Technological Change in Turkish Manufacturing Industry: The Case of Gaziantep City

Mehmet Ragıp KALELİOGLU, PhD

Department of Geography, Gaziantep University, Turkey

Abstract:

Ensuring competition in global economy, the production of high value products within the country and the reduction of current budget deficit; in other words, increasing the output of industries manufacturing intermediate goods and end products, which have high import dependency, are major targets of Turkey. The state of technological infrastructure of manufacturing industry in the country as well as the process of change that the industry undergoes are essential for the realization of these targets. New technologies play an important role in the competitiveness and economic development of cities, region and the country in the international market. In particular, the use of new technologies in manufacturing industry and companies' capacity for innovation are prerequisites for businesses to enter a tougher competition in the global economy as well as for cities and countries to persevere on the larger scale. In this respect, the main purpose of this study is to examine the technological transformation of the manufacturing industry in Gaziantep, which is positioned in the top five among Turkey's exports and employs a considerable work force, in comparison to the technological change experienced by the manufacturing industry in Turkey. In the study, the technological level of manufacturing industry in Turkey and the technological change process of manufacturing industry in Gaziantep are presented between 2009-2016 with key indicators. The findings of this study reveal that the current level of technology the city of Gaziantep manufacturing industry has had is far behind the level Turkish manufacturing industry has reached.

Keywords: Technological Innovation, Competition, Gaziantep, Turkey

Introduction

Developed countries, especially in the different geographical areas of the world after the Second World War, achieved a rapid growth trend with strong industrial structure and increased their prosperity levels. Although developed countries have many dynamics on the basis of this growth and development adventure, the most important factor is the existence of manufacturing industry. It is the driving force behind the manufacturing sector of the economies of developing countries such as Turkey and developed countries of the present day (Doğruel ve Doğruel, 2008). The wave of globalization which has started to spread over the world since 1990 has been developing countries in international markets, and in the meantime Turkey has entered a serious competition.

Manufacturing and exporting of the manufacturing industry, which has an important place in the Turkish economy, has seen a significant increase in recent years. This increase is mostly due to the increase in production and exports of low tech products. However, today as the transition to the 4th industrial revolution has begun, it is necessary to further increase the share of the production and export products of the industrial goods within the "high and medium-high technology" group, which will further develop the manufacturing industry. To realize this, it is necessary to make the necessary arrangements and plan the policies and strategies of the central government very well.

Figure 1: The location of the city of Gaziantep

This study covers the technological structure of the manufacturing industry in Turkey and in particular Gaziantep (Figure 1), which is an important commercial, industrial production center and border city in the south of Turkey. Moreover, regional and recent international migration route has transformed the city of Gaziantep into an important consumption center in the last twenty-five years. From 1990 onwards, the economy in the city, which is trying to be integrated into the global world, is mostly based on industry and service sectors (NUTS-2, TRC1 Industry 33.3%, service 54,6% TURKSTAT, 2017). The export volume, which is considered as an important variable in terms of economic weight, reached to 6.1 billion dollars per year in Gaziantep and the country's manufacturing sector constituted 4.4% of total exports and led to the rise to 6th place in 81 provinces (TURKSTAT, 2017). Gaziantep which is considered as a brand and model city for other cities in Turkey (Keyman and Lorasdağı, 2010), is the second rank after Istanbul in terms of the number of firms in the regional distribution of the top 500 companies exporting in 2012 (Bölgesel Gelişme Ulusal Stratejisi, 2014: 80). Therefore, Gaziantep city, which has an advanced economy in its region, is a medium-scale competitive city in global scale, attracting some of the migration in the region and being one of the new industrial centers of Turkey.

Technology, defined as the ability to produce, use and spread information, is an important factor in determining international competitiveness and economic growth, or in other words, the welfare of societies (Saygılı, 2003). From the earliest times of the Industrial Revolution to the day-to-day technological change, many theoretical and empirical studies have been carried out on economic growth, employment and development (Taymaz, 1997). Technology which has been shown to be one of the main reasons for the increase in unemployment as well as economic development and quality of life (Taymaz, 1997), plays an important role in the transformation of the international competitive power and in the spatial dimension of the manufacturing sector. Although there are many different and important classical and neo-classical approaches to technological change in the literature, this study has been examined in the context of the Schumpeterian Theory (creative destruction). According to this theory, technological innovation has been regarded as the engine of economic development in a long period of time. According to Schumpeter's (1942) theory, technological innovation has long been regarded as the engine of economic development (Swedberg, 2003). Again, according to Schumpeter (1942), the process of technological change can be "destructive" at the same time as being a "creative" process maintained by innovations (Swedberg, 2003). In fact, this theory tries to explain the technological differences between firms, and therefore the mechanism of "creative destruction" is related to technological developments (Avcı, Uysal and Tasci, 2016). At the same time, this technological development or change process foresees the redistribution of resources among firms, professions, sectors and countries and suggests that those who can not compete with this process may disappear (Taymaz, 2001). Therefore, the use of new technologies and the need to innovate are essential to the increasing competitiveness of the global economy and the survival of firms and even countries in this process.

In fact, the aim of this study is to determine what kind of goods are based on the production of the existing industry in Turkey and micro scale in the city of Gaziantep according to the density of technology. Moreover, this study investigates

whether there is a change towards the higher technology industry in the manufacturing industry of Gaziantep in comparison to Turkey within the context of development levels. Data for the study NACE Rev. 2, the manufacturing industry consists of 24 sub-sectors with two digits. Today, however, some traditional manufacturing sectors are shifting towards technology that is more advanced. For this reason, some sectors are classified as two-digit, while others are classified as three or even four-digit. In this study, the manufacturing industry was divided into four groups by OECD according to the technology density of each sector. Therefore, some sectors can be included in one of four groups as high, medium-high, medium-low and low technology group in two, three or even four digits (Table 1).

Table 1: Classification of manufacturing sector by technology level

ISIC Rev. 4	Sectors	Group types according to technology
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	A
26	Manufacture of computer, electronic and optical products	A
303	Manufacture of air and spacecraft and related machinery	A
20	Manufacture of chemicals and chemical products	B
254	Manufacture of weapons and ammunition	B
27	Manufacture of electrical equipment	B
28	Manufacture of machineryand equipment n.e.c.	B
29	Manufacture of motor vehicles, trailers and semi-trailers	B
302	Manufacture of railway locomotives and wagons	B
304	Manufacture of military combat vehicles	B
309	Manufacture of other transport equipment n.e.c.	B
325	Manufacture of medical and dental instruments and supplies	B
182	Reproduction of recorded media	C
19	Manufacture of coke and refined petroleum products	C
22	Manufacture of rubber and plastic products	C
23	Manufacture of other non-metallic mineral products	C
24	Manufacture of basic metals	C
25	Manufacture of fabricated metal products, except machinery and equipment	C
301	Building of ships and boats	C
33	Repair and installation of machinery and equipment	C
10	Manufacture of food products	D
11	Manufacture of beverages	D
12	Manufacture of tobacco products	D
13	Manufacture of textiles	D
14	Manufacture of wearing apparel	D
15	Manufacture of leather and related products	D
16	Manufacture of wood and of products of wood and cork	D
17	Manufacture of paper and paper products	D
18	Printing and reproduction of recorded media	D
31	Manufacture of furniture	D
32	Other manufacturing	D

A: High Technology, B: Medium-High Technology, C: Medium-Low Technology, D: Low Technology

Source: EUROSTAT

In addition, in this study, the Turkish Statistical Institute (TURKSTAT) has been utilized for manufacturing, number of firms, employment, and foreign trade data related to the manufacturing industry. Moreover, in order to determine how the manufacturing industry performs in the Turkish economy, the number of firms in each sub-sector and the share of employment and foreign trade within the manufacturing sector are determined by processing the data for specific years. In this way, the relative size and importance of the sub-sectors within the manufacturing industry has been determined relative to the technology levels. However, the fact that data other than foreign trade data related to Gaziantep are not published by the statistical institution has been a major obstacle to this study.

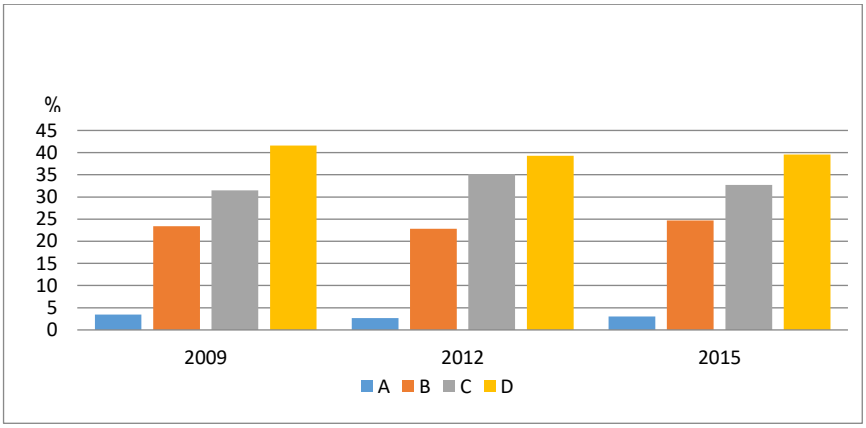
Turkish Manufacturing Sector:

The fact that many economic crises occurred from 1980 to the present day and the application of different development and economic programs in various periods coincide with important structural transformations in the Turkish economy. Therefore, this bumpy process has also been found in manufacturing industry. Especially during periods of economic crises, the manufacturing industry has been in a downturn. However, except for the crisis years, the manufacturing sector economy has generally maintained its position as the driving force or locomotive in general (Doğruel and Doğruel, 2008). Increasing production is essential for a country, a region or an urban space to grow quickly and continuously. In this case, with the economic growth, the share of the manufacturing sector in the economy is foreseen to increase. According to the data from the World Bank (2017), the share of the value added of manufacturing industry in GDP in the period between 1980 and present in Turkey reached to 24% in 1998. Later, however, the share of manufacturing industry in GDP fell to 19% in 2016. (World Bank Data, 2017).

Technological Change in Turkish Manufacturing Sector:

Significant changes have taken placed over time in the technological structure of the manufacturing industry, whose share in the world has declined considerably. For this purpose, according to the OECD grouping, the Turkish Statistical Institute (TURKSTAT), NACE Rev. 2 published data were used.

Figure 2: Production Value by Technology Level - Turkey

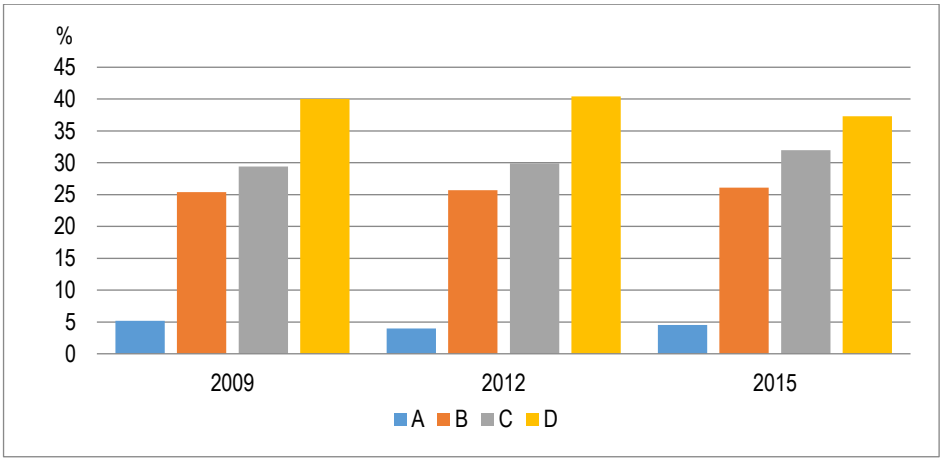


Source: TURKSTAT, based on 2017 data, created by the author

In Figure 2, Turkey's production value "production value" shares are compared to the four technology groups of 2009, 2012 and 2015. Low-tech (D) production, which is 41% in 2009, remains at 40% by 2015, indicating that there is not much change. However, the production value of the medium-high technology (C) manufacturing industry is slightly increasing compared to 2009, especially in 2012. This small proportional increase in the medium-low technology manufacturing sector is related to the decrease in the share of low technology. A noteworthy situation is the decline in the share of the high-tech (A) manufacturing sector in recent years. The share of production value of medium-high technology (B) in recent years shows that there is a shift in medium-high technology from high technology. As a result, despite the decline in the high-tech manufacturing sector in the last ten years in terms of production value in Turkey, low-tech and medium-low-tech manufacturing sectors continue to maintain its importance.

In addition to the production value, examining the technological change in the Turkish manufacturing industry as "added value" will make this work even more meaningful. The "added value", which is defined as the value added to the product at each stage of production, is given in Figure 3 as the share of the products entering the four technology groups in the total manufacturing sector. Accordingly, the share of the goods entering the low tech group in the total manufacturing industry declined in the added value again from 2009 until 2015, after an initial slight rise. Products supported by scientific and AR-GE studies are products with high "added value". A large majority of these products are in the high and medium-high technology manufacturing industry group. Therefore, the share of the goods entering the high tech group in the "value added" of the manufacturing industry has not changed much in the years stated and remained below 5%. There has been a steady increase in the share of goods entering the medium-high and medium-low technology group in Turkey. Although this seems to be positive, the share of goods in the low and medium-low technology group within the total manufacturing sector in Turkey was 70% in 2015, indicating that there is not much change compared to 2009.

Figure 3: Added Value by Technology Levels - Turkey



Source: TURKSTAT, based on 2017 data, created by the author

It may not be enough to determine the changes in the level of technology in the Turkish manufacturing sector as "production value" and "value added". For this reason, while approximately 200 thousand companies operate in the low-tech manufacturing sector in 2009, the number of firms decreased by 1% between 2009 and 2015 (Table 2). This decline suggests that the sector has improved beyond the workplace growth in the manufacturing industry as a whole. Similarly, employment in the manufacturing sector increased by 37% between 2009-2015 compared to the number of employed in the low-tech group, but its share in the total manufacturing sector fell to 52.33% in 2015 from the previous turnover.

Table 2: Number of Firms and Employment by Technology Levels – Turkey

	2009		2015		2009		2015	
	Number of Firms	%	Number of Firms	%	Employment	%	Employment	%
A	805	0,25	1.129	0,34	58.106	2,25	75.335	2,05
B	30.024	9,36	32.011	9,55	448.075	17,3	674.130	18,34
C	90.362	28,2	104.579	31,2	677.974	26,2	1.002.441	27,28
D	199.624	62,2	197.592	58,9	1.400.618	54,2	1.923.137	52,33
TOTAL	320.815	100	335.311	100	2.584.773	100	3.675.043	100

Source: TURKSTAT, based on 2017 data, created by the author

While 805 firms in Turkey were active in 2009 in the high-tech group, the number of firms in the period 2009-2015 increased by 40%. The 30% increase in employment in the same technology group (42% in the manufacturing industry) is the first indication that the industry is in a development (Table 2). In addition, low and medium-low technology industries dominate the manufacturing industry in Turkey with a share of over 90% still at the number of firms. The same group has also formed an important business area in the country's economy with an 80% share in terms of employment in the manufacturing sector in recent years.

Table 3: Exports by Technology Levels (dollars) - Turkey

	2010		2012		2014		2016	
	Export	%	Export	%	Export	%	Export	%
A	3.365.705.110	3,16	4.493.535.793	3,1	4.617.639.862	3,1	4.250.014.981	3,2
B	34.166.301.623	32,1	41.003.582.226	28	46.836.427.927	32	44.594.513.293	33
C	33.693.070.132	31,7	54.374.531.213	38	43.149.075.746	29	38.077.881.021	28
D	35.122.289.055	33	44.434.286.355	31	53.863.278.673	36	47.863.838.611	36
TOTAL	106.347.365.920	100	144.305.935.587	100	148.466.422.208	100	134.786.247.906	100

Source: TURKSTAT, based on 2017 data, created by the author

When the export structure of the Turkish manufacturing industry sector is analyzed, the exports of the total manufacturing sector have decreased compared to the previous year in 2016, with an increase from 2010 to 2016 (Table 3). Within the total manufacturing industry sector, there is a 30% increase in exports of goods entering the high and medium-high technology group in 2010-2016 period. The share of these two groups in the total manufacturing sector reached to 36.2% in 2016 from 35.2%. Therefore, this is an important development for the high and medium-high technology manufacturing sector when compared with other shows. The share of exports of low-tech goods in the total manufacturing sector increased 36% from 33% in 2010 to 36% in 2016. While the exports of goods in the medium-low technology group increased by 13% between 2010 and 2016, the share of the total manufacturing sector in the same period decreased from 31.7% to 28%, unlike other technology groups. As a result, Turkey still has a significant share of 64% in 2016 (Table 3), as is the case for low and medium-low technology group exports in 2010.

Table 4: Imports by Technology Levels (dollars) - Turkey

	2010		2012		2014		2016	
	Import	%	Import	%	Import	%	Import	%
A	19.220.854.379	13,2	20.437.364.457	11,6	23.809.992.283	12,6	26.071.868.042	15,5
B	64.059.659.203	44	75.747.691.529	42,8	81.528.761.676	43,3	77.105.791.033	45,8
C	41.905.517.490	28,8	57.030.937.381	32,3	57.400.226.636	30,5	43.243.657.348	25,7
D	20.528.779.820	14,1	23.593.845.006	13,3	25.765.570.161	13,7	21.805.122.298	13
TOTAL	145.714.810.892	100	176.809.838.373	100	188.504.550.756	100	168.226.438.721	100

Source: TURKSTAT, based on 2017 data, created by the author

Looking at the technological level of imported goods in the manufacturing sector, goods in the high and medium-high technology group increased by 24% in the period of 2010-2016 and their share in the total manufacturing sector increased from 57.2% to 61.3% (Table 4). As mentioned earlier, the share of exports of high and medium-tech goods in the same period was 36.2% in 2016 and the share of imports was 61.3%. While the imports of goods produced in low and medium-low technology groups increased by 4% between 2010 and 2016, their share in total imports decreased from 43% to 38.7%. This indicator shows that Turkey is moving towards high and medium-high technology group regarding imports (Table 4). This situation shows that the manufacturing industry in Turkey is more and more dependent on external markets and

increasing current deficit. The way to improve this negative situation is to increase the added value created in this sector, especially with the number of products and firms competing globally, which would increase the level of technology of the manufacturing industry.

Gaziantep Technological Change in Manufacturing Sector:

According to ISIC Rev.3 and Rev.4 classification obtained from TURKSTAT NUTS 1 (province) scale, 2, 3 or 4 digit data were used in the analysis of goods produced in Gaziantep's manufacturing sector according to 4 different technological group. In this part of the study, it was not possible to determine the technological change in the manufacturing sector of Gaziantep because the production, added value, number of firms and employment statistics were not published by the TURKSTAT. On the other hand, Gaziantep is making the changes in the level of technology in manufacturing sector from the data of the firms exporting and importing in the city.

Table 5: Indicators of Foreign Trade Performance of Gaziantep Manufacturing Sector, Dollar

	Export	Import	Capacity of Foreign Trade	Balance of Foreign Trade	Rate of Exports Meeting Imports (%)	Rate of Deficiency (%)
2010	3.427.447.370	2.890.191.224	6.317.638.594	+537.256.146	118,6	-
2012	5.418.998.298	4.437.431.868	9.856.430.166	+981.566.430	122,1	-
2014	6.528.850.315	5.016.756.745	11.545.607.060	+1.512.093.570	130,1	-
2016	6.103.605.663	3.935.309.515	10.038.915.178	+2.168.296.148	155,1	-

Source: TURKSTAT, based on 2017 data, created by the author

The total foreign trade volume of Gaziantep province, which was 6.3 billion dollars in 2010, reached 10 billion dollars with an increase of 59% in 2010-2016 period (Table 5). However, Gaziantep's foreign trade volume in the manufacturing sector reached its peak year of 11.5 billion dollars in 2014. Between 2010 and 2016, the rate of exports meeting imports varies from year to year, with the exports being higher in all years, giving "foreign trade surplus". In other words, exports in Gaziantep have been surplus in every period and this shows that the city of Gaziantep is a net exporter.

Table 6: Exports According to Technology Levels (dollar) - Gaziantep

	2010		2012		2014		2016	
	Exports	%	Exports	%	Exports	%	Exports	%
A	4.119.006	0,12	10.616.162	0,2	23.460.690	0,36	21.501.319	0,35
B	280.220.243	8,18	343.124.853	6,33	539.137.402	8,26	498.009.276	8,16
C	630.808.514	18,4	800.845.438	14,8	869.923.431	13,3	702.682.103	11,5
D	2.512.299.607	73,3	4.264.411.845	78,7	5.096.328.792	78,1	4.881.412.965	80
TOTAL	3.427.447.370	100	5.418.998.298	100	6.528.850.315	100	6.103.605.663	100

Source: TURKSTAT, based on 2017 data, created by the author

In the Gaziantep manufacturing sector, exports of goods produced in the high technology group increased by 422% (4 times) in the period of 2010-2016 and total exports of Gaziantep reached from 0,12% to 0,35% in the same period (Table 6). In the exports of goods produced in the medium-high technology group, there was not much difference between 2010 and 2016 and its share in total exports reached 8,16%. In the medium-low technology group exports increased by 11.4% compared to the period 2010-2016, but in the same period the share of total exports decreased from 11,5% to 18,4% (Table 6). Therefore, the greatest decrease among the technology groups was realized in this group. The decline in this group emerges as an "increase" in the low tech group. That is, the share of low-tech goods in total exports with a record increase of 94% in the period of exports of 2010-2016 has increased from 73% to 80% in the same years (Table 6). The increase rate in the low tech group in Gaziantep is about 3 times higher than the increase in total export volume of Turkey (Table 3 and 6).

When we look at the technological dimension of imports in Gaziantep, it is remarkable that there is the same export. When the imported goods are examined according to the technology groups, the highest share is in the medium-high technology group. The share of the total manufacturing sector in imports declined from 75% to 61.6% during the same period, although imports of intermediate goods and especially 20-code products were up by 11.8% between 2010 and 2016 (Table 7). Another technology group that has fallen is the medium-low manufacturing group. Since the production of a large part of the goods in this group has been replaced by the Gaziantep industry, there has been a serious decline both in quantity (13% decrease) and share (4.57% to 2.92%) between 2010 and 2016. Another significant aspect is the increase in imports of products in the low-tech group. While the share of this group in Turkey's total imports decreased, there was a 127% increase in Gaziantep between 2010-2016. Its share in total imports also reached from 18% to 30% in the same period. While imports of high technology products increased by 198% in the period of 2010-2016, in other words about 2 times, the share of total imports increased from 2.53% to 5.54%. As a result, while the share of imports of high and medium-high technology products in Turkey's imports was around 61% (Table 4), Gaziantep city imported 67% of medium-high and high technology products (Table 7).

Table 7: Imports by Technology Levels (dollar) - Gaziantep

	2010		2012		2014		2016	
	Import	%	Import	%	Import	%	Import	%
A	73.234.922	2,53	91.697.587	2,07	137.058.782	2,73	218.169.694	5,54
B	2.165.993.253	74,9	2.998.796.974	67,6	3.418.939.088	68,2	2.422.423.714	61,6
C	132.159.874	4,57	157.386.229	3,55	130.328.984	2,6	114.869.509	2,92
D	518.803.175	18	1.189.551.078	26,8	1.330.429.891	26,5	1.179.846.598	30
TOTAL	2.890.191.224	100	4.437.431.868	100	5.016.756.745	100	3.935.309.515	100

Source: TURKSTAT, based on 2017 data, created by the author

While the manufacturing industry in Turkey gave foreign trade deficit each year, it was seen that the city of Gaziantep gave "foreign trade surplus" in contrast to the trend in Turkey (Table 5). While the share of exports in Gaziantep's exports, especially in 2010, constituted 3.2% of the total exports of the Turkish manufacturing sector, it increased by 56% in 2010-2016 period and reached 4.4% of Turkey's total exports in 2016. Gaziantep is ranked 6th in Turkey in 2016 after Istanbul, Ankara, Kocaeli, Izmir and Bursa with this export performance (TURKSTAT, 2017). On the other hand, imports in Gaziantep in 2010 accounted for 2% of total imports in Turkey, an increase of 73% in 2010-2016 period and reached a share of 2.3% in total imports in Turkey in 2016.

3. Conclusion:

The high and medium-high technology group of the manufacturing sector, which is regarded as the locomotive of economic growth, is a sector that has grown rapidly in recent years especially in the developed countries, has increased the level of prosperity and has added high value. The share of manufacturing industry, which is now decreasing in developed countries, is developing very slowly in Turkey and it is a sector which has a decreasing share in GNP in recent years. This situation proves especially that the number of firms in the high and medium-high technology group, the number of employed persons, the production value of the produced goods and the added value are low. Moreover, Turkey has shown that it is an importer in this sector. In particular, imports of products in the high and medium-tech group exceeded 100 billion dollars (60% of total imports). The production of domestic low and medium-low technology products meet the need of production consumption and some of them are exported. However, the city of Gaziantep has imported relatively high and medium-high technology products which are not different from the general situation of Turkey. Besides, both production and export of goods in the low and medium-low technology group, which are considered as traditional production, are much more than the exports of Turkey. At the same time, the fact that exports of low and medium-low technology goods in Gaziantep, which is close to 92%, show that it is an industrial city based mostly on labor-intensive production. This is a sign that the production technology of the city of Gaziantep is unfortunately far behind developed countries and Turkey. Regarding this production model in traditional style and export sustainability, there are serious questions for both Turkey and Gaziantep city.

The lack of sufficient data on production in this part of the study of Gaziantep city is a weakness of this work. Nevertheless, foreign trade data provide information about the production technology of Gaziantep city which is limited to us. Cities such

as Gaziantep should plan technological innovation for a long time in order to compete with the other important cities of the world in manufacturing industry. In fact, this process of technological change takes place with innovations, but in this process there is a risk of destructive features for firms and employment opportunities that can not perform especially technological innovation in the places where the manufacturing industry like Gaziantep is the frontline. This may perhaps lead firms to take their place of residence (ie, the redistribution of the space) into their agenda. As a result, as innovations or technological developments emerge in the context of evolutionist theory, it is important not to forget that traditional production areas like Gaziantep can get out of the way in time and that another city can take its place.

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