Contribution of the Mexican food agroindustry to the gross domestic product during 1993-2019

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Abstract

This research aimed to quantify the contribution of the Mexican food agroindustry to the national gross domestic product, as well as to calculate the average annual growth rate during a 27-year period from 1993 to 2019, which considered the last four six-year periods, and to determine the contribution to the manufacturing industry and the national economy. The methodology was documentary with the following stages: i) selection of the topic to be studied; ii) collection of information from secondary documentary sources, which was mainly from the national accounts of INEGI; iii) preparation of the research plan; iv) information organization, using the North American Industry Classification System of the National Institute of Geography and Informatics; and v) use of the statistical function, which for this case was the average annual growth rate. It was found that the food industry presented a positive trend throughout the period, with an average annual growth rate of 2.21% and with a parallelism with the manufacturing industry, which is the sector that encompasses the food industry; however, the latter presented some falls in its growth. The most relevant agroindustry in relation to the contribution of food GDP was the preparation of bread and tortilla with 30.15%, essential products of the basic basket in the diet of the people of Mexico. Finally, the food industry, on average for the period, contributes 22.42% of the manufacturing gross domestic product and 3.72% of the national product.

Keywords:

average annual growth rate, growth, six-year periods, trends.

Introduction

One of the conceptualizations of agroindustry is that by Torres *et al.* (1997), which indicates that the food industry is the set of agricultural, livestock, or marine products that are made for direct human consumption and that have gone through at least one process of industrial transformation, where at least one additional input has been incorporated into the basic raw material, in addition to being manufactured and distributed by formal establishments, regardless of their technological level, the size of the company and their forms of connection with the market.

This economic activity is very broad and is integrated by multiple types of manufacturing establishments, and as pointed out by Hernández and Pérez (2020), there are establishments that supply the demand for popular foods, such as the preparation of tortillas, bread, sauces, and other products that are aimed at consumers of another type of income level, who consume products such as yogurt, meat, fish and seafood and a variety of semi and processed foods that facilitate the work of their preparation in homes.

The above gives an idea of the breadth and diversity of the food agroindustry, in which food processing technologies are used, from very sophisticated to those that use traditional and artisanal ones, which places us in micro, small, medium, and large enterprises with personnel that includes from family-members to those that require specialists in various technical and administrative disciplines; as well as coverages ranging from the totally local to those that cover the entire country and those that reach international levels.

Regarding the location of the food agroindustry, this is fundamentally oriented towards two aspects: those that seek immediate consumption (oriented to the market), such as those for the preparation of tortillas and bread, and those that, for logistical reasons, need their raw materials nearby (oriented to the production centers), such as sugar mills (supply of sugar cane) and slaughterhouses (supply of cattle, pigs, poultry, etc.).

The official agency Secretaría de Economía (2010) indicates that, due to their dynamism within the economy, the four relevant variables of the food industry are: i) employment, since they are a source of work for approximately 4.1% of the national workforce; ii) the gross production of this agroindustry represents 6.5% of the total Mexican economy; iii) the value added of this industrial branch represented 4.4% at the country level; and iv) both domestic and foreign investment was allocated precisely in areas of physical infrastructure, food processing machinery and equipment, as well as various office equipment, laboratories, and various transport equipment.

On the other hand, a serious problem of this industrial segment is the survival of food agroindustries since it is very low, as pointed out by Rodríguez (2014), who mentions that in Mexico, after 10 years pass, only 10% of micro and small enterprises (MSEs) manage to mature, succeed and grow (they go from micro to small and small to medium) and he also mentions that 75% of new agro-industrial enterprises must close their businesses after two years in the market, 50% of them go bankrupt in the first year of operation and no less than 90% before five years of activity, this situation alone indicates how difficult the consolidation of the food industry is.

Similarly, Coelho and Castillo (2010) mention the emergence of multinational companies in emerging economies as another problem, which compete with local industries to which they are ahead with infrastructure, technology, and above all, capital to survive long periods. With information from Censos de INEGI (2019) and (2014), the number of food agroindustry establishments in 2014 was 171 369, and in 2019, they reached the figure of 208 166 economic units, so that in the five-year period, it increased by 36 795 enterprises engaged in the food industry; in 2014 the proportion of large enterprises, within the universe of food agroindustries, represented 1.3% and this proportion changed in 2019 to 1.7% of a large nature.

As for the number of jobs generated by the food industry in the country, it was 878 695 jobs in 2014, a number that in 2019 increased to 1 092 943, and the proportion of jobs in the large industry in 2014 was 43.92%, and in 2019 the proportion changed to 49.2%.

The purpose of the research is to have a global overview of its situation and contribution to the Mexican economy since, within this segment, there are several industries that provide 33 of the 40 products that are considered within the basic basket of the consumer (SADER, 2022), of which 82.5% are food and that serve as references in the determination of the inflationary process of the country.

The objective of the document was to quantify the contribution of the Mexican food agroindustry to GDP in the country's economy, as well as within the manufacturing industry, and to determine the growth rates of food activity in the last four six-year periods, which serve as a contextual reference for comparison through different eras.

Materials and methods

The methodology was based on documentary research of five stages, which is described below: 1st. stage: selection of the topic to be studied. For the present research, the topic selected was the one that deals with the evolution of the economy of the food industry in Mexico regarding its growth, in which the macroeconomic indicator known as gross domestic product (GDP) was taken as a reference. 2nd. stage: collection of information from secondary documentary sources.

The central idea was to collect data in order to carry out its ordering, classification, and quantification to size the importance of the topic, as well as the construction of a content scheme of the document. The search and precise location of documents kept in information centers, libraries, reference centers, databases, as well as articles and abstracts of proceedings of national and international seminars and congresses, among others, were used.

During this phase, an Excel database was designed and prepared, which was fed with the information generated by the National Institute of Statistics, Geography, and Informatics (INEGI, for its acronym in Spanish) in the various documents that it publishes periodically, and that served to organize the documentary sequence. The study period was delimited according to the national accounts published by INEGI (2020) during the period 1993-2019. 3rd. stage: preparation of the research plan.

With the purpose of ordering and having points of comparison, the 27-year period was segmented into four six-year periods (1995-2000; 2001-2006; 2007-2012; 2013-2018), in addition, the timeline began with the years 1993/1994, which corresponded to the last two years of the six-year term of Carlos Salinas de Gortari and ended in the year of 2019 (preliminary data) of the current administration.

The economic indicator selected to carry out this analysis was the GDP of the Mexican food industry with monetary quantifications on an annual basis, which was calculated under the methods of current (market) prices and constant (deflated) prices, for the latter, 2013 was taken as the base year because they were available at the time of data collection since the update to the year 2017 was in the process of development and they were not yet available to the public, in order to have a way to make comparisons over time. 4th. stage: organization of the information that was collected.

It was carried out through the aggregation of the nine branches of the Mexican food industry used by INEGI, and subsequently, their values were compared with those of the manufacturing industry, which consolidates 21 subsectors, to know the percentage contribution of the economic value of the food industry to the manufacturing industry.

According to the classification system of INEGI-SCIAN (2013), the food industry belongs to subsector 311, which has nine branches that are: 3111 manufacture of animal feed, 3112 grinding of grains and seeds and obtaining of fats and seeds, 3113 manufacture of sugar, chocolates, candies, and the like, 3114 preservation of fruits, vegetables, stews, and other prepared foods, 3115 production of dairy products, 3116 slaughtering, packaging and processing of meat from livestock, poultry, and other edible animals, 3117 preparation and packaging of fish and seafood, 3118 manufacture of bakery products and tortillas and 3119 other food industries.

In turn, the subsector of this industry is included in the sector 31-33 of the manufacturing industry, and 5th stage: statistical function. According to Cavsi (2022), statistical functions are useful to perform the analysis of the data stored in a spreadsheet, for the case study, they were 27 years, which allows us to obtain their average value.

It was considered that the mathematical formula that best reflects growth is the average annual growth rate of an activity in a medium and long term, its mathematical expression is: AAGR = ((FV / IV) ^ (1 / n) - 1) * 100. Where: FV= it is the final value of the period; IV= it corresponds to the initial value of the period; and n= it represents the number of years considered by the analysis.

Likewise, a trend line was included to have a better understanding of the evolution of the indicators, and finally, a comparison was made with the economy of Mexico.

Results and discussion

For a better understanding and comparison of the data series of the information that was processed from the 27 years of the time series, it was presented under two modalities: i) GDP of the value of the production of the food industry at current prices; and ii) GDP of the value of the production of the food industry at constant prices, for constant prices, 2013 was taken as the base year according to the methodology of INEGI (2020), which considers information from the Bank of Mexico and the Secretariat of Finance and Public Credit.

Based on Economipedia (2022), the deflator is a coefficient that is used in economic science to cancel the monetary value of economic variables, the effects produced by inflation occurred in a period of analysis. Table 1 shows the GDP values of the Mexican food industry at both current and constant values during the period 1993-2019.

Table 1. GDP of the Mexican food industry during the years 1993-2019 at current and constant prices, with base year 2013. Million pesos.

Year	Current GDP food industry	Increase (%) previous year	Constant GDP food industry	Increase (%) previous year
1993	52 649	n/a	382 895	n/a
1994	57 691	9.577	392 719	2.566
1995	81 015	40.429	398 123	1.376
1996	113 882	40.569	408 295	2.555
1997	138 398	21.528	416 644	2.045
1998	158 628	14.618	438 047	5.138
1999	189 133	19.23	452 657	3.336
2000	212 704	12.462	469 046	3.621
2001	232 988	9.536	480 436	2.428
2002	246 779	5.919	490 433	2.081
2003	269 431	9.179	500 483	2.049
2004	296 702	10.122	515 473	2.995
2005	316 270	6.595	530 106	2.839
2006	331 549	4.831	538 680	1.617
2007	367 477	10.836	546 277	1.41
2008	405 728	10.409	552 763	1.187
2009	438 708	8.129	555 097	0.422
2010	469 172	6.944	566 495	2.053
2011	517 962	10.399	579 281	2.257
2012	573 678	10.757	597 350	3.119
2013	602 862	5.087	602 862	0.923
2014	620 292	2.891	604 202	0.222

Year	Current GDP food industry	Increase (%) previous year	Constant GDP food industry	Increase (%) previous year
2015	663 701	6.998	619 044	2.516
2016	720 051	8.49	639 769	3.288
2017	774 542	7.568	656 205	2.569
2018	819 690	5.829	675 165	2.889
2019	855 903	4.419	690 813	2.318

INEGI-System of National Accounts (2020).

According to Table 1, the largest increase over the previous year at current prices occurred in 1996 with 40.57%, and the lowest occurred in 2014 with 2.89%. The food industry presented six consecutive years, 1995-2000, with double-digit GDP increases, between 40.57% and 12.46%, a situation that indicated the high dynamism of its growth, on the contrary, single-digit percentage variations occurred in seven consecutive years: 2013 to 2019; however, this period can be considered acceptable, since the average for that period was 5.9%.

In relation to the constant prices of 2013, the largest increase over the previous year occurred in 1998 with 5.14% and the lowest growth was obtained in 2014 with 0.22%, and the average of the period was 2.18%. Under this approach, there are positive increases throughout the period, a situation that reinforces the dynamism of the food industry always with growth in its economy and its contribution to the national economy. Figure 1 shows the evolution and trend of the GDP of the food industry in Mexico at current and constant prices in million pesos during the period 1993-2019.

Figure 1. Value of the GDP (million pesos) of the Mexican food industry at current and constant prices in the period 1993-2019. Data from INEGI.
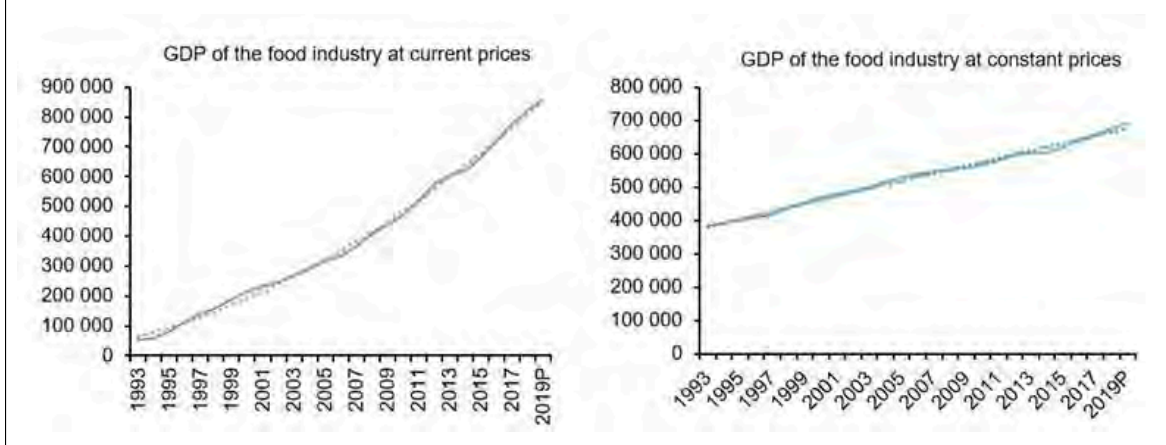

Figure 1 shows the trend in the value of GDP of the food industry in Mexico, both current and constant prices show positive slopes throughout their trajectory, the current price curve is more pronounced than that of constant prices, both trends are polynomial with formulas of $y = 633.36x^2 + 12693x + 49582$ and with an $R^2 = 0.9973$, for the curve of GDP at current prices and for that of constant prices $y = 11.575x^2 + 11664x + 369298$ and with an $R^2 = 0.9922$, both considered with a high degree of acceptance.

Throughout the period, food GDP always increased, both at market and constant prices, a situation that indicates a dynamism of the sector, which is difficult to achieve within an economy, such as Mexico, with ups and downs in most of the different productive sectors that make it up. In order to visualize the two ways of calculating the GDP of the food industry, the calculation at current prices against constant prices during the analysis period is shown in Figure 2.

Figure 2. Value of the GDP (million $) of the Mexican food industry at constant *vs* current prices in the period 1993-2019. Data from INEGI.
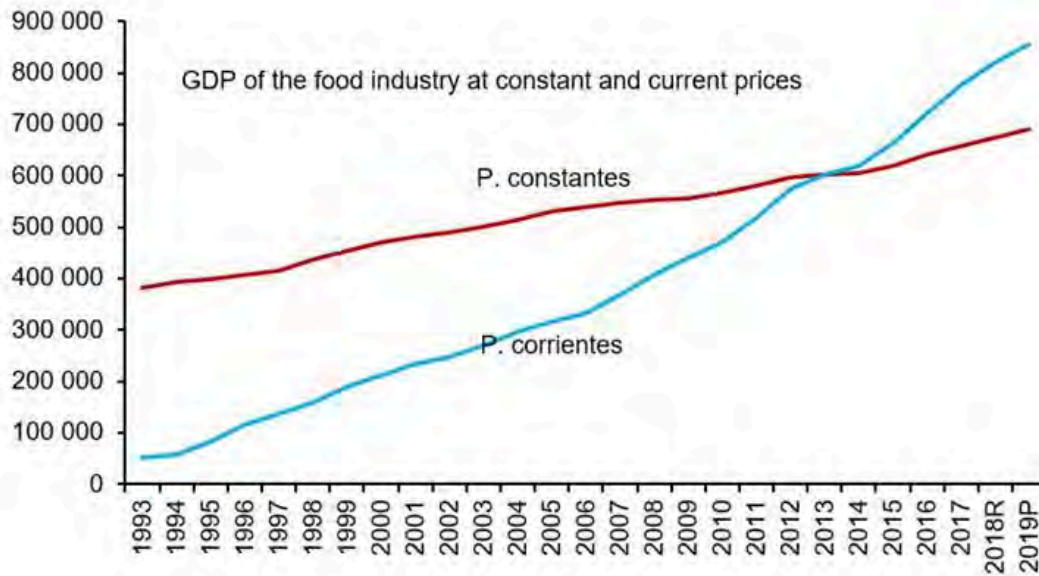

Figure 2 shows the crossing point of the GDP of the food industry that was calculated at constant and current prices, which occurs in the base year 2013, in which current prices show a pronounced trend, while in constant prices, the trend is slight. The gap between the two narrows until in 2012, they are almost equal, and in 2013, they intersect.

From the crossing point, food GDP at current prices continues with a high positive slope due to market prices, while GDP at constant prices also shows a positive but less pronounced slope.

Average annual growth rates (AAGR) as a percentage (%) of the value of GDP of the food industry during the period 1993-2019

Table 2 presents the average annual growth rates that were calculated for the GDP of the Mexican food industry under the methods of current and constant values in the period under analysis.

Table 2. Average annual growth rates expressed in (%) of the value of GDP at current and constant values of the food industry in Mexico for six-year periods and of the total.

Method	1995-2000	2001-2006	2007-2012	2013-2018	1993-2019
Current valor	17.45	6.06	7.71	5.25	9.12
Constant valor	2.77	1.93	1.5	1.91	2.21

In both cases of the calculation method, the AAGRs were positive, higher under current values than under constant values because of market prices, and the best indicators, in both cases, were obtained during the six-year period 1995-2000 in first place and in the total period, in second.

Percentage participation of the GDP of the Mexican food industry in the processing industry and at the macroeconomic level at the national level during the period 1993-2019

In order to have an assessment and comparison of the importance of the food agroindustry, Table 3 shows its participation with respect to the manufacturing industry and the Mexican economy.

| Table 3. Participation in percent of the GDP of the food industry at two levels of economic aggregation during the period 1993-2019.			
Economic aggregate	Participation (%) Minimum	Participation (%) Maximum	Participation (%) Average
Food industry[1]/ manufacturing industry[2]	19.8	25.24	22.42
Food industry/ Mexican economy	3.58	3.98	3.72
[1] = 9 branches; [2]= 21 branches.			

The food industry has a high specific weight within the manufacturing industry, since on average for the period, it meant just over a fifth, while its importance within the Mexican economy decreases significantly and reaches just under four percentage points, and the country's food agroindustry is one of the branches that give added value to the raw materials of the subsectors of agriculture, livestock, fisheries, and aquaculture.

Comparison in the evolution of the GDP of the food industry *vs* manufacturing industry at constant prices and its percentage composition in 2019

Figure 3 shows the behavior of the value in million pesos of GDP at constant prices of the year 2013 of the food industry and its comparison with the manufacturing industry and the percentage composition by branches of the food industry in 2019.

Figure 3. Comparison of the GDP of the food industry *vs* manufacturing industry in million pesos at constant prices of the year 2013 of the period 1993 2019 and percentage composition by branches of the food industry in 2019. Data from INEGI.
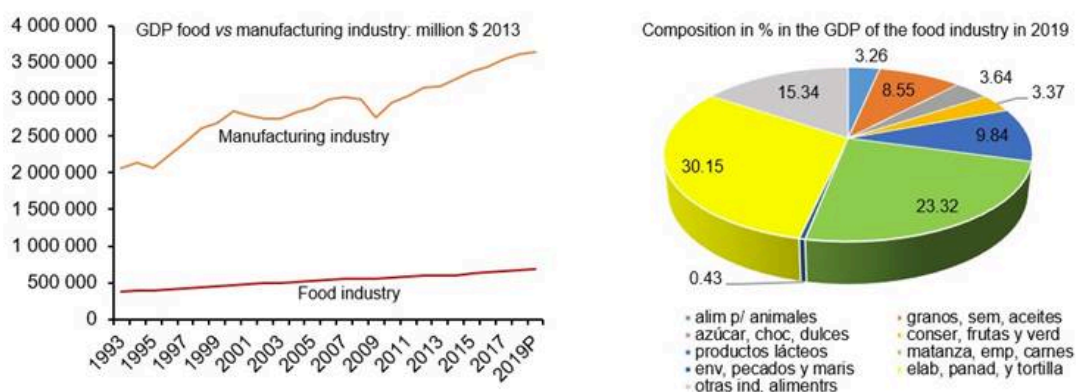
On the left side of Figure 3, GDP shows a parallelism in the behavior of both industries; nevertheless, the manufacturing industry has ups and downs that show a certain cyclicity, and the

behavior of the food industry is growing and without peaks and valleys, which represent greater stability.

The right side of Figure 3 indicates that in 2019 the branch that contributed the most to GDP was the production of bakery products and tortillas, with almost a third, when adding the branches that were in second place, the meat industry, and third place, their participation rises to more than two thirds, the first branch supplies popular food products that are part of the basic basket (SADER, 2022) and the meat industry that in recent years has a strong orientation towards exports that are processed in federal inspection type (TIF, for its acronym in Spanish) slaughterhouses.

On the contrary, the branches that had the lowest participation within the GDP of the food industry in 2019 were the packaging of fish and seafood, the manufacture of animal feed, and that of canned fruits, vegetables, stews, and other prepared foods, the three branches together barely reach 7.06% of the participation in GDP, the fishing industry; even though the country has coasts on the Pacific and the Gulf of Mexico.

The taste of consumers has not managed to consolidate and its participation is marginal; for its part, the manufacture of balanced feed for animals (pets) presents a promising future since the population has more and more pets, and for the branch of the industry of canned fruits, vegetables, and prepared foods, its consumption is becoming more widespread, especially in young populations, alone or with a partner and without children.

The remaining three branches of the food industry together have a participation in the food GDP of just over a fifth, 22.03%, in which the dairy industry stands out with a participation of 9.84% of the food GDP, which is an area with a great diversification of products by age, social strata, and cultural customs; it is followed in importance by the branch of the oil industry, which meets the needs of cooking food at home and that is also part of the basic basket (SADER, 2022).

Nevertheless, today there are types of oil aimed at segments of high purchasing power, such as coconut, grape seed oils, or those containing the omega component, and the branch of the industry of sugars, chocolates, candies, and the like, its main consumer is the production of soft drinks and various sweetened beverages.

In a study of the food industry, Moreno *et al*. (2018) point out that these establishments contributed 23% of Mexico's manufacturing GDP; in the same way Hernández and Pérez (2020) mention that the GDP of the food industry, when compared with that of the manufacturing industry and the national industry, in an analysis from 2000 to 2014 and with 2012 as the base year, presented smaller variations in the economic cycles.

On the other hand, Torres *et al*. (1997), in a collective work, pointed out that in the 60s, there was a period of expansion and consolidation in the food industry, it represented 4.7% of the national GDP when it grew and 5.1% during the strengthening.

Likewise, Navarrete *et al*. (2017) indicate that the food industry participated with 6.1% of the national GDP in the period from 1946 to 1965 and was concentrated in five states: State of Mexico, Jalisco, Federal District (today Mexico City), Guanajuato and Nuevo León. In a documentary study, Ibarra (2016) pointed out that for 40 years, the agricultural sector has been the most important in food production and which was neglected, which caused a strong import of products and a positioning of transnationals.

For her part, Ríos (2018) indicates that food agroindustry represents 23.4% of manufacturing GDP, very similar to that obtained in the present study (0.98% higher), and 3.9% of the national economy and also slightly higher (0.22%) than the one reported. In other studies, Solleiro and del Valle (2003); Ibarra (2016) point out that during the decade from 1983 to 1999, the AAGR of the food industry was 2.95%, and the one reported from 1993 to 2000, which is the period that most resembles this work, was 2.77%, and Moctezuma (2021) mentions that the transformation activities of the wood industry in the period from 2001 to 2018 had a growth rate of 5.72%.

Conclusions

The Mexican food agroindustry had a growth in the value of its production, both at the level of current prices and at constant prices, during the 27 years of the analysis period and showed parallelism with the manufacturing industry; however, this last sector had drops in its GDP and its growth was lower than that of the food subsector, which demonstrated its dynamism and that it is an engine that generated confidence among investors at the level of micro, small, medium and large enterprises that cover the country and that supply food to the population of different economic strata.

This situation was confirmed through its AAGR, which was always positive throughout the horizon of the project and six-year periods. The industrial branch with the greatest participation in the food industry was the slaughtering, packaging, and processing of meat from cattle, poultry, and other edible animals, which was mainly due to the impulse from the establishment of federal inspection type (TIF) slaughterhouses, which meet all national and international sanitary standards and with a strong orientation to cover international markets of the United States of America and recently Japan.

The opposite was the case of the packaging of fish and seafood, with a marginal participation despite the fact that the geographical conditions of Mexico in terms of coasts are abundant and with a diversity of marine species susceptible to be used to feed its population. The importance of the national food agroindustry is given by the participation it has within the manufacturing industry, which represented 22.42% in 2019, and within the national economy, it meant 3.72%, and both the number of establishments engaged in the food agroindustry and the jobs they generate increased in the last five years.

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