's policy

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TABLE 5.14 (Continued)...

	08. Chassis for colour TV sets.	1. Board	USA	5 - 10	227 gr	-	Firm's policy
		2. Integrated Circuits	USA	600	-	-	Firm's policy/It is not produced
		3. Resistors	USA	100 - 400	-	-	Firm's policy
		4. Capacitors	USA	200 - 400	-	-	Firm's policy
	09. Electronics parts and comp. for military vehicles.	1. Wire	USA	0.15 mt - 3 mt		-	Firm's policy
		2. Plastic	USA	0.15 mt - 3 mt		-	Firm's policy
		3. Connectors	USA	2 - 20	100 gr	-	Firm's policy
		4. Terminals	USA	2 - 100	5 gr - 25 gr	-	Firm's policy
REYNOSA	12. Thermostats	1. Aluminum	USA	1	115 gr	-	Firm's policy
		2. Copper	USA	1	150 gr	-	Firm's policy
	and	3. Plastic	USA	1	150 gr	-	Firm's policy
	12. Electronic controls	1. Board	USA	1	200 gr	-	Firm's policy
		2. Resistors	USA	1	200 gr	-	Firm's policy
		3. Capacitors	USA	1	115 gr	-	Firm's policy
		4. Lead welding	USA	1	115 gr	-	Firm's policy
	13. Colour TV sets	Elec. components	USA	-	-	-	Firm's policy Unreliability High prices
	14. Modular circuits,	1. Resistors	Japan	-	-	-	Firm's policy
		2. Printed circuit	USA	-	-	-	It is not produced
	and	3. Integrated circ.	Japan	-	-	-	Firm's policy
		4. Condensers	USA	-	-	-	Firm's policy
	14. Subassemblies for printers,	1. Metallic parts	USA	-	-	-	Firm's policy
		2. Direct current motor	Japan	-	-	-	Firm's policy
		3. Rubber rollers	USA	-	-	-	Firm's policy
		4. Bars	USA	-	-	-	Firm's policy

(a) Retail price in the main market.
SOURCE: Field-work in the Mexican Northern Border, September-november, 1990.

Some of the in-bond plants themselves assemble products with high levels of precision and quality (as the plant in Cd. Juarez which assembles electronic components for US military vehicles), so if the high quality products can be assembled why many of the inputs cannot be supplied by the domestic industry with the same high levels of quality and reliability?. One of the often cited arguments is the lack of information and interest of local suppliers in the in-bond industry potential market which prompts some of the firms to import most of the inputs and acquire solely stationery and ancillary goods in the locality (Sklair, 1989). However, as stated above, in some cases it was found willingness from the part of the managers to advocate for the use of local materials should the suppliers fulfill the quality and reliability specifications required by the corporation.

c) Characteristics of the Labour-force.

As pointed out in chapter I, the product-cycle approach and the NIDL theory assumes the existence of an undifferentiated mass of unskilled or low-skilled workers who perform those routinary operations. However, as latter developments show, there is an increasing substitution of capital for labour in production processes (as the introduction of automated technologies, robots, and etc) which require more commitment, responsibility and attention from the production workers, deemed improbable before in "unskilled" or "low-skilled" workers, which in many cases blur the distinctions within blue-collar activities and supervisory and technical activities.

Unfortunately, in the case of the plants examined in this work was not possible to get information about the total operation costs of the plant to weight the importance of the different items in the value-added of the assembly operations. But, according to INEGI's monthly data on the in-bond industry, in 1988, wages, salaries and other social benefits to employees represented almost 50 per cent of the value-added generated in the in-bond industry as a whole whereas in the in-bond electronics industry this item represented 56 per cent (INEGI, 1989b:table 12). As shown in chapter IV (table 4.10), plant size in the electronics in-bond industry is bigger than in the in-bond industry as a whole. Thus, higher expenditures in wages and salaries can be explained, in part, by a bigger labour-force, but just in part. As the labour processes transform in more sophisticated ones, requiring major attention from the production worker, major supervision and technical support the wage and salaries bills go up (as higher wages or other social benefits) to hire more technical staff and retain the labour-force, specially in those places where the turnover rate is so high that results in a loss of productivity and additional costs in training new employees. In some of the firms (firm 02 in Tijuana and firm 03 in Nogales) I was told that they had had a 100 per cent and 40 per cent turnover rate respectively in the past, this phenomenon being the general complain in all the plants visited.

In the case of the plants visited it was found, in general, a predominance of females among the production workers and of males in technical and supervisory staff and in administrative and managerial staff (see tables 5.15 and 5.15.A). When asked about the predominance of females among production workers the interviewed persons pointed out that women are more fit for this routine , repetitive and delicate task which require great concentration and manual dexterity and they thought the tasks to be unsuitable for men's capabilities. However, when reminded about the presence of males in assembly lines and asked about their performance I was told that the demand for labour is greater than the supply therefore firms were forced to hire males for the assembly lines finding them as fit as females for the job.

It is important to note that the production processes performed in the in-bond electronics industry no longer consists of those traditional assembly operations which require no special skill from the workers but just literacy

TABLE 5.15. Employment in In-bond Electronics Firms by Category, Firm and Locality, 1990.

		SAMPLE TOTAL		MANAGER		STAFF		TECH. AND SUPERV.		PRODUCTION WORKERS		OTHER WORKERS	
LOCALITY/FIRM	TOTAL	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
TOTAL	27608	9764	17844	257	33	643	611	2714	594	6016	16221	134	385
TIJUANA*	2125	421	1704	37	5	15	30	62	10	300	1650	7	9
01(a)	537	124	413	2	0	5	10	12		100	400	5	3
02	1588	297	1291	35	5	10	20	50	10	200	1250	2	6
NOGALES	69	37	32	2	0	0	2	5	0	30	30	0	0
03	69	37	32	2	0	0	2	5	0	30	30	0	0
AGUA PRIETA	1083	533	550	15	2	25	52	259	81	230	410	4	5
04(a)	135	39	96	4	1	5	10	6	0	20	80	4	5
05	47	14	33	1	0	0	2	3	1	10	30	0	0
06	901	480	421	10	1	20	40	250	80	200	300	0	0
CD. JUAREZ	11269	2859	8410	133	17	264	151	495	66	1965	8175	2	1
07	1537	854	683	12	0	57	18	135	15	650	650	0	0
08	5750	395	5355	45	5	150	50	100	0	100	5300	0	0
09(b)	63	40	23	4	1	15	5	4	1	15	15	2	1
10	60	19	41	6	0	7	11	6	0	0	30	0	0
11*	3859	1551	2308	66	11	35	67	250	50	1200	2180	0	0
REYNOSA	10591	5081	5510	51	7	279	294	1797	417	2953	4792	1	0
12	910	454	456	9	1	200	200	45	5	200	250	0	0
13	8655	4190	4465	30	2	68	74	1689	394	2403	3995	0	0
14	987	431	556	11	4	10	20	60	15	350	517	0	0
15(b)	39	6	33	1	0	1	0	3	3	0	30	1	0

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TABLE 5.15 (Continues)...

MATAMOROS	1809	466	1343	6	2	20	22	46	20	324	939	70	360
16(c)	1192	365	827	5	2	10	15	30	10	300	700	20	100
17(c)	617	101	516	1	0	10	7	16	10	24	239	50	260
AGUASCALIENTES*	113	103	10	2	0	5	10	12	0	84	0	0	0
18	113	103	10	2	0	5	10	12	0	84	0	0	0
QUERETARO*	549	264	285	11	0	35	50	38	0	130	225	50	10
19	302	72	230	2	0	25	30	15	0	30	200	0	0
20(c)	247	192	55	9	0	10	20	23	0	100	25	50	10

* From Garza, Ibarra and Aguilar, 1988.
(a) Other workers = cleaning premises
(b) Other workers = engineers in maintenance
(c) Other workers = non-skilled production workers
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

TABLE 5.15.A: Employment in In-bond Electronics Firms by Category, Firm and Locality, 1990.

LOCALITY/FIRM	TOTAL	SAMPLE TOTAL Male	SAMPLE TOTAL Female	MANAGER Male	MANAGER Female	STAFF Male	STAFF Female	TECH. AND SUPERV. Male	TECH. AND SUPERV. Female	PRODUCTION WORKERS Male	PRODUCTION WORKERS Female	OTHER WORKERS Male	OTHER WORKERS Female
TOTAL	100	35.37	64.63	0.93	0.12	2.33	2.21	9.83	2.15	21.79	58.75	0.49	1.39
TIJUANA	100	19.81	80.19	1.74	0.24	0.71	1.41	2.92	0.47	14.12	77.65	0.33	0.42
01(a)	100	23.09	76.91	0.37	0	0.93	1.86	2.23	0	18.62	74.49	0.93	0.56
02	100	18.7	81.3	2.2	0.31	0.63	1.26	3.15	0.63	12.59	78.72	0.13	0.38
NOGALES	100	53.62	46.38	2.9	0	0	2.9	7.25	0	43.48	43.48	0	0
03	100	53.62	46.38	2.9	0	0	2.9	7.25	0	43.48	43.48	0	0
AGUA PRIETA	100	49.22	50.78	1.39	0.18	2.31	4.8	23.92	7.48	21.24	37.86	0.37	0.46
04(a)	100	28.89	71.11	2.96	0.74	3.7	7.41	4.44	0	14.81	59.26	2.96	3.7
05	100	29.79	70.21	2.13	0	0	4.26	6.38	2.13	21.28	63.83	0	0
06	100	53.27	46.73	1.11	0.11	2.22	4.44	27.75	8.88	22.2	33.3	0	0
CD. JUAREZ	100	25.37	74.63	1.18	0.15	2.34	1.34	4.39	0.59	17.44	72.54	0.02	0.01
07	100	55.56	44.44	0.78	0	3.71	1.17	8.78	0.98	42.29	42.29	0	0
08	100	6.87	93.13	0.78	0.09	2.61	0.87	1.74	0	1.74	92.17	0	0
09(b)	100	63.49	36.51	6.35	1.59	23.81	7.94	6.35	1.59	23.81	23.81	3.17	1.59
10	100	31.67	68.33	10	0	11.67	18.33	10	0	0	50	0	0
11	100	40.19	59.81	1.71	0.29	0.91	1.74	6.48	1.3	31.1	56.49	0	0
REYNOSA	100	47.97	52.03	0.48	0.07	2.63	2.78	16.97	3.94	27.88	45.25	0.01	0
12	100	49.89	50.11	0.99	0.11	21.98	21.98	4.95	0.55	21.98	27.47	0	0
13	100	48.41	51.59	0.35	0.02	0.79	0.85	19.51	4.55	27.76	46.16	0	0
14	100	43.67	56.33	1.11	0.41	1.01	2.03	6.08	1.52	35.46	52.38	0	0
15(b)	100	15.38	84.62	2.56	0	2.56	0	7.69	7.69	0	76.92	2.56	0

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TABLE 5.15.A (Continues)...

MATAMOROS	100	25.76	74.24	0.33	0.11	1.11	1.22	2.54	1.11	17.91	51.91	3.87	19.9
16(c)	100	30.62	69.38	0.42	0.17	0.84	1.26	2.52	0,84	25.17	58.72	1.68	8.39
17(c)	100	16.37	83.63	0.16	0	1.62	1.13	2.59	1.62	3.89	38.74	8.1	42.14
AGUASCALIENTES	100	91.15	8.85	1.77	0	4.42	8.85	10.62	0	74.34	0	0	0
18	100	91.15	8.85	1.77	0	4.42	8.85	10.62	0	74.34	0	0	0
QUERETARO	100	48.09	51.91	2	0	6.38	9.11	6.92	0	23.68	40.98	9.11	1.82
19	100	23.84	76.16	0.66	0	8.28	9.93	4.97	0	9.93	66.23	0	0
20(c)	100	77.73	22.27	3.64	0	4.05	8.1	9.31	0	40.49	10.12	20.24	4.05

(a) Other workers = cleaning premises
(b) Other workers = engineers in maintenance
(c) Other workers = non-skilled production workers
SOURCE: Table 5.14.

and dexterity to assemble the products in long assembly lines in which the simplification of movements, the routine character of the work and the determined output expected from each worker resemble the Taylorism of the 1920's. Indeed, there is a new element to consider which is the current ability to automatically grade products for quality, thus obtaining products with zero-error.

The quality control starts from the receiving of the inputs (parts, components and materials to be assembled) which are to be inspected and tested as in the case of the firms 06 which assembles the main module of TV sets and power supplies. Quality control operations, which include replacing of unusable components, represents about 25 per cent of the activities of the production process. The replacement and inspection of parts and components entails special visual attention, manual dexterity and much concentration on the worker's part. To be hired, therefore, a worker must undergo a detailed eye examination.

For example, in the case of wire-harnesses for military vehicles (firm 09 in Ciudad Juarez). Since it is a strategic final application, the component requires stricter than usual norms and quality controls. As stated above quality control is an operation all along the duration of the production process. In this case quality (product reliability and the assurance of proper functioning) is the important thing not cost, volume or production time. For this product it is essential that the workers handle, one by one, the wires that will integrate the mechanism. Each worker is given a square board with the color scheme of the maze of lines representing the wires making-up the wire harness. The wires are installed one by one, and the internal division of labour is almost non-existent. This apparently less-intensive process means a greater responsibility of the worker, and greater stress. Also the training period extend from a few hours in simple devices to something like three-four weeks to allow the worker to reach a certain quality average.

There is also the case of semiconductors where, as mentioned in chapter II, the production of semiconductors involves five stages, or different labour processes, which can be technically disarticulated: R & D, mask making, water fabrication, assembly and testing. The continued development of integrated circuit technology has had implications for the first three stages. Assembly and testing are still predominantly manual processes, which are performed offshore in sites like the NICs and New-NICs. But, later developments have allowed the automation of this tasks as well, so it can be found the application of computerised machine-tools, specially in soldering and automatic, final-product testing equipment. It is found in semiconductors assembly that the worker must exert more control and attention of a totally miniaturised process in which he/she has to solder the gold, aluminum, and molybdenum leads from the chip to the exterior. With the introduction of reprogrammable automated machinery (which cuts the wafer and solders the leads), the operator of this apparatus has to center, by means of a monitor, the points which are to be subsequently soldered by the machine.

A major part of the encapsulating process takes place in the so-called clean-rooms. These are closed spaces where the environment is controlled by vacuum and air filtration systems (like operating rooms or laboratories). Cleanness is required from the workers before entering these rooms (in some cases they have to have a bath upon arriving to the plant, and no make-up and nail-polish in the case of women) and they have to observe strict discipline -no talking or chewing gum. Also in the case of high-precision tasks as hybrid circuit assembly, the workers are invited almost every hour to leave the production line and do some exercises. All these require from the worker a longer training period than in other plants, about five weeks. It is important to remark that in the assembly of semiconductors in general workers are paid wages above the average to avoid high turnover rates.

Finally, the assembly of consumer electronics consist of two parts, sub-assemblies and final assembly. In the case of subassemblies, active and passive components[8] are inserted into a board called "printed circuit". In the case of TV sets there is a great quantity of inserted components, and a board may contain as many as 200 capacitors, 100 resistors and 600 integrated circuits (see table 5.14). In general, the manufacture of television receivers, like that of most other consumer electronics products is thought to be less advanced technologically that the production of semiconductors. In product cycle terms, television sets were regarded as mature products in which technology had standardised so the emphasis was on reducing production costs through economies of scale and the use of less-skilled labour (Dicken, 1988a). This being true in the case of black and white sets, but in the case of colour television, as shown in previous chapters, it can be seen a process of technological rejuvenation (a 'dematuring' as in the car industry) in process with the incorporation of new technology and in products which embody a wide range of new functions and in the emergence of new related products as video recorders and teletext.

For example, in the case of the firm assembler of TV sets in Reynosa, I was told that the production process consisted of five phases, automatic insertion ("surface mounting"), manual assembly, wave soldering and inspection and testing. Before the components were inserted by means of wire "pads" passing through the board and soldered from below. Now, with the introduction of surface mounting, the board is uniformly smooth and the components adhered with alloys of molybdenum, tin, silver, and polymers. With the higher density and miniaturisation of components the process is almost impossible to carry out by hand thus making necessary the use of automatic-reprogrammable systems. In this case it is also necessary the utilisation of clean rooms.

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[8] Electronic components are divided basically into passive and active components. Passive components are resistors, capacitors switches, wires and cables, connectors, etc. Active components are diodes, transistors, rectifiers, semiconductors which are incorporated within integrated circuits and microprocessors (Dicken, 1988a:317).

The operators of the surface mounting system comprise one technician, two semi-skilled assistants, and service personnel (vacuuming and laundry), with the part-time support of an electronics engineer. The technical personnel are in charge of controlling the machinery and the process, which is highly delicate. The workers execute the task of feeding and removing pieces from the machine, and this is a simple routine task. In this case the speed of the surface-mounting line is whatever the system can bear and it is necessary great care and precision from the worker in inserting and removing the boards from the machine. The remaining phases of the production process are predominantly done by hand. Throughout the assembly line the electronic and electromechanic parts are mounted by hand, soldered, inspected and tested. The new in these phases is the emphasis in quality control, the workers compile the quality control statistics for his or her own work and the group, therefore sharing a responsibility previously borne by the managerial staff.

In general, the occupational structure of the plants visited exhibits a change in comparison with the early in-bond assembly plants and in concordance with the transformation of the industry shown in the statistics (see chapter IV). Although women still predomine in the assembly lines there is a noticeable trend in hiring males mainly due to problems of labour shortages in all along the Mexican Northern Border[9]. It was found that in some of the firms visited the number of engineers and technicians (mainly males) is greater than in the rest of the in-bond electronics industry and of the in-bond industry as a whole. Within the in-bond industry as a whole in 1988, 12 per cent of the workforce were engineers and technicians (up from 9 per cent in 1980); the proportion for the in-bond electronics industry was 14 per cent (up from 10.2 per cent in 1980). For the firms visited this percentage raised to 18 per cent in integrated circuits assembly (firm 15

[9] We were told by the TV sets plant in Agua Prieta that due to a labour shortage in the city they have buses to go around the nearby villages taking the workers to and from the plant. This point will be discussed later in relation to infrastructure.

in Reynosa), 30 per cent average in assembly of TV sets (firms 06 and 13 in Agua Prieta and Reynosa respectively).

In the survey it was also found that whereas in the rest of the in-bond industry production workers are required to have finished primary school, in most of the plants visited, production workers are required to have finished secondary school (11 cases) and in one case (firm 15, produced of integrated circuits) it was required preparatory school. In six cases it was required only primary school (table 5.16). With regard to technicians it was found that, predominantly, it is required technical school or a university degree (engineering) and in the case of supervisors in most of cases production workers are promoted. In hiring managerial staff is required a university degree whereas in the case of other administrative staff it is qualifications relevant to the job, secretary, accountancy, are required.

The changes in the labour-force in the in-bond electronics industry are not only in the proportions of the different classifications (by sex, skill, etc.) but also in the profile of the workers. As products and productions processes become more sophisticated, incorporating the latest technological innovations and requiring the highest possible level of precision and quality, it becomes necessary a change in behaviours, attitudes and skill from the workers. It is no longer enough to teach the worker to perform his/her specific task which mostly requires only minimum literacy. Now he or she has to fill numerous forms to register productivity levels which requires more schooling and has to perform his/her tasks with great precision to achieve the highest quality in products, etc., that is the worker must understand that his/her presence in the plant requires sharing the responsibility for production. Likewise, the kind of production processes performed demands an increasing number of technicians which are expected to have higher qualifications since their are in charge of controlling the machinery and the process.

TABLE 5.16. Qualifications Required for Employment in In-bond Electronics Firms by Category and Locality, 1990.

LOCALITY/FIRM	MANAGER	STAFF	TECH. AND SUPERV.	PROD. WORKERS	OTHER WORKERS
TIJUANA*					
01(a)	5	3	4	2	2
02	5	4	-	2	-
NOGALES					
03	5	3	4	2	-
AGUA PRIETA					
04(a)	5	3	4	2	1
05	-	3	2	1	-
06	6(d)	3	4	1	-
CD. JUAREZ					
07	5	5	4	1	-
08	5	3	4	1	-
09(b)	5	3 & 4	3	1	5
10	5	4	5	2	-
11*	5	4	3	2	1
REYNOSA					
12	5	5	5	1 & 2	-
13	5	5	4 & 5	1 & 2	-
14	5	3	3	2	-
15(b)	5	5	3	3	5
MATAMOROS					
16(c)	5	3 & 4	4	2	2
17(c)	5	4 & 5	5	1	-
AGUASCALIENTES*					
18	5	4	2	2	2
QUERETARO*					
19	5	3	4	2	2
20(c)	5	3	3	2	1

* From Garza, Ibarra and Aguilar, 1988.
(a) Other workers = cleaning premises
(b) Other workers = engineers in maintenance
(c) Other workers = non-skilled production workers
(d) Other qualification = Master degree
CODES:
1 - PRIMARY SCHOOL; 2 - SECONDARY SCHOOL; 3 - HIGH SCHOOL;
4 - TECHNICAL SCHOOL; 5 - UNIVERSITY; 6 - OTHER.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

Table 5.17 shows that, according to the localisation coefficients for the in-bond electronics industry as a whole, the existence of staff, technicians and female labour force does have an influence in the location of the industry. Looking by geographical location, the localisation coefficients are slightly greater in the non-border states than in the border states. This fact can be explained by the relative abundance of staff, technicians and female labour force in the interior which, considering the labour shortages in the border, is attracting in-bond plants.

TABLE 5.17. Localisation Coefficients for In-bond Electronics Industry by Job Category, 1988 (a).

CATEGORY	ELECTRONICS INDUSTRY	Assembly of Electric and Electronic Mach., Equip. Apparatuses and Appliances	Electric and electronic materials, accessories and components
BORDER STATES (b)			
Technicians	1.177	0.129	1.109
Staff	10.062	10.085	10.092
Workers	0.973	0.957	0.983
Women	1.068	1.077	1.061
Men	0.811	0.751	0.849
NON-BORDER STATES			
Technicians	1.208	1.147	1.192
Staff	14.32	15.297	13.818
Workers	0.598	0.937	0.942
Women	1.113	1.045	1.152
Men	0.643	0.751	0.583

(a) The location coefficient (LQ) indicated the importance of the job category within a given industrial group. By means of LQ it is possible to asses the locational orientation or degree of specialisation of the industrial group towards a job category in any locality. The magnitude of LQ in relation to the unity indicates the degree of specialisation as follows: LQ > 1, High degree of specialisation; LQ = 1, No specialisation; LQ < 1, Job category does have any incidence in the location of the industry. To calculate LQ,

$LQ = (Eci/ti)/(Ecg/Tm)$

Eci = Employment in job category in industrial group i.

ti = Total employment in industrial group i.

Ecg = Employment in job category in all groups.

Tm = Total employment in manufacturing.

(b) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.

SOURCE: Author's calculation from INEGI, 1989b.

d) <u>The Role of Government.</u>

The role of the government is an important factor in the localisation of the industry since it contributes to reduce the setting-up, operation, or capital costs of the firm through subsidies, credits, financing or tax holidays. Analyses such as Frobel's (1980) see the valorisation process of capital as guaranteed by the compliant governments, thus devaluating the role of the nation-states to the simple provider of the optimum conditions for the successful performance of the production process. As pointed out in previous chapters this view is rather simplistic and leaves no place for the governments' manoeuvreing in the promotion of development.

As with all the other aspects of the in-bond plants the role of the government has been much criticised in every respect, the lax enforcement of the labour and environmental legislation, the cheap leasing of industrial sites, tax holidays and the like. However, when asked about the role of the government in their selection of location most of the firms visited seemed to be either unaware or give, in appearance, little importance to this factor in general. One of the most often cited incentives were the facilities for the import of equipments, materials and inputs and for the export of the products (i.e. the in-bond assembly plants regime). In one case, the interviewed mentioned tax holidays as an additional incentive to locate. In one another case it was found that the government's labour legislation (whose enforcement is very lax) and control of the unions was an "incentive" to locate.

The new provisions for in-bond assembly plants, reduction from 40 to 36 per cent in corporation tax, exemption of value-added for all the sales to in-bond plants (to raise local content) and, specially, permission to sell up to 50 per cent in the local market, are more likely to influence the location of some in-bond plants in Mexico rather than other locations in Latinamerica. As Mexico recovers from the deep crisis in the 1980's, the internal market expands thus making it more attractive as location. Actually some big computer makers as IBM and Hewlett-Packard have established plants in Mexico to serve the domestic market and the Latinoamerican market both with high potential growth.

3. <u>CRITERIA FOR CHOICE OF CURRENT LOCATION.</u>

It is not my intention to repeat what already was exhaustively in the second part with regard to the characteristics of the firms, but rather to evaluate the importance of different factors in their choice of location from the point of view of the firms. That is, if the different factors here considered had an influence in the localisation of the firms in the country and in the city and if some of them can be regarded as an effective instrument in industrial location strategies and urban planning in Mexico.

In the survey, the firms were asked to choose between different factors, labour, government incentives, accessibility to inputs and/or markets, industrial parks, infrastructure and access to means of transport, etc. to locate in the city and in the country. Although such questions are usually open to problems of perception (sometimes the person interviewed was hired years after the starting operations), subjectivity, categorisation, and memory lapse, it was hoped that the answers would give some indication of the underlying factors.

The importance of a particular factor is measured by a mean score calculated by dividing the sum of all the marks given to a factor by the number of firms. Those factors given a mark above of the mean are considered important for that particular firms in its selection of location. Likewise to evaluate the factors a simple mean was calculated by dividing the sum of the means and dividing by the number of factors, therefore those factors with marks above of the mean are considered to be important in the location of the in-bond electronics plants. In what follows it will be examined the weight of each factor in the location of the firms interviewed.

a) The Choice of City.

As stated above factors as availability of non-skilled cheap labour, non-labour problems, access to infrastructure, existence of industrial parks and provision of public and industrial services, are considered important for the choice of a particular city as location.

Before examining the importance of these factors in the location of in-bond assembly plants in Mexico it is necessary to point out that the economic activities of any country are concentrated in a few centres rather than forming an even distribution pattern. That is production, services and population concentrates in few points and this structure is, for some, self-maintaining and hinders the development of the country as a whole since the national economies develop a dual character which has been object of exhaustive research. That is why governments recognising the interdependence between industrial development and urbanisation engage in industrial location strategies (mainly tax holidays and subsidies, but also provision of some basic industrial infrastructure as industrial parks) with the aim of redirect investment, towards those less developed areas and thus achieve a more balanced urban growth and ultimately, economic development.

However, in several countries this kind of attempts has not been, in many cases, enough to attract industrial investment as in the case of the industrial parks and new towns programme in Mexico. Garza, Ibarra and Aguilar (1988) found in their survey that the existence of industrial parks was not a key factor in the location of industry in middle-size cities in Mexico and that their role in the deconcentration of industry was overestimated by the Mexican government. Actually, a great amount of investment in industrial infrastructure in industrial parks and else was a waste since it failed to attract private investment to those middle-range cities. However, Sklair (1989) in his survey on the in-bond industry found that in some of the most important locations for the in-bond industry, Tijuana, Mexicali and Ciudad Juarez in the border and Chihuahua City in the interior, the existence of industrial parks was important for the selection of the cities concerned, specially those which offered shelter plans (a kind of subcontracting) to potential in-bond investors.

In the case of the firms interviewed it was found that in Tijuana, both firms regarded as very important in their decision all the factors listed (with the exception of the access to market, see table 5.18), availability of skilled and non-skilled cheap labour force, non-labour problems, access to infrastructure and existence of industrial parks, the provision of public and industrial services and government incentives.

In the case of the firm in Nogales only three factors were considered in the selection of the city, the inexistence of labour problems, the existence of industrial parks and government incentives as the in-bond industry regime. In the case of the firms in Agua Prieta it was found the only two factors can be considered to have been important since the average mark for these factors in this city is greater than the mark for all the sample, availability of skilled labour and the provision of public and industrial services.

With regard to the firms in Ciudad Juarez, it was found that seven out of nine factors were considered important to locate in that city, these seven factors have a mean well above the general mean of 6.5 for all the factors, availability of skilled and non-skilled cheap labour force, non-labour problems, access to infrastructure and existence of industrial parks, the provision of public and industrial services. Access to the market and government incentives and facilities were considered not decisive in the location decision.

The case of Reynosa is worthy to emphasize since according to the industrial relations manager of the firm assembler of colour TV sets there were not enough infrastructural facilities nor provision of acceptable public and industrial services. Likewise the industrial parks did not offer much in the way of infrastructure or administrative services as their counterparts in Tijuana and Ciudad Juarez. Therefore, in Reynosa it was found that only those factors related to the labour force seem to have been decisive in the location of the plants interviewed (table 5.18) as in the case of the plant located in Matamoros.

TABLE 5.18. Reasons for Choice of Location IN THE CITY, by Firm and Locality, 1990(a)

LOCALITY/ FIRM	ACCESS TO MARKETS	AVAILAB. SKILLED LABOUR	AVAILAB. NON-SKILL LABOUR	AVAILAB. CHEAP LABOUR	NON-LABOUR PROBLEMS	ACCESS INFRAST.	EXIST. INDUST. ESTATES	PROVISION PUB & IND SERVICES	GOVERN. INCENTIV & FACIL.
FACTOR MARK(b)	4.05	6.15	6.85	7.35	7.75	6.6	7.35	7.15	5.5
TIJUANA*									
01	1	6	10	10	10	10	10	6	10
02	1	10	10	10	10	10	10	10	10
NOGALES									
03	8	-	-	-	7	-	10	-	9
AGUA PRIETA									
04	-	6	1	6	-	-	10	7	-
05	3	6	4	6	8	7	2	8	1
06	9	10	10	9	10	10	9	10	9
CD. JUAREZ									
07	10	8	2	9	6	4	7	5	2
08	7	10	10	10	10	10	10	7	7
09	9	9	3	10	9	9	10	10	9
10	1	6	10	1	10	10	10	10	1
11*	1	6	10	10	10	10	10	10	10
REYNOSA									
12	3	8	7	2	6	4	5	9	10
13	8	9	9	9	10	-	-	-	-
14	2	3	4	10	9	5	6	7	8
15	8	9	9	9	8	8	10	10	-
MATAMOROS									
16	-	-	-	-	-	-	-	-	-
17	7	9	8	10	2	5	6	4	3
AGUASCALIENTES*									
18	1	1	10	10	10	10	6	10	1
QUERETARO*									
19	1	1	10	10	10	10	10	10	10
20	1	6	10	6	10	10	6	10	10

* From Garza, Ibarra and Aguilar, 1988.
(a). Interviewed persons were asked to rank the factors according to their importance in the choice of location. 10 - VERY IMPORTANT, ..., 1 - NOT IMPORTANT.
(b). The factor rank is a simple mean: SUM all marks/number of answers = 6.5.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

Sklair (1989:131) suggests that since Reynosa has a massive PEMEX (the giant petrol state company) plant, the local authorities did not place a very high priority on the development of the in-bond industry at that time (mid-1970s).

Regarding the two cities in Central Mexico, Queretaro and Aguascalientes (this last one with a textiles industry tradition) the factors associated with the labour force were considered of great importance by the plants but also infrastructural facilities, provision of public and industrial services and industrial parks were considered. It is interesting to note that the plants did give importance to government incentives and facilities which was not the case for the in-bond electronics plants in the North.

b) The Choice of Country.

When asked about the determining factors in choosing Mexico as location in general was agreed that the provisions for the in-bond industry, that is facilities for import of inputs and materials and export of finished goods was a very important factor, followed by the proximity to the US and the existence of cheap labour force (table 5.19).

Against the assumption that political stability had played an important role in the location decision it was found that in general firms gave little weight to this factor. In a close look city by city some slight differences are found, in Tijuana for example, the availability of non-skilled cheap labour force, non-labour problems and the in-bond industry regime were considered as decisive in the location followed by the access to the market, infrastructure, means of transport and political stability. In Nogales only three factors were considered, the access to market, availability of non-skilled labour and the in-bond industry regime.

In Agua Prieta, it was found that only four factors have means above of the respective general mean for that factor, availability to skilled labour, facilities to import inputs, access to means of transport and political stability. In Ciudad Juarez, almost all the factors have means above the respective general mean for that factor, overwhelmingly facilities to import inputs, access to markets, availability of skilled, cheap labour force and infrastructure and means of transport. With regard to Reynosa and Matamoros, those factors related with the labour force were considered more important than the provisions for in-bond industry.

TABLE 5.19. Reasons for Choice of Location IN THE COUNTRY, by Firm and Locality, 1990(a).

LOCALITY/ FIRM	ACCESS TO MARKETS	AVAILAB. SKILLED LABOUR	AVAILAB. NON-SKILL LABOUR	AVAILAB. CHEAP LABOUR	NON-LABOUR PROBLEMS	FACILIT. TO IMPORT INPUTS	ACCESS INFRAST.	ACCESS MEANS OF TRANSPORT	GOVERN. INCENTIV & FACIL.	POLIT. STAB.
FACTOR MARK(b)	4.6	6.05	7.3	7.25	7.2	8.25	5.95	7.3	4.65	5.85
TIJUANA*										
01	1	6	10	10	10	10	6	6	10	7
02	1	10	10	10	10	10	10	10	10	6
NOGALES										
03	9	-	8	-	-	7	-	-	-	-
AGUA PRIETA										
04	-	6	1	6	-	6	-	10	-	1
05	10	6	4	6	8	10	7	8	1	8
06	9	10	10	9	10	9	10	9	9	10
CD. JUAREZ										
07	10	8	2	9	6	7	4	5	1	3
08	6	9	7	9	9	10	10	10	9	7
09	9	9	3	10	9	9	9	9	9	7
10	1	6	10	1	10	10	10	10	1	6
11*	1	6	10	10	10	10	10	10	10	10
REYNOSA										
12	9	8	7	1	6	4	6	5	3	10
13	7	9	9	9	10	8	-	5	-	6
14	1	2	8	10	7	9	3	4	6	5
15	8	9	9	9	8	10	8	10	-	8
MATAMOROS										
16	-	-	-	-	-	-	-	-	-	-
17	7	9	8	10	1	6	4	5	3	2
AGUASCALIENTES*										
18	1	1	10	10	10	10	6	10	1	7
QUERETARO*										
19	1	1	10	10	10	10	10	10	10	6
20	1	6	10	6	10	10	6	10	10	8

* From Garza, Ibarra and Aguilar, 1988.
(a). Interviewed persons were asked to rank the factors according to their importance in the choice of location 10 - VERY IMPORTANT, ..., 1 - NOT IMPORTANT.
(b). The factor rank is a simple mean: SUM all marks/number of firms = 6.46.
NOTE: The firms in Aguascalientes and Queretaro were excluded.
SOURCE: Field-work carried on in the Mexican Northern Border, September-November, 1990.

As can be seen from table 5.19, in the case for choosing Mexico as location, seven out of ten factors can be considered as important, access to the market (that is to the US), availability of skilled and non-skilled cheap labour-force, non-labour problems, facilities to import inputs and access to means of transport, the other factors may be considered of secondary importance (access to markets, access to infrastructure, government incentives and facilities and political stability. In the case for choosing a particular city as location it was found that six of the nine factors can be considered important for the location of in-bond plants and therefore should be taken into account in any industrial strategy to attract this kind of industry to particular locations, availability of non-skilled cheap labour-force, non-labour problems, access to infrastructure, existence of industrial parks and provision of public and industrial services (table 5.18). The results obtained with the simple means are consistent with those of similar surveys done for Brazil and Philippines (see Herrin and Pernia, 1987).

c) Problems of Past and Present Location.

As a way of deepening in the answers given all along the questionnaire, firms were asked where was the previous location (if applicable), the reason to locate in Mexico and what other place would they choose in case they could change location. Also they were invited to talk freely about the problems encountered in their present locations in general. Since not all the interviewed persons answered these questions in deep, I will examine just those cases were there is an answer or those considered interesting for the analysis.

We have, for example, the case of plant 03 (see table 5.6) in Nogales which assembles electronics switches. This plant was originally located in Haiti but, in view of the political problems in that country the parent company decided to change location to any other cheap location (in terms of labour-force). After some research it was decided, in 1986, to locate in Mexico which offered additional advantages as political stability and geographical proximity. However, as the manager of the plant recognises, the availability of labour force has been a problem since they had a 40 per cent turnover. Nowadays, although the turnover rate has decreased still they face problems. When asked what location he would choose in case he could change location he mentioned Ciudad Obregon or

Navojoa, both cities in the south of Sonora state where costs are lower and the labour force cheap and abundant.

Plant 04 in Agua Prieta, in Sonora state, was located as a first time in this location and, as the general manager mentioned, because of the existence of a pool of cheap labour force. There have been minimal problems with the labour force but the manager complained about the low quality of the public services in the city[10] and commented that he would change location to Merida the capital city of the state of Yucatan (in the Gulf of Mexico) if he could do so and where, due to the closeness to the state of Florida, many firms have established in-bond plants (mainly in textiles).

Plant 06, also in Agua Prieta, was located before in the city of Paris, in the state of Illinois, USA and assembles TV sets and power supplies. The parent company (American) decided to move production facilities offshore due to the strong competition from the Japanese electronic companies. Since it had already production facilities in Matamoros (established in 1969-70 and nowadays the single largest employer in the whole in-bond industry, Sklair, 1989:120) and in Reynosa (established in 1977) the state of Tamaulipas it was relatively easy to move this plant offshore (in 1982), thus taking advantage of the cheap labour force (skilled and semi-skilled) and the in-bond plants regime. The main problem faced by the plant was the high turnover rate, great absenteeism of the labour force (the plant has about 1 000 employees) and unavailability of labour force but also the insufficiency of public services in the city means the plant has to incur in some additional costs. The plant recruits employees in the nearby villages and therefore has to have some buses to take them to and fro. The manager pointed out that he would move the facilities to the city of Nuevo Laredo in the state of Tamaulipas in case he could change location since, as far as he is informed, the city counts with a pool of skilled and

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[10] The area of the industrial park and neighbourhood lacks pavement and there is not drain so when rains it is really difficult to go around.
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semi-skilled cheap labour force, infrastructural facilities and availability of public services.

In Ciudad Juarez, the same problems and complains about labour force and insufficiency of infrastructure were found. Firm 07, assembler of wire harnesses for the car industry located as a first time in Ciudad Juarez, the plant manager mentioned that the insufficiency of labour force for about 400 plants operating in the city, means a high turnover rate, and that there are great advantages in Chihuahua City as a location because of the availability of infrastructural facilities for the industry, public services and, above all, cheap labour force. Likewise Firm 09, assembler of wire harnesses for military vehicles, also faces a great turnover rate which has been the main reason to hire men for the production line. Nowadays 50 per cent of production workers are men.

Firm 12 in Reynosa which assembles valves, control panels and thermostats was originally located in Wisconsin (Milwaukee), and also had production facilities in the state of Kentucky in the United States. However in an attempt of reducing costs, increase productivity, quality and, ultimately, profits the plant moved to the city of Reynosa in 1983 where, as in all the other cities, there is a scarcity of labour force and, thus, high turnover rates in the plants which usually poach each other's employees. This plant has also taken recourse to hire men for production lines. The manufacturing manager pointed out the city of San Luis Potosi (in that state of the same name in Mexico) as better location for the plant mainly due to the relative abundance of labour-force. Firm 13 (colour TV sets) and 14 (subassemblies for printers) and located in 1977 and 1979 respectively also mentioned the scarcity of labour force (mainly skilled and semi-skilled) as one of the main problems encountered in their present locations. The operations manager in firm 14 pointed out that he would move the facilities to the city of Monterrey in the state of Nuevo Leon in case he could change location since as the second industrial core in the country, the infrastructural facilities are more available and also has a greater supply of skilled cheap labour force due to the existence the various prestigious universities and technical colleges.

As can be seen from the above answers, the labour factor is considered one of the most important in the location of the in-bond electronics plants in Mexico. However, this is not as the NIDL theory assumes just a search for an undifferentiated mass of unskilled labour force from which a great amount of absolute surplus value is to be extracted. Also important for the performance of the assembly processes is the role of the government in the provision of infrastructure and public services, land, etc., apart form the financial incentives and tax holidays. One point important to recall is the awareness of the managerial staff of the fact that, locations in the interior of the country can offer, actually offer, great advantages for the in-bond electronics industry, as availability of cheap labour force either skilled or not, as well as the necessary infrastructure and public services without incur, in considerable additional transportation costs.

4. CONCLUSIONS.

Without denying the existence of traditional sweatshops in the Mexican in-bond electronics industry, my survey revealed a change in the characteristics of both the labour force and the kind of plants established in accordance with what other surveys have found. Nowadays, in-bond plants use more skilled labour. Specially, the performance of more sophisticated assembly processes requires more attentiveness and skill from the workers, more supervision from technicians as well as the introduction of automated phases to secure productivity, efficiency in the use of inputs and better quality. Likewise, the importance of women in production lines is decreasing.

As to the factors influencing the location of this kind of industry in the Mexican Northern Border it was found that the availability of cheap skill and semi-skilled labour force was the main factor considered by the firms, as the location coefficients demonstrated in-bond electronics plants tend to locate in those places with abundance of technicians. The facilities to import inputs and equipment and export the assembled products, that is the in-bond industry regulations, are also an important factor. The access to markets and inputs are not determining in the location since, due to the existence of intra-firm trade, plants receive all the parts and components from the parent company (or any other firm within the corporation) and, once assembled, they are returned to the parent company for distribution and sale. That is why the local content of the assembled products is minimum and limited to some packaging materials. Moreover, most of the firms pointed out that, apart from the intra-firm trade policy of the parent company, the unavailability of inputs, quality control and unreliability of supplies was one of the main reasons to import all the inputs. However, in some cases managers showed willingness to incorporate Mexican parts and components if they attained the quality, cost and specifications demanded.

With regard to the inter-urban location of the plants I think that there is a great chance for the cities in the interior of the country to attract in-bond plants provided a good deal of information about advantages and etc. is given to potential investors. Due to the population growth brought about by the booming in-bond industry there are already bottlenecks in infrastructure, public services and housing in the cities along the Northern Border counteracting all the advantages gained from the existence of cheap labour force which itself is becoming relatively scarce due to the great demand. Many cities in the interior already count with the basic industrial infrastructure (industrial parks) and health and educative services which can secure the productivity of the labour force and the smooth performance of the in-bond assembly plants.

The changes in the profile of the worker are the ultimate expression of the redistribution of world production capacity. That is, as economies develop, the changes in their comparative advantage lead to shifts in the composition of output and eventually to changes in the structure of exports. These changes are expressed in the emergence of new patterns of industrial location within the country (and at the world level) and changes in composition of the labour force. Finally, it is necessary to emphasise the important role of the governments, which in fostering employment and ultimately growth, intervene either directly (tax holidays, repatriation of profits, etc) or indirectly (infrastructure and public services, hospitals, schools and other educative centres, etc) to attract this kind of industries.

VI. CONCLUSIONS: THE LOCATION OF IN-BOND INDUSTRY IN MEXICO. Issues for Regional and Industrial Development.

INTRODUCTION.

At the beginning of this study it was argued that the changes in the structure of world production capacity has led to an increasingly more elaborated territorial pattern of specialisations in production. Since the mid-1960s there were some signs or relocation of some particular phases of production from the DCs to the most advanced of the developing countries, the so-called NICs. Subsequent waves of relocation have incorporated more and more countries to world production known as New-NICs and, in time, it is presumed, a third tier of NICs (New-New-NICs?) will integrate as well as the countries of Eastern Europe and of what used to be the Soviet Union.

To be able to understand this process of internationalisation of capital it was first examined those theoretical analyses which deal with the subject with particular reference to the electronics industry. However, as seen all along this examination, the process involves many factors which are difficult to grasp by appealing to any one theory. Ultimately, theories are attempts at interpretation of phenomena and thus limited by their one-sided view when confronted with the hard facts of reality.

As shown in the review of the literature about the internationalisation of production, and in particular that of the electronics industry "is not longer possible to understand local economic and social change in a global context by means of core-periphery categories...[since]...they appear to be simply too static and inflexible to be able to grasp the enormous range of development actualities and possibilities that exist within industrialisation (and other economic development) processes in various parts of the globe" (Henderson, 1989:154). Likewise, the use of outdated dichotomies like those TNCs versus the state, labour versus capital, labour versus technology, DCs versus NICs, LDCs, etc. only hinders the analysis by giving, in most of the cases, more weight to one than another, or defining a relation in the old dependency school when, actually, there is an interrelation and, at the very end there is a process of competition at work that permeates the relation among all this subjects. As there is no TNC laying the conditions of development of any particular nation state, neither there is an "undifferentiated mass of labour-force, easily exploitable, from which to extract absolute surplus value as the NIDL argues or a submissive state kneeling to please the great corporations.

Our purpose was to analyse the emergence of a new pattern of in Mexico, the in-bond electronics industry in the light of the increasing international integration of the sector. The main argument is that redistribution of world production capacity has had as a corollary, the emergence of a new pattern of location of the industry in the host countries, away from the old industrial cores which dominated the economy. As the new locational pattern consolidates and spreads into the country the labour processes upgrade and result in changes in the structure of the labour force in response to the need for more skilled labour.

In this context, the forces of competition which led the firms to seek minimisation of costs and increase productivity, either by technological innovation in products and processes or by relocation of some phases of the production process in lower cost location, were undoubtedly important impulses. However, these impulses could not, by themselves, have led to the redistribution of world production capacity. It was necessary that there were important economic and social changes in those countries potential hosts for the production processes to relocate. These changes were result of the direct and indirect intervention of the governments in the promotion of industrialisation and development.

In essence, I hope this attempt was successful in demonstrate by means of the electronics industry the process above mentioned, that is, we are confronted with changing international division of labour in the electronics industry which is less organised on the basis of core-periphery relations or dichotomic relations. In what follows I will indicate some general implications for the geographical distribution of the electronics industry at the world level. Then theoretical implications of the analysis will be examined. Finally the electronics in-bond industry as a new pattern of industrial location in Mexico and its viability for the regional and industrial development will be discused.

1. THE ELECTRONICS INDUSTRY AND THE CHANGING INTERNATIONAL DIVISION OF LABOUR.

As regards the electronics production,it is clear that a redistribution of world production capacity has emerged since the early 1960s, and it seems unstoppable as more countries integrate with the international arena like those of Eastern Europe, the former Soviet Union and the booming Southern region of China. The most important factors contributing to the internationalisation of production are, the internal characteristics of the production processes (which allows for the spatial separation of phases of production) and strong competition between capitals in the industry. Competition has led the firms to look for strategies to increase productivity levels, whereas cutting down cost per unit of output and prices. But, also, as mentioned above, there needed to be economic and social changes in those Third World countries to make them able to host production processes at the productivity levels required by the firms to maintain profitability levels.

Therefore, firms have looked for the best locations to perform the several phases of production process. Henderson (1989:155) suggests that there is a continuum of interrelated production activities at the global level. At the top end, decision-making, R&D and design activities locate in the US and Japan, then there is the location of production facilities in Scotland, West Germany and other countries of the EC and at the lower end, the assembly phases of production with lower skill-requirements locate in the most developed of the developing countries, the so-called NICs in a first stage and later, the New-NICs. However, the pattern of location and interrelations is more complicated.

Henderson affirms that Hong Kong, Singapore, South Korea and Taiwan "play a more subservient role in the international division of labour than does Scotland" (1989:156). However, my own survey and other studies on the subject suggests that the Asian NICs as important producers of consumer electronics, computers and semiconductors are less dependent than Scotland. Crucial inputs to the electronics industry are much cheaper in Asia. Moreover, the cost of assembly labour and engineers are lower with higher levels of productivity (Ernst, 1985:339). More important, the Asian NICs count with local firms which already compete in the world market of consumer electronics, computers and semiconductors. As it was pointed out in chapter II, Taiwan and South Korea are leading exporters of terminals, Singapore is a major supplier of disk drives and Taiwan, South Korea and Hong Kong are expanding their shares in the world market for personal computers. In the field of semiconductors, according to Scott's (1987) study on South-East Asia, in 1985 out of 124 plants in the region, 61 were locally-owned from which 17 were engaged in diffusion and assembly (wafer fabrication was found only in Hong Kong, South Korea and Taiwan) and 44 only in assembly. Likewise, it is now seen that TNCs from these NICs are aggressively investing in the DCs to gain access to their markets. There is also the exceptional case of Malaysia which in less than ten years became the third producer of semiconductors in the world and is likely to host a number of integrated plants combining wafer fabrication with automated assembly and testing facilities. Thus, South-east Asia is becoming an important "core" in the production of electronics on its own right with an interregional division of labour where the more advanced phases of production are performed in the NICs (Hong Kong, Singapore, South Korea and Taiwan) and the less-sophisticated phases in New-NIC locations as Thailand, Philippines, Indonesia, etc., as a result of their upgrading and improvements in the performance of assembly activities and their cheaper labour costs. On this conditions it is hardly probable that the diffusion of automation in assembly-lines gives place to the 'exodus' from the NICs to the DCS as several authors foresee due among others to several factors. The Asian market will grow fastest for years to come than any other, the pace of reform in China suggests that the boom may not be limited to the Southern provinces making up for the biggest single market for electronics. Already Motorola announced the establishment of a $120m semiconductors factory in Tianjin, a port city near Beijing, due to go into production in 1994 (The Economist May 30th, 1992). The high cost involved in 'automation' investment and the high rate of innovation which makes the life- cycle of products shorter, makes it necessary great flexibility in assembly-lines possible with the utilisation of labour force.

Likewise, recent developments in the Latinamerican economies are likely to raise incomes and improve living standards in those countries hence constituting another potential market of considerable size. In the late 1980s investments in production facilities were made in Mexico by IBM, Hewlett-Packard, Apple, Ericsson and Xerox aiming to the Mexican market in particular and the Latinoamerican in general. Apart from these investments, there is the in-bond electronics industry whose location in the Northern Border was in principle aimed to access the US market[1] and take advantage of the cheap labour force and the facilities to import materials and equipment and export the assembled goods. As the restrictions on location have relaxed together with labour shortages and bottlenecks in

1 However, since most of the assembled goods are sent to the parent company or to any other company within the corporation rather than to the retail market it is difficult to know if all the production is destined to the US market or to any other foreign market.

public services this industry has spread into the interior of the country. Tax exemptions, the possibility of selling a great part of the output in the local market, the prospects of a free trade agreement with the US as well as the positive economic environment in Mexico means that the in-bond electronics industry will continue growing and the new locational pattern in Mexico will consolidate.

In the case of places like Scotland, the location is aimed to have access to the EC markets. The type of international production located by electronics firms in developed countries (like in Scotland) is substantially different from that in the Third World countries. For example, in the case of the semiconductors industry Scotland specialises in different production processes than those performed in the Asian NICs, for example firms make the masks (production of celluloid filaments that contain the microscopic electronic circuits) in the DCs (e.g. US), fabricate the wafers (process by which the circuits on the mask are transferred to the silicon wafer and etched into its surface) in Scotland; then, the assembly of transistors diodes and integrated circuits is made in some New-NICs (Malaysia, Indonesia, etc) and from there the ICs are sent to Hong Kong or Singapore to be tested and then they are distributed either directly to the markets or to other firms down the ladder to be assembled in electronic products as TV sets, computers, etc (as in the case of some in-bond plants in Mexico). In this context, it is difficult to say which country has a stronger electronics industry since they specialise in different activities.

2. THE INTERNATIONALISATION OF ELECTRONICS PRODUCTION: IMPLICATIONS FOR THEORY.

In the analysis of electronics industry in general and of the in-bond electronics industry in particular, it was tried to emphasise the complexity of the process of internationalisation of capital to be explained on the light of only one theory. It is not the pretension of this research to be conclusive at this respect but, taking a pragmatic stance, point out that, in the main, all the existent body of theory on the internationalisation of capital has idelogical connotations resulting from the own view of the theorists, and are not definite statements of facts.

For example, the NIDL thesis highlighted some which led to the offshore location of production facilities in the early 1960s as the need to reduce production costs while increasing productivity in the face of an intense competition. The fact that important changes were taking place at the time in some Third World economies was also acknowledged since it allowed for the location offshore of production facilities to take advantage of the "comparative advantage" which these countries possessed, a large pool of unskilled labour force mostly unemployed or underemployed.

However, and against what some other authors claim, the TNCs role was not one of bulling the nation-states to intervene in their favour and against the interest of the working class. Actually, state interventionism has been a product of the development priorities of the governments and very often the first concern is with the employment effects of a given strategy. As shown in chapter III with particular reference to the emergence of the of Mexico as NIC but extensive to the other NICs, many times foreign investment has been regulated or restricted to certain sectors or conditions like local content, export quotas, import restrictions, technology transfer, etc. to achieve important goals, as the upgrading of the labour force skills (as in Singapore and Hong Kong) and thus secure the investment in relatively high-skill capital intensive production processes or to encourage local firms (as in the case of South Korea) that soon would attain world level standards and hence compete with other TNCs in their own "play-fields".

At this respect, it becomes clear that the NIDL obsession with valorisation problems, absolute surplus value extraction and exploitation of the large supplies of cheap labour force; the product-cycle model production continuum in which the mass production of standardised goods takes place in LDCs or the pyramidical structure of corporate power of Hymer (1979) failed to anticipate the complexity of the contemporary trends in the redistribution of world production capacity as, the movement of some segments of US industry from the old industrial areas to the "Sunbelt" areas in the West; the movement to backward areas within the DCs (e.g. Ireland, some areas of the UK and Spain); the upgrading of some NICs (notably the Asian Gang of Four, Hong Kong, Singapore, South Korea and Taiwan) which, thanks to either government policy or business activities, are location of more sophisticated labour-intensive processes and regional headquarters of important TNCs in the electronics industry giving place to the emergence of a regional division of labour. Also the New-NICs (and New-New-NICS) and the emergence of TNCs in the NICs are object of concern of some academics nowadays. It is necessary to keep in perspective that the redistribution of production capacity is not simply the consequence of TNCs operations (as the dependence and development theories would argue) or nation-states intervention alone, world slump and the policies of international institutions (like World Bank or IMF) have also some influence in the economic policies of the countries concerned and thus in the shaping of the industrial geography.

The driving force in the internationalisation of capital are both the contradiction between capital and labour and the competition between capitals. To survive and expand, capital must maintain the rate of profit which requires increases in labour productivity which in turn can only be accomplished by large investments in education, health services and other public services. Those countries whose labour productivity is accompanied with investments in higher education capable of reproducing the skilled labour power required to perform relatively high-skill, capital-intensive production processes will go up in the ladder vacating their places to less developed countries able to perform low-skill labour processes.

All along the survey, it was tried to show that there cannot be a Great Theory about the redistribution of world industrial capacity due to the complexity of the phenomenon, it is necessary to understand the historical changes taking place in the potential host countries and the role of the nation states as well as the dynamics of development and competition in industrial production, the structure of the markets and technology.

3. THE ELECTRONICS IN-BOND INDUSTRY: A NEW PATTERN OF INDUSTRIAL LOCATION AND DEVELOPMENTAL POSSIBILITIES.

There is not pretension of giving a conclusive analysis on such a controversial subject, but it is thought that some important questions may have been better clarified with the findings of the survey as, for example, to what the extent the host countries' governments can influence the location of this kind of industry through the careful design of an industrial location strategy, which includes the provision of educational, public services and other infrastructural facilities, to improve productivity levels. However, there remain some questions to be answered, for example, What kind of policy instruments can increase the consumption of local inputs as to generate important linkages with the subsequent developmental effects throughout the rest of the economy?, What then are the effects of in-bond plants and the internationalisation of capital upon long-term regional development? in what follows I will try to give an answer to these questions.

From the analysis on the performance of Mexico in the last two decades in economic terms and international trade and more specifically in terms of electronics industry it was clear that the changes of comparative advantage over time led to shifts in the composition of output and eventually to changes in the pattern of exports, and in the geographical distribution of industry.

Despite of having great advantages as geographical proximity to the United States, market size and natural resources contributed to maintain longer than in the Asian NICs the import-substitution strategy while at the same time establishing the conditions for a full opening of the economy. Actually, some sectors performed outstandingly well throughout all the period considered as machinery and parts, specially automotive parts and the in-bond assembly industry located, mainly in the Northern Border. In particular, the in-bond industry became an important source (the second), after the petroleum sector, of foreign currency and a big generator of employment, nowadays it provides an estimated of 500 000 jobs for Mexicans. The oil-boom and the expansion of the domestic market further delayed the integration to the world economy. However, once it became clear that the expansion of manufacturing for export was a major source of employment and dynamism for the economy, the Mexican government committed to take the necessary measures to open the economy and make a more efficient utilisation of resources instead of pampering an uncompetitive industrial base, now exposed to competition from foreign companies.

The measures had, as a result, positive consequences for the economy in terms of growth, reduction of inflation, increase in DFI, increase in exports, and a major integration of Mexico to the world economy. In this respect is noteworthy the negotiations of a free trade agreement with United States and Canada which will bring further advantages to all the parties, spite criticisms, and specially to Mexico in terms of an increase in investment (foreign and domestic) and employment.

Therefore, the changes in the composition of industrial output towards a more export-oriented production have had, as a consequence the emergence of a new locational pattern different to that of the heavy industrial concentrations in the three metropolitan areas of Mexico City, Guadalajara and Monterrey. This new locational pattern merged in the Northern Border in the way of in-bond plants mentioned above. The assembly of electronic products and components is a good example of this shift in Mexican industry. It is heavily concentrated in the Northern Border Region though the interior region is gaining importance in terms of the location of in-bond industry due to wage differentials, labour shortages and bottlenecks in the supply of public services and infrastructure in the Northern Border plants.

From the analysis it can be concluded that the incentives provided by the government (the BIP and the in-bond industry regulations and later reforms) were and are important in attracting production processes first to the Northern Border and nowadays to the rest of the country. But it is also the case that this area designated by the government provided the kind of low-cost labour suitable for routine and assembly-line tasks required by the TNCs and with the required levels of productivity. Also the geographical proximity to United States provided and additional stimuli.

Without denying the existence of traditional sweatshops in the Mexican in-bond electronics industry, the survey revealed a change in the characteristics of both the labour force and the kind of plants established. In-bond plants use more skilled labour and also more males in production lines. Likewise the kind of production processes established in Mexico is changing. Nowadays, there are more sophisticated assembly processes which require more attentiveness and skill from the workers, more supervision from technicians as well as more automation of some phases to secure productivity, efficiency in the use of inputs and better quality. These changes in the profile of the assembly worker and of the in-bond plants are the ultimate expression of the redistribution of world production capacity.

As to the factors influencing the location of this kind of industry in the Mexican Northern Border it was found that the availability of cheap skill and semi-skilled labour force was the main factor considered by the firms as well as the facilities to import inputs and equipment and export the assembled products. It was found that, due to the existence of intra-firm trade, plants receive all the parts and components from the parent company (or any other firm within the corporation). That is why the local content of the assembled products is minimum and limited to some packaging materials. Moreover, most of the firms pointed out that, apart from the intra-firm trade policy of the parent company, the unavailability of inputs, quality control and unreliability of supplies was one of the main reasons to import all the inputs. However, in some cases managers showed willingness to incorporate Mexican parts and components if they attained the quality, cost and specifications demanded. It will be necessary then to design a system of incentives to attract more in-bond electronic firms to the interior and hence boost the local content of the products. Recently, Mexico changed the tax regime for in-bond plants, including a 4 per cent cut in corporation tax from 40 to 36 per cent and exempted all Mexican sales to in-bond plants from value-added tax - an incentive to raise local content. Likewise according to a new decree in-bond plants can sell to the domestic market up to 50 per cent of the value of their exports. However important these measures, it is considered that it is also necessary to provide in-bond plants with information about the range of possibilities in terms of availability of inputs in the country and also to design another system of incentives and provide information about potential customers to the Mexican manufacturers to encourage them to supply in-bond plants. For example tax credits and deferral can induce local firms to serve in-bond plants. Although a permanent tax give-up by the government would obviously be irrational, a short tax holiday could conceivably be efficient. It would allow potential suppliers to take maximum advantage of any deferral provision while forging a close customer-supplier relation with the efficiency, quality and reliability required. The government revenues sacrificed in this way would be more than compensated by the effects on employment and income in the concerned location.

As the boom in the Mexican Northern Border show, there are undeniably some positive impacts of in-bond plants in terms of employment, income and upgrading of the production processes that can be extended to interior locations with the changes to the tax regime above mentioned and also with a better promotion of the industrial structure in the way of industrial parks already existent in many interior locations. This industrial structure, being initially aimed to the domestic manufacturing industry, is underutilised, and in some cases semi-abandoned[2] due to the economic crises of the 1980s and also due to a failure of the municipalities to provide in some cases the essential public services needed. This infrastructure and a better provision of public services, specially transport, and educational and health services can attract the in-bond electronics industry to the interior thus easing the pressure on land, public services and infrastructure that the border cities now face and diffusing those positive impacts. Actually, there are already signs that what I have called a new locational pattern of industry in Mexico is consolidating in the interior of the country as it is patent the growing importance of the interior locations in the relevant variables of the in-bond industry.

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[2] During more than three decades a complex of 131 industrial parks and industrial towns has been developed in Mexico. From the microeconomic point of view only 26.7 per cent of all industrial parks and new towns existent in 1988 can be considered successful. The entire complex has about 14 907 plots on which 2 752 firms are located, that is, it utilises only 18.5 per cent of the space available (see Garza, Ibarra and Aguilar, 1988).

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APPENDIX I

QUESTIONNAIRE

LOCALISATION OF IN-BOND ELECTRONICS PLANTS IN MEXICO

QUESTIONNAIRE

LOCALISATION OF IN-BOND ELECTRONICS PLANTS IN MEXICO

Date: __/__/__

No. ______

I - GENERAL INFORMATION CODES

- Name of the firm:.................................
- Person interviewed
  and category:.....................................
- Address and telephone.............................
  ....
  ....
- City:... ______
- Municipality and state:........................ ______
- Date of establishment:............................

1. What kind of plant is this? ______
   (state if more than one, e.g. subcontracting assembly plant).
   1. Headquarters (go to 9)
   2. Branch
   3. Subcontractor
   4. Assembly plant
   5. Other (specify)...............................
2. IF APPLICABLE
   a) What is the name of the headquarters company?
   ______

   ____

   ____

   b) Where is it located? ______

   ____

   ____

3. What is the ownership regime of this plant? ________
    1. Totally foreign owned
    2. Totally national owned
    3. Joint venture between two foreign firms
    4. Joint venture between foreign and national firms
    5. Other companies (specify).......................

II - CHARACTERISTICS OF THE PRODUCT

4. What kind of production process is performed here? ________
    1. Assembly
    2. Manufacturing
    3. Mixture
    4. Other (specify)

5. Could you explain the main stages of the production process? ________

____

____

____

____

6. Can you list the main products of the plant and their main characteristics?

PRODUCTS	WEIGHT	VALUE*	DESTINATION	TRANSPORT

* Selling price in the main market, state in US$ if known.

7. Do you sell mainly to other companies? ________
    1. Yes a) Which?________________________
            b) Where?________________________
    2. No

8. Do you sell to retail markets? ________
   1. Yes   a) Where?________________________________
   2. No

9. Do you sell both other companies and retail markets?

   ____

   1. Yes   a) Which companies? ________________
      ____
      b) Where are the companies__________
      ____
      c) Where are the markets? __________
      ____

10. Do you have any problem with the transportation of the product?
    1. Yes
    2. No
       a). Cost ________
    b). Theft in deliveries ________
    c). Time of delivering ________
    d). Handling ________
    e). Other (specify).......................... ________

11. Can you asses the share of your main markets in the total sales of the plant?
    (Please assess the percentage of each one)

      a) Regional ________
      b) National ________
      c) Latin America ________
      d) USA ________
      e) Japan ________
      f) Europe (specify the country)...... ________
      g) Asia (specify the country)......... ________
      h) Other (specify the country)...... ________

12. If known, please state
      a) Who you main competitor are ________
    ____
      b) Where they are located (headquarters)________
    ____

III - CHARACTERISTICS OF THE INPUTS

13. What are i)the main materials (raw or semi-raw) processed, ii) the main components assembled, and iii) where do they come from (origin of plants, city and country)?

MATERIALS OR COMPONENTS	ORIGIN City	ORIGIN Country	QUANTITY (in numbers)	WEIGHT (gr/unit)	VALUE (US$)	IF NOT DOMESTIC WHY*?
PRODUCT I (specify)__________						
1).						
2).						
3).						
4).						
- continue on another sheet(s) if necessary -						
PRODUCT II (specify)__________						
1).						
2).						
3).						
4).						
- continue on another sheet(s) if necessary -						
PRODUCT III (specify)__________						
1).						
2).						
3).						
4).						
- continue on another sheet(s) if necessary -						

* 1. Not able to produce
2. Price
3. Not enough capacity of production (reliability of supply)
4. Government policy (encouraging imports)
5. Firm policy (intra-firm trade mandatory)
6. Quality
7. Other (specify)

V - CHARACTERISTICS OF THE LABOUR FORCE

14. Specify the number of employees and sex in the different categories

	MEN	WOMEN	TOTAL
1. Managers	______	______	______
2. Administrative personnel	______	______	______
3. Supervisors & technicians	______	______	______
4. Production workers	______	______	______
5. Others (specify)............	______	______	______

15. Specify the qualifications required for each category

1. Managers ________________
2. Administrative personnel ________________
3. Supervisors & technicians ________________
4. Production workers ________________
5. Others (specify)................________________

CODES:

1. Primary school
2. Secondary school
3. High school
4. Technical school
5. University
6. Other (specify)..............................

16. IF APPLICABLE is there any special reason to hire women?

____

____

____

17. What kind of problems do you have with the labour force? ________

1. No problems
2. Stoppage
3. High turnover rate
4. Performance of the activities
5. Absenteeism
6. Low productivity per worker
7. Other (specify)..............................

VI - GOVERNMENT INCENTIVES

18. Please thick if you receive any of the following incentives from the government

a) Financial ________
b) Subsidies and grants ________
c) Loans ________
d) Tax exemptions ________
e) Facilities to take out profits ________
f) Facilities to import machinery or inputs ________
g) Facilities in relation to the labour force treatment (social security fees, control of unions) ________
h) Provisions for the establishment of the plant (land, services, infrastructure, etc.) ________
i) Others (specify).................... ________

19. Please specify the institution ________

____

____

VII - FACTORS OF LOCATION.

20. Was this plant located anywhere else before? ________
    1. Yes
    2. No
    If yes, where?________________________________
21. Why was the plant located here?
    Mexico?________________________________
    State?________________________________
    City?________________________________
22. According to your experience, if you could change location where would you go?
    Another city or state?________________________

    ____

    Another country? (US, South Korea, etc.)__________

    ____

23. Can you define the costs of the plant?

ITEM	COST	PERCENTAGE
1. EQUIPMENT		
2. LAND		
3. BUILDINGS		
4. INPUTS		
5. LABOUR		
6. INFRASTRUCTURE		
7. OTHERS (specify)		
a)		
b)		

- if necessary, continue on another sheet -

24. Please rank (1, 2, 3, so on) the following location factors in relation to their importance in the location of the plant <u>IN THE COUNTRY</u>

a. Access to markets ________
b. Availability of skilled labour force ________
c. Availability of non-skilled labour force ________
d. Availability of cheap labour force ________
e. Non-existence of labour problems ________
f. Facilities to import inputs and parts ________
g. Access to infrastructural facilities ________
h. Access to the main transport means ________
i. Government incentives and facilities ________
j. Political stability ________
k. Others (specify)........................... ________

25. Please rank (1, 2, 3, so on) the following factors in relation to their importance in the location of the plant <u>IN THE CITY</u>

a. Access to Markets ________
b. Availability of skilled labour force ________
c. Availability of non-skilled labour force ________
d. Availability of cheap labour force ________
e. Non-existence of labour problems ________
f. Access to infrastructural facilities ________
g. Existence of industrial estates ________
h. Provision of public and industrial service ________
i. Government incentives and facilities ________
j. Others (specify)......................... ________

APPENDIX II

STATISTICS TABLES

TABLE 4.7.A: Mexico: Value-Added in the In-Bond Industry, 1974-1989.
(million of pesos)

YEAR	NATIONAL TOTAL (1)	BORDER STATES (a) (2)	INTERIOR STATES (3)	TOTAL ELECTR. (b) (4)	ELECT. IN BORDER (5)	ELECT.IN INTERIOR (6)
1974	3945.5	3614.8	330.7	2724.3	2450.1	274.2
1975	4014.5	3625.2	389.3	2601.7	2335.9	265.8
1976	5425	4843.8	581.2	3432	3098.3	333.7
1977	7114.6	6244.2	873.4	4453.1	3908.9	544.2
1978	9999.9	8813.5	1186.4	6144.9	5440.3	704.6
1979	14543	12305.3	2237.8	9016.9	7753.1	1263.8
1980	17728.8	15206.6	2522.2	10069.9	8623.4	1446.5
1981	23957	20734.8	3222.2	13305	11493.7	1811.3
1982	46587.7	40380.4	6207.3	25326.3	21481.5	3844.8
1983	99521.2	86682.1	12839.1	49800.2	41152.9	8647.3
1984	194756.6	168518.8	26237.8	96928.3	81976.3	14952
1985	325249.7	282838.4	42411.3	145265.8	121999.9	23265.9
1986	792017.1	669935.8	122082.1	356656.5	300865.3	55791.2
1987	2235150	1802748	432401.6	947946	778504	169442
1988	5263925	4204378	1059547	2179729	1745676	434053
1989(c)	6658320	5903730	754490	2723252	n.a.	n.a.

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuhua, Sonora and Tamaulipas.
(b) Corresponds to electrical and electronic machinery, equipment, apparatus, parts and accesories.
(c) Corresponds to the period January-August, 1989.

SOURCE: INEGI, 1988a, 1989b and 1989c.

TABLE 4.7.B. Mexico: Rate of Growth of the Value-Added in the In-Bond Industry (selected years) (a).

	1974/89	1974/80	1975/82	1980/89	1980/88	1982/87	1987/88	1987/89
NATIONAL TOTAL	39.1	22.2	29.5	48.2	50.9	53.9	57.5	20.9
BORDER MUNICIPALITIES	38.9	21.3	29.1	48.4	50.5	53.2	57.1	28.8
INTERIOR	40.3	28.7	32.7	46.9	53	57.2	59.2	-40.4
TOTAL ELECTR. IND.	36.9	19.6	27.8	46.3	8.9	51.5	56.5	20
ELECT. IN BORDER MPOS.(b)	-	18.9	27.2	-	48.5	51.2	55.4	-
ELECT.IN INTERIOR(b)	-	24.2	31.7	-	51	53.1	61	-

(a) Annual rate of growth was calculated using the following expression

$$r = 1 - (Po/Pf)^{1/n} *100$$

where Po and Pf are the population at the beginning and the end of the period considered, respectively, and n is the number of years.
(b) Data for 1989 not available.
SOURCE: Table 4.7.A.

TABLE 4.8.A: Mexico: Employment in the In-Bond Industry, 1974-1989.
(yearly average)

YEAR	NATIONAL TOTAL (1)	BORDER STATES (a) (2)	INTERIOR STATES (3)	TOTAL ELECTR. (b) (4)	ELECT. IN BORDER (5)	ELECT.IN INTERIOR (6)
1974	75974	71122	4852	50970	47172	3798
1975	67214	62145	5069	42376	38977	3399
1976	74496	67532	6964	47029	42772	4257
1977	78433	70681	7752	48339	43719	4620
1978	90704	82387	8317	56209	51183	5026
1979	111365	100537	10828	69862	63613	6249
1980	119546	106576	12970	69401	62110	7291
1981	130973	116450	14523	76187	68736	7451
1982	127048	113227	13821	74108	66428	7680
1983	150667	134915	15952	82690	73257	9433
1984	199684	176909	22775	108520	95007	13513
1985	211968	176800	25968	100859	87937	12922
1986	249833	212291	37542	113081	96495	16586
1987	305253	251403	53850	134477	109762	24715
1988	369489	298863	70626	161130	127455	33675
1989(c)	443682	354946	88736	171478	n.a.	n.a.

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuhua, Sonora and Tamaulipas.
(b) Corresponds to electrical and electronic machinery, equipment, apparatus, parts and accesories.
(c) Corresponds to the period January-August, 1989.
SOURCE: INEGI, 1988a, 1989b and 1989c.

TABLE 4.8.B. Mexico: Rate of Growth of the Employment in the In-Bond Industry (selected years) (a).

	1974/89	1974/80	1975/82	1980/89	1980/88	1982/87	1987/88	1987/89
NATIONAL TOTAL	11.1	7.3	8.7	13.6	13.2	16.1	17.4	17.1
BORDER MUNICIPALITIES	10.2	6.5	8.2	12.5	12.1	14.7	15.9	15.8
INTERIOR	17.6	15.1	13.3	19.2	19.1	23.8	23.8	22.1
TOTAL ELECTR. IND.	7.8	5	7.7	9.6	10	11.2	16.5	11.4
ELECT. IN BORDER MPOS.(b)	-	4.5	7.3	-	8.6	9.6	13.9	-
ELECT.IN INTERIOR(b)	-	10.3	11	-	17.4	20.8	26.6	-

(a) Annual rate of growth was calculated using the following expression

$$r = 1 - (Po/Pf)^{1/n} * 100$$

where Po and Pf are the population at the beginning and the end of the period considered, respectively, and n is the number of years.
(b) Data for 1989 not available
SOURCE: Table 4.8.A.

TABLE 4.9.A. Mexico: Plants in the In-Bond Industry, 1974-1989.
(yearly average)

YEAR	NATIONAL TOTAL (1)	BORDER STATES (a) (2)	INTERIOR STATES (3)	TOTAL ELECTR. (b) (4)	ELECT. IN BORDER (5)	ELECT.IN INTERIOR (6)
1974	455	429	26	204	189	15
1975	454	418	36	197	179	18
1976	448	406	42	179	161	18
1977	443	398	45	170	153	17
1978	457	420	37	174	160	14
1979	540	480	60	199	182	17
1980	620	551	69	223	200	23
1981	605	533	72	230	205	25
1982	585	514	71	223	198	25
1983	600	533	67	224	201	23
1984	672	595	77	244	219	25
1985	760	672	88	274	250	24
1986	987	915	72	301	268	33
1987	1125	1017	108	334	297	37
1988	1490	1334	156	411	357	54
1989(c)	1699	1491	208	473	n.a.	n.a.

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuhua, Sonora and Tamaulipas.
(b) Corresponds to electrical and electronic machinery, equipment, apparatus, parts and accesories.
(c) Corresponds to the period January-August, 1989.

SOURCE: INEGI, 1988a, 1989b and 1989c.

TABLE 4.9.B. Mexico: Rate of Growth of the No. of Plants in the In-Bond Industry (selected years) (a).

	1974/89	1974/80	1975/82	1980/89	1980/88	1982/87	1987/88	1987/89
NATIONAL TOTAL	8.4	5	3.6	10.6	10.4	12.3	24.5	18.6
BORDER MUNICIPALITIES	8	4.1	2.9	10.5	10.5	12.8	23.8	17.4
INTERIOR	12.9	15	9.2	11.5	9.7	8	30.8	27.9
TOTAL ELECTR. IND.	5.5	1.5	1.8	8	7.4	7.8	18.7	16
ELECT. IN BORDER MPOS.(b)	-	0.9	1.4	-	7	7.8	16.8	-
ELECT.IN INTERIOR(b)	-	6.9	4.6	-	10.1	7.5	31.5	-

(a) Annual rate of growth was calculated using the following expression
$r = 1 - (Po/Pf)^{1/n} * 100$ where Po and Pf are the population at the beginning and the end of the period considered, respectively, and n is the number of years.
(b) Data for 1989 not available
SOURCE: Table 4.9.A.

TABLE 4.14.A. In-bond's Industry Inputs by Source and Geographical Location of Plants, 1975-1989 (million pesos)

	NATIONAL TOTAL			BORDER STATES(a)			INTERIOR STATES		
YEAR	TOTAL	Foreign	National	TOTAL	Foreign	National	TOTAL	Foreign	National
1975	8809.3	8689.3	120	8230.4	8164.4	66	578.9	524.9	54
1976	12205.6	11834.4	371.2	11291	11052.8	238.2	914.6	781.6	133
1977	18527.4	18252.6	274.7	16960.5	16778.1	182.3	1566.9	1474.5	92.4
1978	25914	25456.9	377.1	23903.5	23579.4	244.2	2010.5	1877.5	132.9
1979	36410.4	35895.3	515.2	33559.9	33263.4	296.6	2850.5	2631.9	218.6
1980	40792.7	40095.7	697	36761	36456.4	304.6	4031.7	3639.3	392.4
1981	55386.8	54679.4	707.4	50590.9	50175	415.9	4795.9	4504.4	291.5
1982	110346	108928.2	1417.8	100944.8	100124.2	820.6	9401.2	8804	597.2
1983	349318.9	344782.9	4536	315736.8	312624.7	3112.1	33582.1	32158.2	1423.9
1984	637770.4	629299.6	8470.8	577250.7	570917.3	6333.4	60519.7	58382.3	2137.4
1985	989439.6	980548.9	8890.7	902126.7	895858.6	6268.1	87312.9	84690.3	2622.6
1986	2684371.	2653200	21171.2	2417308.	2396768.	10539.7	267062.7	256431.2	10631.5
1987	7706729.	7588323.	118405.9	6827444.	6769219.	58225.3	879284.4	819103.8	60180.6
1988	17879487	17582455	297032	15489815	15338339	151476	2389672	2244116	145556
1989(b)	15326700	15091600	235100	14613700	14475000	138700	713000	616600	96400

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.
(b) Corresponds to the period January-August, 1989.

SOURCE: INEGI, 1988a, 1989b and 1989c.

TABLE 4.15.A. In-bond Electronics Industry Inputs by Source and Geographical Location of Plants, 1979-1988. (million pesos)(a)

	NATIONAL TOTAL			ELECTRONICS INDUSTRY			ELECTRONICS INDUSTRY IN BORDER STATES(a)			ELECTRONICS INDUSTRY IN INTERIOR STATES		
YEAR	TOTAL	Foreign	National	TOTAL	Foreign	National	TOTAL	Foreign	National	TOTAL	Foreign	National
1979	36410.4	35895.3	515.2	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d	n.d
1980	40792.7	40095.7	697	26378.3	26211.1	167.1	23621.2	23585.4	35.8	2757.1	2625.7	131.3
1981	55386.8	54679.4	707.4	35556.1	35377.8	178.1	32093.3	32021.7	71.5	3462.8	3356.1	106.6
1982	110346	108928.2	1417.8	70681.7	70301.3	380.5	63305.4	63211	94.5	7376.3	7090.3	286
1983	349318.9	344782.9	4536	197821.2	196593.9	1327.3	172426.1	172090.7	435.4	25395.1	24503.2	891.9
1984	637770.4	629299.6	8470.8	337100.2	336034.8	1065.4	292617.6	291922.4	695.2	44482.6	44112.4	370.2
1985	989439.6	980548.9	8890.7	471644.7	470220.7	1424	418965	418091.2	873.8	52679.7	52129.5	550.2
1986	2684371.	2653200	21171.2	1267122	1259676.	7445.8	1116660	1112174	4486.6	150462	147502.8	2959.2
1987	7706729.	7588323.	118405.9	3448120.	3420168.	27952.6	3043801	3030861	12940.3	404319.8	389307.5	15012.3
1988	17879487	17582455	297032	8185259	8112638	70621	7042908	7009558	33350	1142351	1103080	37271

(a) Corresponds to the sectors Electrical and electronic machinery, equipment and parts, and Electrical and electronic apparatus, articles and accesories.
(b) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.
SOURCE: INEGI, 1988a, 1989b.

TABLE 4.16.A. Employment in the In-bond Industry by Geographical Location of Plants and Category, 1975-1988.

	NATIONAL TOTAL						BORDER STATES(a)						INTERIOR STATES					
		OPERATIVES			TECHNICIANS	STAFF		OPERATIVES			TECHNICIANS	STAFF		OPERATIVES			TECHNICIANS	STAFF
YEAR	TOTAL	Subtotal	Male	Female			TOTAL	Subtotal	Male	Female			TOTAL	Subtotal	Male	Female		
1975	67214	57850	12575	45275	5924	3440	61912	53569	11602	41967	5196	3147	5302	4281	973	3308	728	293
1976	74496	64670	13686	50984	6165	3661	67258	58563	12608	45945	5462	3233	7238	6107	1078	5039	703	428
1977	78433	68187	14999	53188	6348	3898	70494	61565	13892	47673	5609	3320	7939	6622	1107	5515	739	578
1978	90704	78570	18205	60365	7543	4591	82130	71446	16965	54481	6739	3945	8574	7124	1240	5884	804	646
1979	111365	95818	21981	73837	9569	5978	100138	86580	20173	66407	8529	5029	11227	9238	1808	7430	1040	949
1980	119546	102020	23140	78880	10828	6698	106208	91024	21329	69695	9562	5622	13338	10996	1811	9185	1266	1076
1981	130973	110684	24993	85691	12545	7744	116142	98682	22936	75746	10986	6474	14831	12002	2057	9945	1559	1270
1982	127048	105383	23990	81393	13377	8288	112875	94157	22135	72022	11915	6803	14173	11226	1855	9371	1462	1485
1983	150867	125278	32004	93274	16322	9267	134086	111782	29494	82288	14690	7614	16781	13496	2510	10986	1632	1653
1984	199684	165505	48215	117290	22381	11798	175778	145886	44544	101342	20122	9770	23906	19619	3671	15948	2259	2028
1985	211968	173874	53832	120042	25042	13052	184664	151580	49260	102320	22239	10845	27304	22294	4572	17722	2803	2207
1986	249833	203894	64812	139082	30367	15572	210635	172431	58348	114083	25711	12493	39198	31463	6464	24999	4656	3079
1987	305253	248638	84535	164103	36740	19875	249595	203852	74175	129677	30245	15498	55658	44786	10360	34426	6495	4377
1988	369489	301379	110927	190452	44312	23798	297127	242362	95991	146371	36246	18519	72362	59017	14936	44081	8066	5279

(a) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.
SOURCE: INEGI, 1988a, 1989b and 1989c.

TABLE 4.16.B. Growth of Employment in the In-bond Industry by Sex. 1975-1988

YEAR	NATIONAL TOTAL Male	Female	BORDER STATES Male	Female	INTERIOR STATES Male	Female
1975-1982	8.8	8	8.8	7.4	8.8	13.8
1982-1987	22.3	13.1	21.5	11.1	29.1	22.9
1987-1988	23.8	13.8	22.7	11.4	30.6	21.9
1975-1988	15.4	10.5	15	9.2	18.9	18.1

SOURCE: Table 4.16.A.

TABLE 4.16.C. Growth of Employment in the In-bond Industry by Category, 1975-1988.

	NATIONAL TOTAL				BORDER STATES				INTERIOR STATES			
YEAR	TOTAL	OPERATIV.	TECHNICIANS	STAFF	TOTAL	OPERATIV.	TECHNICIANS	STAFF	TOTAL	OPERATIV.	TECHNICIANS	STAFF
1975-1982	8.7	8.2	11	11.8	8.2	7.7	11.2	10.4	13.1	12.9	9.5	20.7
1982-1987	16.1	15.8	18.3	16	14.7	14.3	17	15.2	23.9	24.2	25.8	19.4
1987-1988	17.4	17.5	17.1	16.5	16	15.9	16.6	16.3	23.1	24.1	19.5	17.1
1975-1988	12.3	11.9	14.3	13.8	11.4	11	13.9	12.7	18.2	18.3	16.9	19.9

SOURCE: Table 4.16.A.

TABLE 4.17.A. Employment in the In-bond Electronics Industry by Geographical Location of Plants and Category, 1975-1988(a).

	ELECTRONICS INDUSTRY						ELECTRONICS INDUSTRY IN BORDER STATES(a)						ELECTRONICS INDUSTRY IN INTERIOR STATES					
		OPERATIVES			TECHNICIANS	STAFF		OPERATIVES			TECHNICIANS	STAFF		OPERATIVES			TECHNICIANS	STAFF
YEAR	TOTAL	Subtotal	Male	Female			TOTAL	Subtotal	Male	Female			TOTAL	Subtotal	Male	Female		
1979	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
1980	69401	58151	10241	47910	7099	4151	62110	52393	9369	43024	6273	3444	7291	5758	872	4886	826	707
1981	76187	63127	11300	51827	8208	4852	68736	57384	10313	47071	7320	4032	7451	5743	987	4756	888	820
1982	74116	59823	10698	49125	9037	5256	66428	53974	9834	44140	8175	4279	7688	5849	864	4985	862	977
1983	82690	66483	13180	53306	10538	5659	73257	59094	11959	47138	9586	4577	9433	7389	1221	6168	952	1082
1984	105520	87510	19684	67826	14180	6830	95007	76631	18252	58379	12875	5501	10513	10879	1432	9447	1305	1329
1985	100859	79386	18598	60788	14714	6759	87937	69352	17020	52332	13100	5485	12922	10034	1578	8456	1614	1274
1986	113081	88950	21984	66966	16651	7480	96495	76122	19459	56663	14422	5951	16586	12828	2525	10303	2229	1529
1987	129842	102337	27813	74524	18527	8978	109762	86870	24502	62368	15676	7216	20080	15467	3311	12156	2851	1762
1988	152553	120442	35899	84543	21535	10576	127455	101196	31051	70145	17998	8261	25098	19246	4848	14398	3537	2315

(a) Corresponds to the sectors Electrical and electronic machinery, equipment and parts, and Electrical and electronic apparatus, articles and accesories.

(b) Corresponds to the states of Baja California Norte, Baja California Sur, Coahuila, Chihuahua, Sonora and Tamaulipas.

SOURCE: INEGI, 1988a, 1989b.

TABLE 4.17.B. Growth of Employment in the Electronics In-bond Industry by Sex, 1980-1988.

YEAR	NATIONAL TOTAL Male	Female	BORDER STATES Male	Female	INTERIOR STATES Male	Female
1975-1982	2.2	1.2	2.4	1.3	-0.5	1
1982-1987	17.4	8	16.7	6.7	23.6	16.3
1987-1988	22.5	11.9	21.1	11.1	31.7	15.6
1975-1988	14.5	6.9	13.9	5.9	19.3	12.6

SOURCE: Table 4.17.A.

TABLE 4.17.C. Growth of Employment in the In-bond Electronics Industry by Category, 1980-1988.

	ELECTRONICS INDUSTRY				ELECTRONICS IN BORDER STATES				ELECTRONICS IN INTERIOR STATES			
YEAR	TOTAL	OPERATIV.	TECHNICIANS	STAFF	TOTAL	OPERATIV.	TECHNICIANS	STAFF	TOTAL	OPERATIV.	TECHNICIANS	STAFF
1975-1982	3.2	1.4	11.4	11.1	3.3	1.5	12.4	10.3	2.6	0.8	2.1	14.9
1982-1987	10.6	10.2	13.4	10.2	9.6	9.1	12.2	9.9	17.5	17.7	21.3	11.1
1987-1988	14.9	15	14	15.1	13.9	14.2	12.9	12.6	20	19.6	19.4	23.9
1975-1988	9.4	8.7	13	11	8.6	7.9	12.3	10.4	14.3	14	16.6	13.8

SOURCE: Table 4.17.A.

TABLE 4.22. Mexico: In-Bond Industry, Value-Added in Electronics and Electrical Products by Customs District, 1986. (Items 806/807, millions of dollars)

SITC CATEGORY (Rev. 2)	TOTAL MEXICO	SAN DIEGO	NOGALES	EL PASO	LAREDO
TOTAL	713.1	93.7	95.1	286.5	237.8
1. Personal computers	52.39683	6.90569	0	0	45.49114
mainboards (752.4)				0	0
2. Television sets (761)	54.9472	1.11503	19.54305	23.493	10.79612
3. Radio-braodcast sets (762)	25.36	1.22747	20.52258	1.23195	2.378
4. Telephonic terminals (764.1)	7.31797	7.31797	0	0	0
5. Telephonic apparatus (764.1)	2.77905	0	0	2.77905	0
6. Microphones (and stands therefor) Loudspeakers and audio-frequency electric amplifiers (764.2)	3.96824	1.93022	0.26628	0.6303	1.14144
7. TV transmitter-receivers (764.3)	1.7835	0	0	0	1.7835
8. Radio-broadcasting transmitters-receivers (764.3)	57.95186	0	0	0	57.95186
9. Radiotelephonic and radiotelegraphic transmitters (764.3)	0.06573	0.05622	0.00951	0	0
10. Other parts and accesories falling within heading 76 (764.9)	6.60063	5.87499	0.03804	0.6876	0
11. Tuning parts for TV sets (764.93)	22.48806	0	0.15216	5.2143	17.1216
12. Parts and accesories for sound recorders (764.99)	9.87849	1.23684	0.00951	0	8.63214
13. Parts and acc. elec. (764.9)	18.17422	7.23364	0.42795	6.44625	4.06638
14. Cassetes (764.99)	1.11267	0	1.11267	0	0
15. Rectifiers (771.21)	60.95187	14.03626	3.34752	28.27755	15.29054
16. Inductors (771.22)	20.24604	2.94218	3.53772	8.9388	4.82734
17. Lightning arresters (772.1)	0.45551	0.38417	0	0	0.07134
18. Control panels (772.1)	0.86347	0.29047	0	0.573	0
19. Switchboards (772.1)	15.68916	0.2811	0.12363	4.44075	10.84368
20. Switches (772.1)	16.30866	6.43719	0.20922	7.87875	1.7835
21. Other connectors (772.1)	7.10189	4.61004	0.07608	2.32065	0.09512
22. Resistors (772.3)	11.19839	7.31797	0.00951	3.46665	0.40426
23. Other electrical apparatus (772)	37.79101	7.13994	6.77112	15.55695	8.323
24. Electrical insulated conductors (773.1)	57.52985	6.86821	24.45021	20.59935	5.61208
25. Light emmiting diodes (776.3)	0.31515	0	0	0.31515	0
26. Transistors and similar semiconductor devices (776.3)	8.72459	0.39354	7.10397	1.2033	0.02378
27. Microprocessors, MOS (776.4)	0.00937	0.00937	0	0	0
28. Integrated circuits (776.4)	0	0	0	0	0
29. Piezo-electric crystals (776.8)	0.25654	0.01874	0	0	0.2378
30. Parts of semiconductors (776.89)	0.08541	0.02811	0	0.0573	0
31. Parts of cathode-ray (776.89)	4.94624	0	0	0	4.94624
32. Electrical Engines (778.31)	5.00181	0.0937	0	1.17465	3.73346
33. Electrical generators (778.31)	20.50732	9.85724	6.67602	3.0942	0.87986
34. Electrical starting eq. (778.31)	11.88182	0.07496	0.1902	0.6303	10.98636
35. Electrical ignition eq. for internal combustion engines (778.31)	168.4114	0.01874	0.52305	147.4902	20.37946

SOURCE: Author's calculations from L P Puebla, 1988: Table 16.

APPENDIX III
ELECTRONIC FIRMS IN MEXICO

GUADALAJARA, JALISCO.

1. Computadoras y Sistemas para Negocios, S.A. Colonias No. 225, Sector Juarez 44100 Guadalajara, Jal.	Micros and disk drivers
2. Hewlett Packard Mexicana, S.A. de C.V. Manufac. Plant Montemorelos No. 299, Fracc. Loma Bonita, 45070 - Zapopan, Jal. Tel. (9136) 314995.	Minis, Micros and disk drivers
3. IEP de Guadalajara, S.A. de C.V. Calle Rotonda, No. 14. Col. Valle del Alamo, 44440, Guadalajara, Jal. Tel. (9136) 119972	Electronic Cards
4. Industrias Mexicanas Burroughs, S.A. de C.V. In-Bond Plant Calle 3, No. 1338, Zona Industrial 44940, Guadalajara, Jal. Tel (9136) 120260	Electronic Cards, harnesses and circuits
5. INFO-Espacio, S.A. de C.V. Filial Grupo Microton Pedro Moreno No. 1739, Sector Juarez 44100, Guadalajara, Jal. Tel (9136) 153645	Micros and printers

HERMOSILLO, SONORA.

1. PRINTAFORM, S.A. Filial (Grupo Printaform) Carretera Bahia Kino Km. 5.5 Hermosillo, Sonora, Tel (9162) 166718	Micros (PC's)
2. Printa Bowmar, S.A. Carretera Bahia Kino Km. 5.5 Hermosillo, Sonora, Tel (9162) 168100	Micros
3. Festo Electronic Sierra Morena No. 127 Col. Lomalinda Hermosillo, Sonora, Tel (9162) 157243	Programable Electronic Controllers

4. Electro Digital, S.A. C.V. — Micros
   Veracruz 254, Col San Benito
   Hermosillo, Sonora, Tel (9162) 145313

MEXICO CITY

1. Abastecedora Internacional de Computacion S.A de C.V. — Minis, Micros, Videos Printers and Disk Drivers
2. AESPRINTAFORM, S.A. de C.V. Filial (Grupo Printaform) — Micros and Disk Drivers Videos, Diskettes, etc
   Colima No. 439, Piso 3
   Col. Roma 06700, Cuauhtemoc
   Mexico, D.F.
3. Alternativa en Captura, S.A. (Main Office) — Disk Drivers, Cassetes
   Insurgentes Sur No. 263 Piso 1
   Col Roma 06700, Cuauhtemoc
   Mexico. D.F. Tel (915) 5846922
4. ATI de Mexico, S.A. de C.V. — Disk Drivers
   Amsterdam No. 46-402
   Col Hipodromo Condesa
   06100 Cuauhtemoc
   Mexico, D.F., Tels (915) 2869170, 2869489, 2860625
5. Honeywell Sistemas Sistemas de Informacion, S.A. de C.V. — Mainframes, Mini, Micros Disk Drivers, Printers Videos
   Av. Constituyentes No. 900
   Col. Lomas Altas, 11950 Miguel Hidalgo
   Mexico, D.F. Tels (915) 5702467, 2591966
6. IBM de Mexico — Mainframes, Minis, Micros Disk Drivers, Printers,
   Av. Mariano Escobedo No 595
   Col. Polanco, 11560 Miguel Hidalgo
   Mexico, D.F. Tel (915) 2509011
7. Industria Mexicana de Semiconductores, S.A. de C.V. — Integrated Circuits and Transistors
   Blvd. A Lopez Mateos No. 163
   Col Mixcoac, 03910 Benito Juarez
   Mexico, D.F. Tel (915) 5635411

8. Industrias Digitales S.A. de C.V. Micros and Videos
   Plateros No. 7 Piso 1
   Col. San Jose Insurgentes
   03900, Benito Juarez
   Mexico, D.F. Tel (915) 6601495, 6601988
9. NCR de Mexico, S.A. de C.V. Mainframes, Minis, Micros
   Alfonso Herrera No. 75 Disk Drivers, Printers
   Col. San Rafael, and Videos
   06470, Cuauhtemoc,
   Mexico, D.F. Tel (915) 5464845
10. Texas Istruments de Mexico Minis, Micros, Disk
    S.A. de C.V. Drivers, Videos, Printers
    Reforma No. 450, Piso 10
    Col Juarez, 06600, Cuauhtemoc
    Mexico, D.F. Tel (915)514-35-83.
11. Cibernetica AREX, S.A. de C.V. Micros
    (Main Office)
    Angel Urraza, No 311
    Col Noche Buena 03720, Benito Juarez
    Mexico, D.F. Tel (915) 6879464
12. Cintas VAC, S.A. de C.V. Disk Drivers
    (Main Office)
    Leibnitz No. 1, Piso 7,
    Col. Anzures, 11590, Miguel Hidalgo
    Mexico, D.F. Tel (915) 5287420
13. Complementos en Informatica Disk Drivers
    S.A. de C.V.
    Filial (Corp. Tec. Avanzada)
    Av. Patriotismo No. 4
    06170, Cuauhtemoc
    Mexico. D.F.
14. Computacion y Textiles, S.A. Micros
    Descartes No. 51, Piso 2,
    Col. Anzures, 11590, Cuauhtemoc
    Mexico, D.F. Tel (915) 5140088, 5117585

15. Corporacion Electronica Delta Peripherals
Socrates No. 128, Piso 2
Col. Polanco, 11560, Miguel Hidalgo
Mexico, D.F.

MONTERREY, NUEVO LEON.

1. Computacion, Instrumentacion y Control, S.A. de C.V. — **Mainframes, Minis, Micros, Disk Drivers, Videos**
(Main Office)
Filosofos No. 211, Piso 3
Col. Tecnologico, 64700
Monterrey, Nuevo Leon.
2. Control Data de Mexico, S.A. de C.V. — **Mainframes, Minis, Micros**
Subsidiary
Av. Pablo Gonzalez No. 702 Pte.
Col. Chepe Vera, 64030
Monterrey, Nuevo Leon, Tel (9183) 489933, 489780.
3. Data General de Mexico, — **Minis, Micros, Printers**
Subsidiary (Main Office in Mexico City)
Vasconcelos No. 449 Pte.
Col. del Valle, 66220, Garza Garcia
Monterrey, Tel (9183) 783598.
4. MAI de Mexico, S.A. de C.V. — **Mainframes, Minis, Micros**
Subsidiary (Main Office in Mexico City)
Av. Lazaro Cardenas No. 2475
Col. Torrevilla, 66220, Garza Garcia
Nuevo Leon.
5. Micro Nacional, S.A. — **Micros (PC's)**
(Main Office)
Av. Gonzalitos No. 250 Sur, Desp. 116
Col. Montel 64000 Garza Garcia
Nuevo Leon, Tel (9183) 470792.
6. Sperry, S.A. de C.V. — **Mainframes, Minis, Micros**
Subsidiary (Main Office in Mexico City)
Av. Lazaro Cardenas No. 2400,
Ed. Soles Piso 1 Col. 66220 Garza Garcia
Nuevo Leon, Tel (9183) 786586

7. T.C.A. Division Maquinas, S.A. Micros, Disk Drivers
(Sigma del Norte)
Filial (Grupo Sigma)
Connstitucion No. 1247 Pte.
Col. Leones, 64600
Monterrey Nuevo Leon.
8. Tecnor, Electronica y Control Electronic Circuits
(Main Office)
Av. Vasconcelos Pte, No, 200, Desp 206
Col. del Valle, 66220 Garza Garcia
Nuevo Leon.

PUEBLA, PUEBLA

1. Integracion Electronica PC's and printers
y Sistemas, S.A.
(Main Office)
Av. 31 Pte, No. 2317, Piso 2
Col. Juarez, 72410
Puebla, Puebla.

IN-BOND INDUSTRY

MEXICALI, BAJA CALIFORNIA.

1. AUTONETICA Integrated Circuits
Periferico Oriente, Col. Rivera.
Tel. 660166/660113.
2. Ensambladora Electronica de Mexico Hibrid Circuits
Pasaje Reforma No. 90 Altos,
Tel. 540077.
3. Ensambladores Electronicos, Micros
Ave. Navolato 8-9, Col. San Marcos.
Tel. 552601.

TIJUANA, BAJA CALIFORNIA.

1. Matsushita Electronic Components Assembly of TVs and
de Baja California, S.A. de C.V. VCRs
Calle Blvd. Pacifico, No. 14530
C.P. 22610, Tel. 810006.

2. Kyusho Matsushita Electric de Baja California. 2o. Eje Oriente-Poniente s/n, Cd. Industrial Nueva Tijuana. — **Subassemblies for TVs and Computers**
3. MICROELECTRA. Blvd. Salinas No. 698, Fracc. Aviacion, Tel. 817455. — **Electronic Assemblies**

<u>CIUDAD JUAREZ, CHIHUAHUA</u>

<u>Assembly Plants Exporters of Wire Harnesses</u>

1. **Arneses de Cd. Juarez. S.A. de C.V.**
   Prof. Rivera Lara No. 6622. Tel. 178614.
2. **Autoelectronica de Juarez, S.A.de C.V.**
   Parque Industrial Juarez,
   Post Code 2561, Suc E. Tel. 132811.
3. **Conductores Tecnologicos de Juarez, S.A. de C.V.**
   Parque Industrial Los Aztecas. Tel. 110964.
4. **Sistemas y Conexiones Internacionales, S.A. de C.V.**
   Carretera Panamericana 3339. Tel. 186645.
5. **ENSAMEX, S.A. de C.V.**
   Carretera Panamericana, 9380. Tel. 131005.

<u>Assemly Plants Exporters of Electronic Products.</u>

1. **Manufacturera Alemana S.A.de C.V. Hnos. Escobar No. 6965, Parque Industrial Omega, Tel 167140.** — **Radios & tape recorders**
2. **Manufacturera del Bravo, S.A. de C.V. Hnos. Escobar No. 6965, Parque Industrial Omega, Tel. 180739.** — **Tape recorders**

APPENDIX IV

IN-BOND ELECTRONIC FIRMS VISITED IN THE FIELDWORK

AGUA PRIETA, SONORA.

1. Sonidos Selectos de Sonora (microphones and radio equipment).
   Calle 12 entre Ave. 10 y 11, Tel 823-27

2. Goleta Coil. S. A. (assembly of parts for radios and T.V.).
   Calle Internacional y Avenida 27, Tel. 810-44.

3. TELSON S.A. (assembly and testing of T.V. receivers), subsidiary of Zenith.
   Calle 17, Ave 6 y 10 s/n,
   Parque Industrial, Tel. 801-45

NOGALES, SONORA.

1. CII-MEX (assembly of electronic switches and other telecommunications equipment).
   Carretera Internacional Km. 7.5, Tel 247-00

CD. JUAREZ, CHIHUAHUA.

1. Componentes Electronicos, S.A. (electronic components for motor vehicles).
   Carretera Juarez-Porvenir Km 3.5
   Po Box, 16-42-C. Tel. 181533/181099.

2. Electronica y Espacio, S.A.(assembly of electronic components for militar motor vehicles).
   Ave. Amper s/n, Parque Industrial Bermudez.
   Tel. 180585.

3. R.C.A. Components, S.A. (assembly of colour T.V. receivers) subsidiary of RCA.
   Carretera Juarez-Porvenir Km. 3,
   Parque Industrial Bermudez, Tel. 180000.

MATAMOROS, TAMAULIPAS.

1. AT&T (power supplies).
   Ave. Lauro Villar,
   Parque Industrial Cylsa, Tel. 60200

2. Industrias Thompson de Mexico, S.A. (electronic components for motor vehicles).
   Alabama No. 9,
   Parque Industrial Cylsa.

REYNOSA, TAMAULIPAS.

1. Controles Reynosa (electronic components).
   Brecha E-99, Km, 3,
   Parque Industrial Reynosa, Tel. 260-20

2. Partes de Television de Reynosa (assembly of colour T.V. receivers), subsidiary of Zenith.
   Carretera Matamoros/Brecha E-99
   Parque Industrial Reynosa, Tel. 270-60

3. DATACOM de Mexico, S. A.(components and subassemblies for printers).
   Carretera a Matamoros Km. 109,
   Parque Industrial Reynosa, Tel. 12-10-79.

4. LAMBDA SEMICONDUCTORS (assembly and packaging of discreet transistors, integrated circuits and hybrid circuits).
   Carretera Matamoros/Brecha E-99, Edif. No. 8
   Parque Industrial Reynosa, Tel. 278-18/278-68.