Globalization and the Scrambling Process of Catching Up in Mexico

Clemente Ruiz Durán

In the last 50 years, Mexico's manufacturing growth has been fostered, although its competitiveness has relied on the low wage paradigm. In this article, the country's immersion in globalization is analyzed, thereby departing from the effects derived by the oil crisis that forced the country to leave the trap of natural resources to generate productive value chains through the economic opening boosted by the General Agreement on Tariffs and Trade (GATT) and subsequently, by the North American Free Trade Agreement (NAFTA). Such economic opening allowed the development of global value chains through original equipment manufacturing in the automotive, electronics, pharmaceutical, and medical devices industries. However, this process has been characterized by low investment coefficients and scarce innovation compared with Korea, Malaysia and China, due to the lack of an institutional framework that could have promoted innovation to allow the country to overcome the middle-income trap.

Keywords: Industrial policy, Global Value Chains, Catch-up, Mexico

JEL Classification: L00, F43, F6

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I. Introduction

During the last 50 years, manufacturing value added in Mexico has multiplied almost by four times, keeping its rank among industrial countries. However, it has not been able to close the gap with large industrial economies like the United States. In 1970, Mexico's share in the US manufacturing output was 6%. Today it is only 10%. Hence, it could be argued that the catch-up process in Mexico has been slow and erratic.

However, there is a need to explain why the rising share of Mexico in exports (from 0.4% of world exports in 1970 to 2.4% 2017, reaching USD409,404 million) is not that far from the USD573,694 million generated by Korea, where the catch up process has allowed its manufacturing value added per capita to reach USD7,295 dollars, which is considerable above the US value of USD6,064.

This paper argues that Mexico, in the aftermath of the debt crisis, developed a large export platform but with low linkages with the rest of the economy, though it increased industrial capacity in the country. This move has promoted regional development in the country, which in turn, led to a redesign of the economic geography.

II. Getting out of the Trap of Natural Resources

In the 1970s, in the aftermath of the oil crisis, Mexico pushed oil exploration and extraction to finance the operation wherein the Federal Government contracted large volumes of debt under the assumption of high prices of oil. Unfortunately, this never happened due to the opening of alternative sources of oil in different countries in Asia (South East Asia) and the European North Sea, thus leading to the debt crisis of the early 1980s. Overcoming this situation required the establishment of an export platform that will not rely on raw materials, but on manufactured goods, to provide foreign exchange to the economy. As can be observed in Figure 1, manufacturing exports increased and put Mexico in the global value chain (GVC) ranking. At present, its oil export share is at 5%.

III. Changing the Manufacturing Mix: Linking to GVCs

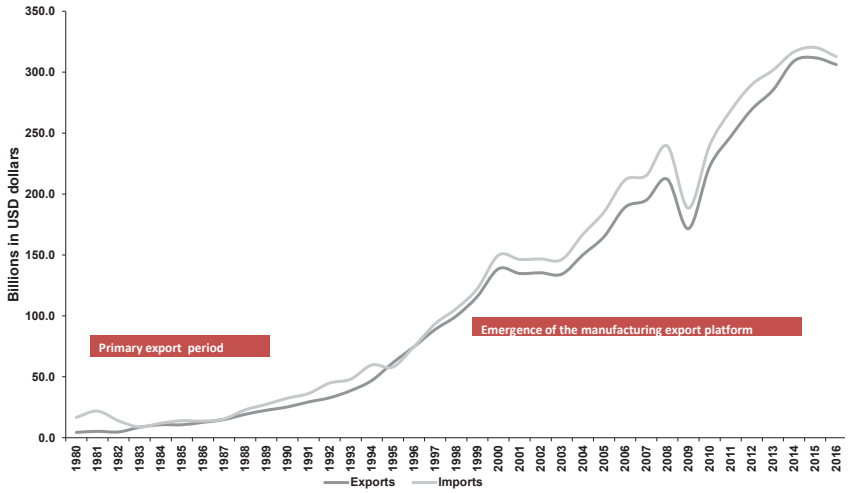
Getting out of the natural resources trap required the development

Table 1

Mexico's Manufacturing Values Compared with Other Countries

International comparisons of manufacturing output: 1970, 1980, 1990, 2000, 2010 and 2016																		
$US in 2010 prices																		
Country	Manufacturing Value Added ($ billions)						Manufacturing Value Added (Rank out of 235)						Manufacturing Value Added as a % of GDP					
	1970	1980	1990	2000	2010	2016	1970	1980	1990	2000	2010	2016	1970	1980	1990	2000	2010	2016
China	NA	NA	NA	NA	1,925	2,979	NA	NA	NA	NA	1	1	NA	NA	NA	NA	31.7	31.3
United States	733	874	1,121	1,655	1,877	1,977	1	1	1	1	2	2	15.3	13.3	12.3	12.9	12.5	11.6
Japan	385	594	950	1,042	1,188	1,261	3	2	2	2	3	3	20.0	20.0	20.3	19.5	20.8	20.9
Germany	408	487	574	609	682	797	2	3	3	3	4	4	26.6	23.9	22.4	19.5	20.0	21.1
South Korea	5	21	67	161	304	371	43	28	15	11	5	6	8.4	15.2	18.6	22.7	27.8	28.4
Mexico	44	88	108	163	165	192	13	11	11	10	15	13	15.3	16.1	16.6	17.8	15.6	15.3
Canada	76	108	135	203	167	183	8	9	9	8	13	15	14.5	13.8	13.4	15.1	10.4	10.0
Brazil	73	177	182	217	281	252	9	7	8	7	7	9	16.1	17.1	15.0	14.0	12.7	11.2
Indonesia	4	18	56	108	166	222	44	31	17	14	14	12	5.9	10.8	18.6	23.7	22.0	21.4

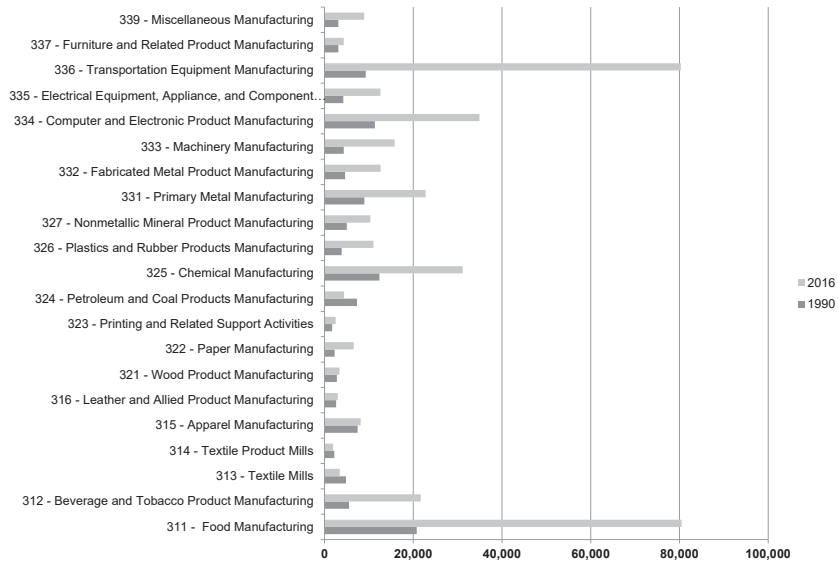
Source: Own elaboration based on UN Conference on Trade and Development (UNCTAD)



Source: Own elaboration based on: OECD, Data, Trade in goods and services.

FIGURE 1
MEXICO: GETTING OUT OF THE TRAP OF NATURAL RESOURCES

of a new manufacturing platform, one that can support an export expansion in a steady way. The main choice was to promote GVCs. Under NAFTA, the main features of Mexico's manufacturing base were its location and wage differential with US and Canada. By 1997, the hourly compensation was of USD2.62, compared with the rates of USD23.04 and USD18.94 in the US and Canada, which was about 10% and 14% of US and Canadian wages, respectively. This differential did not close overtime, for in 2016, hourly compensation rose to USD3.91, which was still 10% and 12% of wages in the US and Canada, respectively. In those terms, Mexico's advantage was its stable low wage neighborhood within NAFTA, which was extremely attractive for many countries willing to export to the States through Mexico. This was the case for German firms to whom Mexico's hourly compensation was even more attractive at just 9% of Germany's rate. GVCs that took advantage of the Mexican platform were those in the transportation equipment manufacturing, computer and electronic product manufacturing, electrical equipment appliances and components, primary metal manufacturing, and chemical manufacturing industries (Figure 2).



Source: Own elaboration based on: INEGI, System of National Accounts, Total Factor Productivity

Figure 2
Change in the Output Mix: Emergence of Transport and Computer Platforms (1990–2016)

IV. New Manufacturing Mix with Low Investment Coefficients

One of the main problems raised by the new manufacturing mix was that it was launched with low investment coefficients typical in bond plants, which often did not require a sophisticated network. There was a high reliance on foreign investors, and from 1999 to 2017, funds for manufacturing plants in Mexico were around USD244 thousand million, mainly concentrated in the transport equipment, electronics, computers, chemical, and beverage manufacturing industries. The overall investment coefficient comprised of 21% of the GDP and the manufacturing investment coefficient was only of 4% of the GDP.

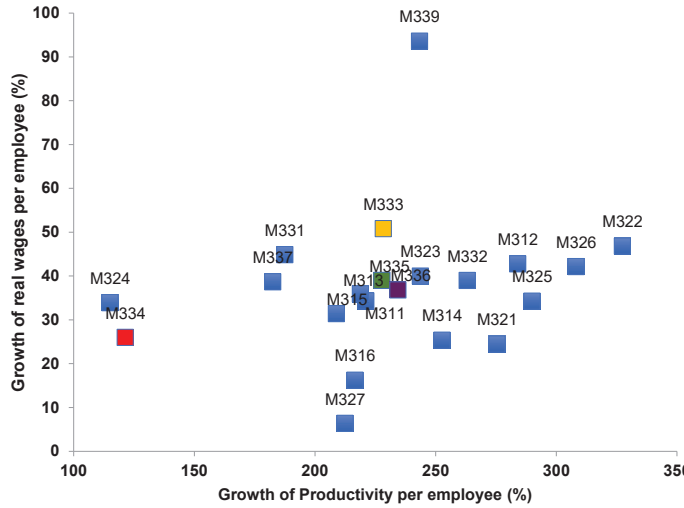
V. Employment and Productivity Effects of the New Manufacturing Mix

The new manufacturing platform created 1,333,744 new jobs in

TABLE 2
MANUFACTURING INVESTMENT AND FOREIGN DIRECT INVESTMENT

	Gross Fixed Capital Formation (% of GDP)	FDI (Millions of Dollars)
Manufacturing industries	4.0	244,540.2
Composition by industry	100.0	100.0
311 - Food Manufacturing	8.4	18,967.5
312 - Beverage and Tobacco Product Manufacturing	3.4	41,768.3
313 - Textile Mills	0.7	1,257.8
314 - Textile Product Mills	0.3	1,447.1
315 - Apparel Manufacturing	0.9	2,367.8
316 - Leather and Allied Product Manufacturing	0.4	369.5
321 - Wood Product Manufacturing	0.2	282.2
322 - Paper Manufacturing	2.4	4,495.5
323 - Printing and Related Support Activities	0.7	745.6
324 - Petroleum and Coal Products Manufacturing	5.1	495.9
325 - Chemical Manufacturing	12.1	29,981.4
326 - Plastics and Rubber Products Manufacturing	3.9	9,806.4
327 - Nonmetallic Mineral Product Manufacturing	2.8	6,388.6
331 - Primary Metal Manufacturing	3.4	12,619.7
332 - Fabricated Metal Product Manufacturing	3.5	4,547.4
333 - Machinery Manufacturing	7.4	9,561.8
334 - Computer and Electronic Product Manufacturing	9.0	19,146.7
335 - Electrical Equipment, Appliance, and Component Manufacturing	6.8	11,692.5
336 - Transportation Equipment Manufacturing	24.7	63,183.6
337 - Furniture and Related Product Manufacturing	0.6	424.3
339 - Miscellaneous Manufacturing	3.4	4,990.6

Source: Own estimates based on INEGI, National Accounts and Ministry of Economics, Deputy of Foreign Direct Investment



Source: Own elaboration based on: INEGI, National Accounts, Total Factor Productivity

FIGURE 3
GROWTH OF PRODUCTIVITY VS GROWTH OF WAGES IN MANUFACTURING 2003–2016.

the period 1990 to 2016, which came mainly from the transportation equipment manufacturing (52%) and from the computer and electronic product manufacturing (33%) sectors. One interesting feature in this process was the increase in the level of education of the manufacturing employees: there was a reduction in posts with basic education, a large increase in intermediate education posts, and a small increase in higher education posts hired by the transport, computer, and electronic product manufacturing sectors.

When this is paired with value added, it could be observed that the growth of productivity per worker increased, but wages increased at a lower rate. Thus, it could be argued that there is paradigm of higher skill combined with low wage manufacturing. As Anderson and Holmes (1995, pp 655) point out "there is a perceived duality between high-wage/high skill and low-wage/low skill industrial strategies underlies many accounts of contemporary industrial change. Within some North American manufacturing sectors, a hybrid strategy has taken root, one that combines technologically sophisticated product and process innovation with low-wage production". This sort of behavior has been

the underlying force of free trade agreements and has also been the driving force of GVCs.

VI. Platform and Cluster Development: Creation of Innovation Ecosystems

One of the main features of Mexico's manufacturing restructuring was that it was led by different forces. On the macro level, the stimulus came through the cost mechanism of low wage paradox, accompanied by an improvement of the education levels among employees. Interestingly, the promotion of investment did not come from a sophisticated central office, but rather by a mix of federal and state level initiatives. The debt crisis pushed the federal government to promote state and local government support for the promotion of industrial clusters. This process became official with the creation of a Board of State Governors Conference (CONAGO) in 2002, which led to the emergence of the planning process at the state level. Governors became active agents for promoting planning, and one of the main features was that they became responsible for developing the business environment and attracting foreign investors into their territory. In some cases, they were supported by long-term planning, *for example*, the State of Guanajuato had a strategic program up to 2040 and the State of Jalisco up to 2032.

Institutional development also led to initiatives that attracted foreign investors through a policy of land use, which was supported by infrastructure development in industrial parks. Around the same time, businessmen created the Association of Industrial Parks (AIP), which hosts more than 538 parks in the country. The AIP promoted the use of new financial tools to promote new developments, as exemplified by the trust funds for industrial real estate denominated FIBRAS, and special funds managed by State governments.

This policy mix led to an uneven process of promotion in the regions, where Federal, State and local governments became involved, with the participation of local businessmen to promote foreign investors into their territories. This sort of policy was successful in attracting investments in the transport equipment, computers and electronics devices, chemical and pharmaceutics sectors, among others. The whole process was developed by stages and by region. The first phase came in the Northern Border States where the electronics industry

took advantage of the Tijuana/San Diego border crossing point for electronics and electro domestic products. This was followed by the auto industry in Sonora and Chihuahua (Ford Corporation), where Chrysler took advantage of Nuevo León and developed the Coahuila network, which later combined the Daimler Benz operation and GM, in the late 20th century. Border states led exports with a whopping 50% of the total exports.

The second wave of investment came from the Western Central area, which aimed to push new industries. Guadalajara became the pioneer in the digital-electronic industries, led by IBM and Hewlett Packard, which promoted the digital businesses that led to creative industries as well as the embedded software developments linked to the auto industry. This attracted the Japanese to set up a Honda Plant for exports. Meanwhile, in the neighboring state of Aguascalientes, Nissan created one of the largest networks that was developed in different stages. At the same time, the Guanajuato area attracted Toyota, Mazda, and Volkswagen. Economies of scope led to the development of the auto parts industries in Querétaro and San Luis Potosí. In the same areas, apart from the development of auto industries, the Canadian Bombardier also set up an assembly plant, and BMW is building a very large facility for the new series 3 cars. Moreover, a domestic complex with national business was built in these areas, which later attracted to Samsung to set up shop in the region. All of these developments have led to a coprosperity area that has posted a 5% annual growth rate, well above the national growth level.

The third area of clustering can be found in the traditional industries platform within the vicinity of Mexico City and the neighboring states, where the first auto industries were installed. Some of them moved up north, while some others refurnished their facilities, *for example*, Ford corporation transformed its Cuautitlan plant from traditional fuels operation to the new generation of electric cars, Nissan in Cuernavaca is assembling the New York City taxis, and Volkswagen and Audi developed new facilities in Puebla. Moreover, Mexico City has attracted large pharmaceutical and medical device corporations, combined with the development of research facilities in the University Centers of Mexico.

Clustering led to a density process that pushed innovations and interactions among regional suppliers, all of which brought in economies of scope at different levels and modalities. In the western

central area of Mexico, interactions increased among relatively medium-sized cities, pushing for a new sort of economic development and giving birth to interactive cities, that instead of increasing in size, took advantage of economies of scope that allowed them to specialize in different segments of the industry. What seems interesting is that the clustering went beyond traditional agglomeration and brought in the new geography of cities that interacted with other cities. As Storper states, "the proximate cause of divergence and turbulence is to be found in changes in specialization, reflecting different levels of creating or absorbing innovative activities" (Storper 2018). Clustering was a disruptive process that required an environment of innovation. For that purpose, there was a demand for technical schools and universities, which in some cases, paved the way for the emergence of research centers. Some key industries took advantage of the knowledge networks developed, as has been the case of Mabe (an electro domestic producer), which decided to interact with local universities in Querétaro and San Luis Potosí to introduce innovations into the production line , instead of creating an R&D department within the company.

University expansion followed a continuous path, as can be observed in Table 3. However, the links have been very loose and very few experiences have followed this path. In a sense, idle capacities are lying in the knowledge network due to the fact that the universities and business have been unable to take advantage of each other's resources, as reflected in the low patent registration in the country. Agent convergence has yet to develop fully due to institutional problems, and there has been no guidance from the Federal, State, or local governments to support these linkages. Actually, there is no need to further expand the educational networks; what is needed is to initiate further interactions, which could be achieved only with a guidance system that could support this process. Today, the Science and Technology Agency (CONACYT), has no power to bring together academic expertise into the enterprises, and reforms are thus needed to push the process.

Although university networks have become the core of knowledge in the aforementioned regions, these have not pushed innovation on a large scale. The isolation of the university networks from the business communities is reflected in the low rate of patent registration. Moreover, even though Central Mexico, Border States, and Western Central States have larger numbers of patents, very few other entities

Table 3
Emergence of Industrial Agglomerations as a Source of the Densification of Manufacturing Activities in the Territory

	1986	2018		1986	2018
Border States	55	289	Western Central States	21	105
Baja California	6	92	Jalisco	6	47
Sonora	15	33	Aguascalientes	3	9
Chihuahua	11	39	Guanajuato	4	23
Coahuila de Zaragoza	7	38	Querétaro	6	13
Nuevo León	8	64	Zacatecas	2	3
Tamaulipas	8	23	San Luis Potosí	0	10
Central Mexico	23	83	Light Industrialization States	16	36
Ciudad de México	0	7	Colima	2	1
Edo. México	11	34	Durango	2	5
Hidalgo	5	11	Michoacán de Ocampo	2	7
Morelos	2	3	Nayarit	2	1
Puebla	4	19	Quintana Roo	2	2
Tlaxcala	1	9	Sinaloa	2	12
			Yucatán	4	8
Oil States	7	17			
Campeche	3	5	Southern States	5	8
Tabasco	1	3	Baja California Sur	2	1
Veracruz de Ignacio de la Llave	3	9	Chiapas	1	2
			Guerrero	1	2
			Oaxaca	1	3

Source: Gustavo Garza (1990) Impacto regional de los parques y ciudades industriales, Estudios Demográficos y Urbanos.

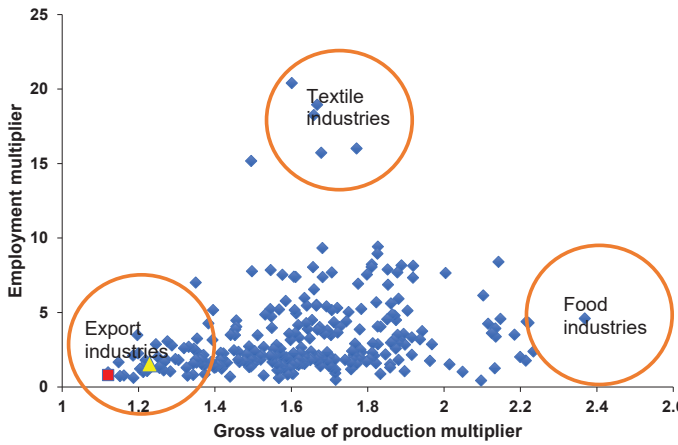
are able to register their own patents. Behind this process, there is also a bureaucratic problem related to the cost of patent registration. As pointed out by Vega González and Hernandez Jardines, "costs that were incurred to obtain two national patents were quite significant, but

Table 4
Mexico Patents Registration by Region

	1986	2018		1986	2018
Border States	302	271	Western Central States	239	256
Baja California	18	12	Jalisco	115	118
Sonora	52	32	Aguascalientes	11	15
Chihuahua	25	42	Guanajuato	55	55
Coahuila de Zaragoza	41	38	Querétaro	46	55
Nuevo León	141	124	Zacatecas	4	5
Tamaulipas	25	23	San Luis Potosí	8	8
Central Mexico	571	657	Light Industrialization States	72	108
Ciudad de México	337	367	Colima	9	11
Edo. México	90	130	Durango	5	8
Hidalgo	30	37	Michoacán de Ocampo	13	21
Morelos	34	41	Nayarit	1	3
Puebla	75	80	Quintana Roo	7	11
Tlaxcala	5	2	Sinaloa	17	28
			Yucatán	20	26
Oil States	25	41			
Campeche	2	1	Southern States	26	26
Tabasco	8	18	Baja California Sur	4	5
Veracruz de Ignacio de la Llave	15	22	Chiapas	14	8
			Guerrero	2	3
Mexicans living overseas	9	5	Oaxaca	6	10

Source: Own estimates based on the Intellectual Property Institute of Mexico, Database, Investment.

much more in the case of patent applications abroad, either by direct application or through the Patent Cooperation Treaty (PCT)" (Vega and Hernandez 2017). Innovation is not homogenous; there is a correlation between cluster development and patent registration, that is, the



Source: Own estimates based on INEGI, Input-Output Matriz 2013

FIGURE 4
MANUFACTURING MULTIPLIERS IN 2013

higher the business concentration, the higher the probability to register patents. As shown in Table 4, concentration is higher in Central Mexico, where 657 patents were registered in 2017, followed by the Border States and the Western Central States. However, the rest of the country has low patent registration rates. Nevertheless, some agribusiness firms are pushing innovation, such as in Sinaloa, where there are large investments in greenhouse and river development. These firms have registered patents for the use of algal blooms as biofuel for agricultural applications.

VII. Industrial Upgrading and Effects over the Economy

The input–output tables in the manufacturing sector were analyzed to estimate the largest multipliers effects over the economy and identify the manufacturing activities that have a larger effect over the economy within the period. As can be seen, there were larger multipliers in industries focused on the domestic market, namely, the food industries in Gross Value Production (GVP) and textile industries in employment, as well as lower multipliers in the export industries.

A question that arises is as follows: If the big transformation of Mexico is based on the creation of an export platform, why do the

Table 5

Exports Value Added as Percentage of Total Production

Subsector	2003	2008	2013	2016	Average Growth 2003 to 2016
31-33 - Manufacturing Industries	10.5	11.1	11.1	13.0	1.7
336 - Transportation Equipment Manufacturing	14.1	20.9	24.4	28.3	5.5
331 - Primary Metal Manufacturing	25.4	27.2	21.9	23.1	-0.7
333 - Machinery Manufacturing	14.3	14.7	14.8	20.5	2.8
335 - Electrical Equipment, Appliance, and Component Manufacturing	19.7	18.4	15.1	17.5	-0.9
339 - Miscellaneous Manufacturing	16.6	19.0	16.3	17.4	0.4
334 - Computer and Electronic Product Manufacturing	25.0	17.2	15.3	14.8	-4.0
332 - Fabricated Metal Product Manufacturing	13.6	11.5	9.0	10.7	-1.8
315 - Apparel Manufacturing	13.0	11.8	9.1	10.1	-1.9
326 - Plastics and Rubber Products Manufacturing	8.5	8.7	7.6	8.6	0.1
313 - Textile Mills	9.9	8.4	6.1	6.8	-2.8
327 - Nonmetallic Mineral Product Manufacturing	7.8	7.3	6.6	6.5	-1.4
314 - Textile Product Mills	3.8	4.4	4.1	6.0	3.6
337 - Furniture and Related Product Manufacturing	3.4	3.7	4.1	5.7	4.1
325 - Chemical Manufacturing	5.4	5.4	4.2	5.3	-0.1
312 - Beverage and Tobacco Product Manufacturing	3.5	4.3	4.3	4.5	2.0
316 - Leather and Allied Product Manufacturing	5.6	3.3	3.0	4.1	-2.4
321 - Wood Product Manufacturing	4.4	4.8	2.4	2.6	-4.0
324 - Petroleum and Coal Products Manufacturing	1.6	1.9	2.4	2.5	3.5
323 - Printing and Related Support Activities	1.2	1.4	1.4	2.3	5.1
322 - Paper Manufacturing	3.1	2.9	2.3	2.2	-2.6
311 - Food Manufacturing	1.5	1.5	1.4	1.3	-1.1

Source: Own estimates based on INEGI, National Accounts, Global Manufacturing value added in exports.

export industries manifest bad performance in terms of employment and gross value of production? It could be argued that domestic linkages are very low. In terms of export value added, all coefficients are below 30%, as can be observed in Table 8, which also shows that the highest coefficients are in the transportation equipment, primary metal, and machinery manufacturing industries. The low value added values indicate that the export platform developed in Mexico is unable to capture more dynamic linkages with the rest of the economy. Changes in the last 13 years have been small, except in the transport equipment manufacturing where it has doubled in the same period, due to the opening of the auto parts manufacturing sector. As mentioned by Lee and Mathews (2012), Mexico fell into the OEM trap, without the possibility of moving beyond the OEM to the ODM or OBM mode (Lee, Szapiro, and Mao 2017). In the Mexican case, the trap is linked to different factors: the free trade agreement, where US multinational firms blocked upgrading, a weak entrepreneurial group focused on rents more than upgrading manufacturing facilities, and the lack of institutions designed to upgrade manufacturing processes within the GVCs.

VIII. How have GVCs increased the Density of Mexican Manufacturing?

The above discussion shows that GVC development has not been able to develop an increased value added into the economy, though it has provided density to the manufacturing sector in Mexico. A complex process of learning with large inequalities has been brought into the sector. This process did not follow the same patterns found in developing economies, rather, it has adapted to multinational patterns, combined with the structure of local governments, which have been taught to develop tools to promote local suppliers, rather than increase imports from abroad. The following paragraphs include detailed examples of how GVCs have been able to develop linkages within the Mexican economy. All of the cases are dynamic and innovative: transportation has gone from the production of traditional vehicles to non-gasoline cars, the electronics industry has allowed Mexico to become a partner in the semiconductor venture reshaping the world economy, and finally, the pharmaceutical and medical devices sector has transformed Mexico into a competitive player in the field of global

health economy.

A. The Auto Industry

In 2015, Mexico produced 3.4 million motor vehicles and occupied 7th place among vehicle manufacturers globally. This level of output was twice that of 2005, when Mexico was the 10th largest producer in the world. This surge is the result of large investments made by international automotive and auto-parts companies, which reached around USD20 billion between 2013 and 2015, according to the Ministry of Economy. The global automotive producers' relocation of production facilities to Mexico has been influenced by several factors, including the country's membership in the North America Free Trade Agreement (NAFTA), its highly skilled labor force, and the low wages. Yet, Mexico's upswing has not yet reached its end for the country is projected to be the world's 5th largest producer of vehicles by 2020. The Federal government has launched a Strategic Program for the Automotive Industry 2012–2020, which aims to combine strategies and policies to make Mexico one of the top three preferred locations worldwide in car assembly and component production. While much of this dynamic should come from exports, the government plans to broaden the domestic market for vehicles with more technology to support the green economy. The value chain developed to date is shown in the diagram 1.

B. The Electronic Sector

The electronic sector focuses on devices or components that process some type of information. This industry is divided into five major sub-sectors: audio and video, computer and office, semiconductors, communications, and medical equipment and precision, measurement, navigation, control and optical instruments. In 2016, Mexico positioned itself as the 8th largest electronic producer in the world and 1st in Latin America. In 2016, the production of this sector was higher than USD77,520 million, contributing 5.3% to the total manufacturing GDP and 1.5% to the GDP.

C. The Pharmaceutical Cluster

Industry production is USD14,283 million, with foreign investments

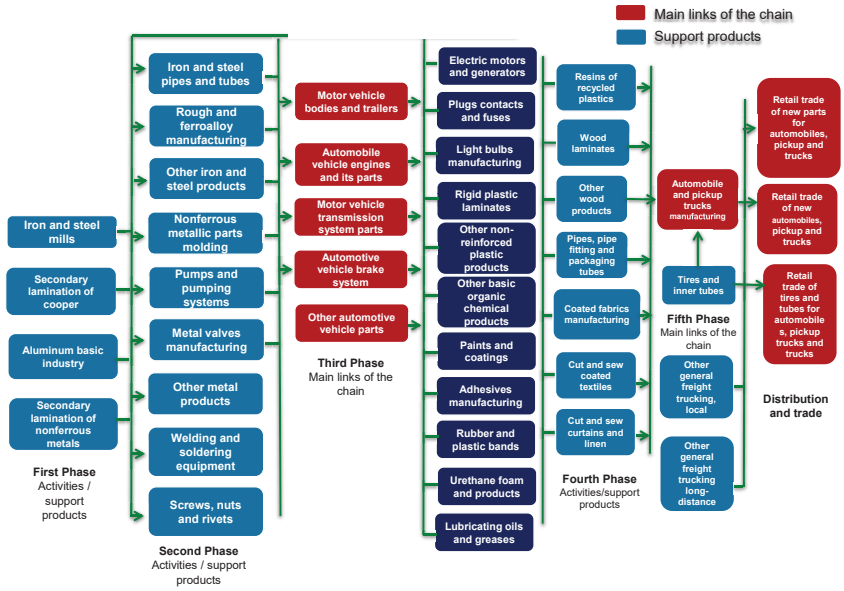


DIAGRAM 1
THE AUTO INDUSTRY

of around USD3,172 million. In addition, local consumption is around USD17,612 million, exports of the pharmaceutical industry reached USD1,847 million, and employment is around 59,650 employees. Over the last few years, Mexico has become an attractive destination for investments in the pharmaceutical industry due to an improved regulatory framework and the increase in quality certifications. Some of the foreign companies that have established operations in the country include Merck Sharp & Dohme, Boehringer Ingelheim, Schering Plough, Bayer, AstraZeneca, Pfizer, and GlaxoSmithKline.

D. The Medical Devices Industry

Mexico is the world's 8th largest exporter and the US' main provider of medical devices. It is also 1st exporter in Latin America; the 3rd exporter of tubular suture needles; the 4th exporter of medical furniture, such as stretchers and operating tables; and the 4th exporter of needles catheters, cannulas, and other similar instruments. The main producers in Mexico, most of which are located in Jalisco, include Medtronic, Johnson and Johnson, General Electric, Siemens, Becton

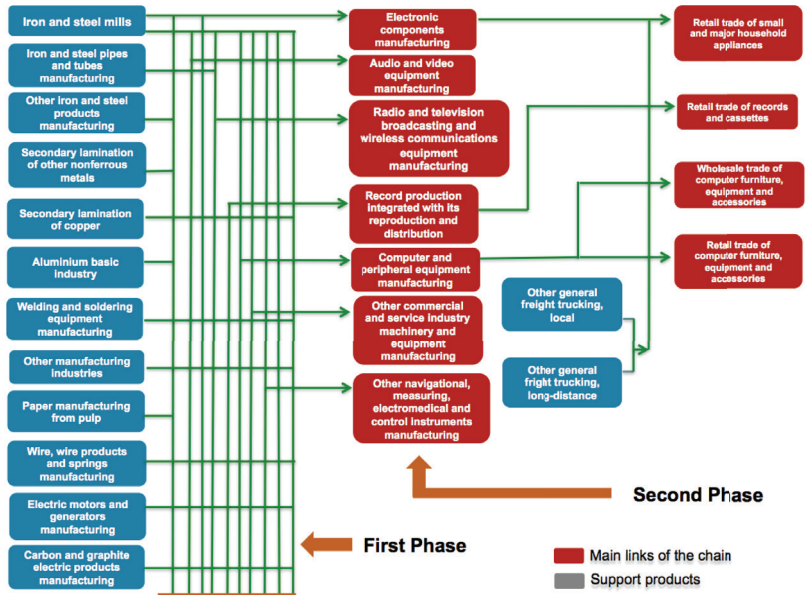


Diagram 2

Electronic and Communications: Value Chain (Part 1)

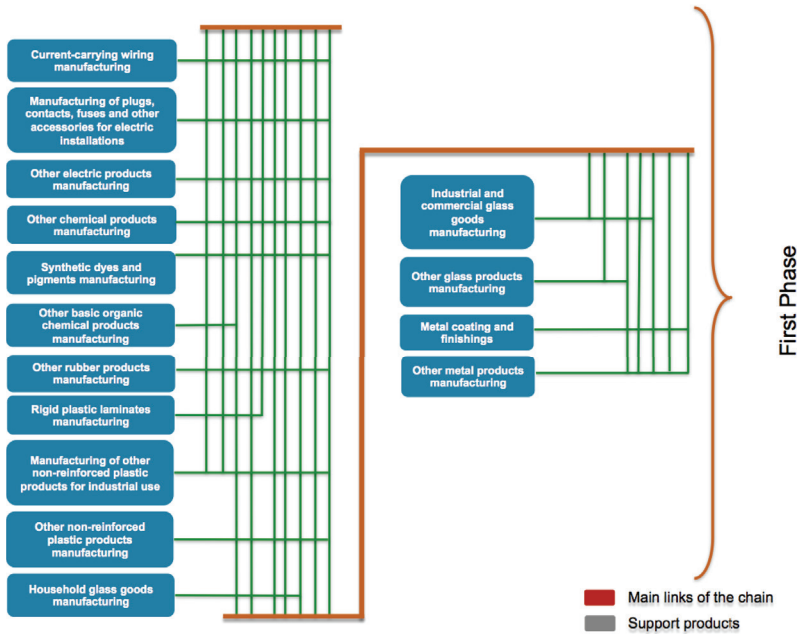


Diagram 3

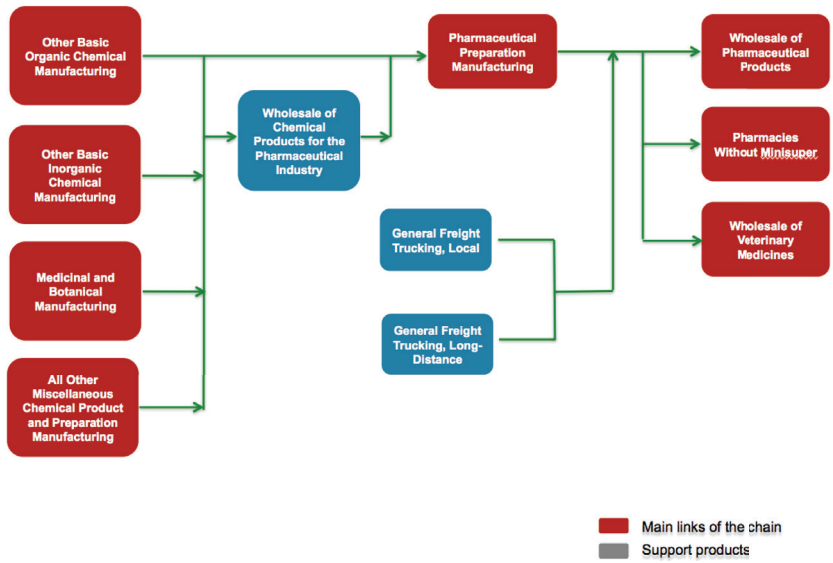


DIAGRAM 4
PHARMACEUTICAL: VALUE CHAIN

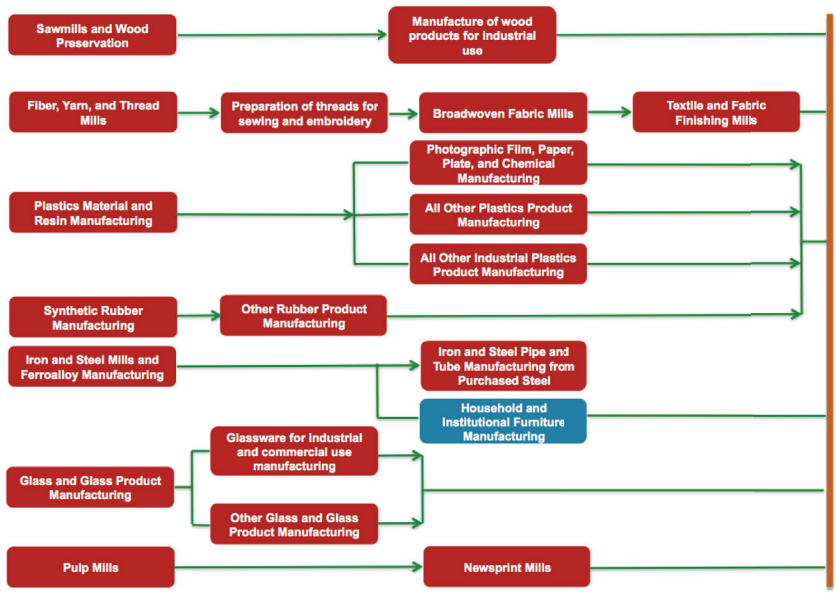


DIAGRAM 5
MEDICAL EQUIPMENT: VALUE CHAIN (PART 1)

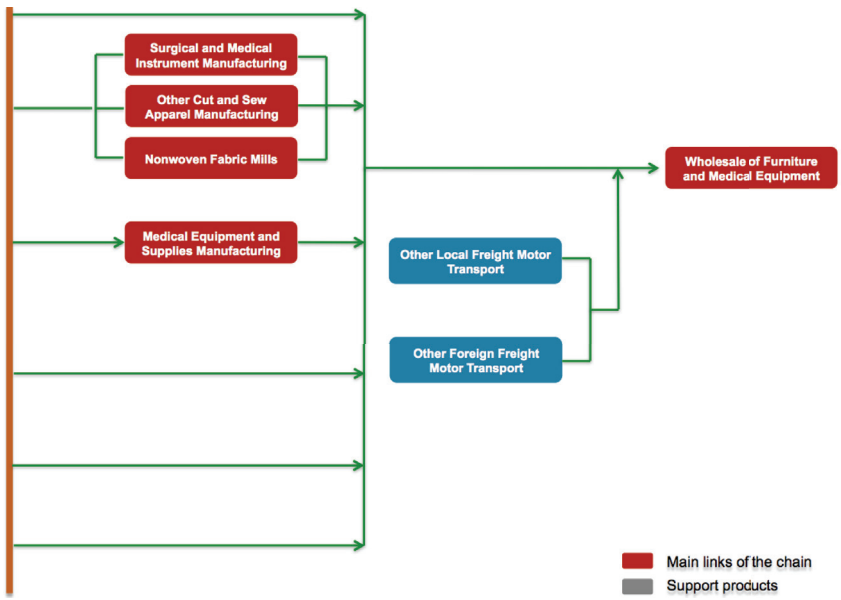


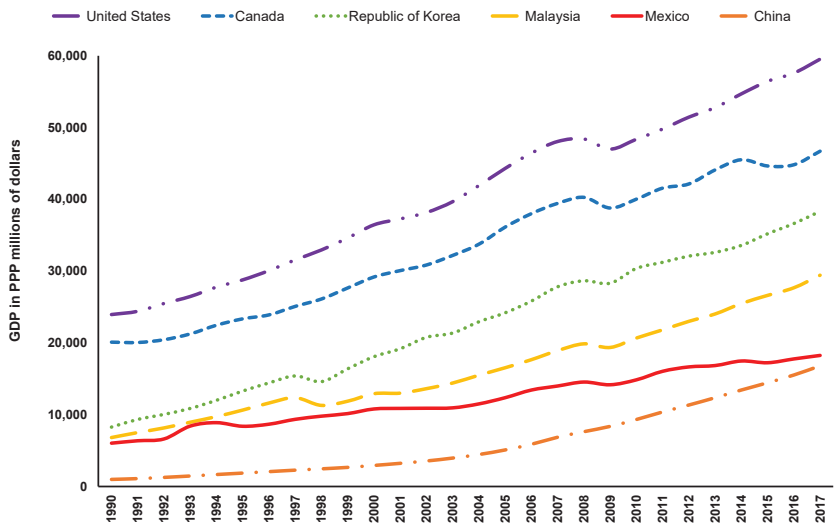
Diagram 6
Medical Equipment: Value Chain (Part 2)

Dickinson, Cardinal Health, Philips, and Baxter.

IX. Institutional Framework and the Catch-up Effect

The Mexican experience reflects clearly the middle-income trap dilemma in that it is currently the 15th largest economy in the world, but is unable to move upwards. The Latin American experience demonstrates that, without mechanisms that stimulate competition in the protected domestic market, government leadership alone is unable to generate sustained productive transformation.

In the last 30 years, several lessons can be gleaned from the Latin American experience. (a) Globalization helps develop comparative advantages, but it does not lead to the broad development of more value added activities. (b) Securing access to developed country markets through trade agreements may lead to greater integration into GVCs, but–by itself–does not lead to an upgrade in production. For example, as shown in Figure 5, Korea and Malaysia used to be at par with Mexico in the 1990s in terms of GDP PPP, now they are dynamic economies



Data source: World Bank, World Development Indicators.

FIGURE 5
MEXICO AND SELECTED COUNTRIES: CATCH-UP PROCESS (1990–2017)

that have surpassed the Mexican economy; China, which used to lag behind, has now almost caught up with Mexico. (c) Encouraging foreign direct investments (FDI) with special incentives and bilateral investment treaties may indeed attract more FDI, but *per se* does not generate significant linkages with the rest of the economy or engender technology transfer. (d) Finally, domestic innovation capabilities do not develop without pro-active government policies at the meso, micro, and macro levels.

To avoid being trapped within the middle-income level, the development strategy for middle-income countries must focus squarely on the promotion of domestic innovation capabilities in a systemic way. As Lee *et al.* (2017) point out in the getting into the "in–out–in again hypothesis," the trend of the FVA of countries would increase initially (during the low-income and lower-middle-income stages), and then decline at the upper middle-income stage when they attempt to create more value-added (relying less on GVC), and finally increase at the high-income stage with the enhanced innovation capabilities and reintegration into the GVC. The reason is that at the initial stage of growth, more participation in the GVC is desirable so that the

industries can learn from the outside. Moreover, functional upgrading at the middle stage requires some effort or stages of seeking separation and independence from existing foreign-dominated GVCs, and at the advanced stage, firms and economies might have to seek further opening to integrate back into the GVC after establishing their own local value chains. The FVA trends in successful catching-up economies, such as Korea, Taiwan, and China, are shown to be consistent with the "in–out–in again" pattern.

The implementation of such a strategy also requires a renewed focus on active policies for productive transformation, on promoting greater innovation in existing sectors, and supporting reallocation towards higher productivity sectors. The large heterogeneity in capabilities and productivity among domestic firms means that the incorporation of knowledge developed elsewhere will continue to be important in increasing productivity for many firms and in reducing the large productivity gaps among firms.

Yet, domestic innovation will be more particularly important in moving forward. It has to be a collective process, wherein public and private actors interact and collaborate, initiatives have to complement each other, and the macro and micro incentives have to support innovation rather than discourage it. Local firms develop capabilities by learning in the production process and through internal R&D efforts as well as through interactions with other key actors in the economy, namely, other domestic firms, foreign firms, research institutions, and universities. The meso and macro contexts have to make learning-by-doing at the micro level possible. This means that social capabilities have to evolve so that firms have the requisite information about technology and markets, have access to funding and the needed qualified personnel, and the possibilities of collaborating with other firms or research entities in the innovation process. Moreover, the relative price and support structure has to be such that it makes the risk-taking of innovation not only possible, but also necessary.

The pervasiveness of coordination failures, capability failures, and market inadequacies, along with the need for non-marginal changes, demand a pro-active state for the achievement of broad-based upgrading. Horizontal and vertical policies are needed to advance social capabilities, support the development of local firm capabilities and establish a critical level of absorptive capacity, enable TNC affiliates to upgrade production in the host country towards more sophisticated

activities, and provide a set of economic incentives that are conducive to broad-based capability accumulation.

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