

**Geographical Analysis of the Bottled Water Industry in Al-
in the Industrial Geography Qassim Region: A Study**

Prof. Mohammed Aldagheiri

Geography Department – Qassim University – Saudi Arabia

aldagheiri@qu.edu.sa

Abstract: The bottled water industry is ranked first in the number of food industries in Al-Qassim region. The number of water-bottling factories has reached 10 factories employing 1166 workers, representing 39% of the total number of workers in the food factories in Al-Qassim region, driven by the increasing demand for water. The growing health awareness of the majority of citizens has led to increasing concern about the quality of household water, which explains the increasing growth in the capacity of these factories. The study follows the descriptive approach and a field survey of bottled water factories in Al-Qassim region using a questionnaire prepared for this purpose. The results show a dispersion in the distribution pattern of the industry in the cities of Al-Qassim region. The results also indicate that the majority of the factories are concentrated in the main cities in the Al-Qassim region, where the components of this industry are available. Despite the availability of these components and the government support for this industry, there are some problems that the industry faces in the region, the most important of which are the high operating expenses and other problems related to marketing and labor supply. The study presents some solutions and proposals that may help overcome these problems and develop the bottled water industry in the region.

Keywords: Bottled Water Industry, Geography, Al-Qassim Region, Saudi Arabia

The author gratefully acknowledge Qassim University represented by the Deanship of Scientific Research, on the material support for this research under the number 4011 – asc – 2018-1-14-S

Introduction:

During the successive five-year development plans, the Kingdom's industrial sector achieved significant achievements that pushed most of the Kingdom's cities towards industrialization and intensified the process of industrial development, especially the food and beverage industries. This was reflected in the increased number of such factories, from 39 factories in 1974 to 732 factories in 2019, which amounted to 46.117 billion Riyals. Given the diversity of industrial establishments in the Kingdom, it appears that the food and beverage industries dominate the largest number of factories (Ministry of Commerce and Industry, 2019).

Industrial activities	Number of factories		Investment Volume (SR Million)		Number of employment	
	1974	2019	1974	2019	1974	2019
Food and beverage products industry	39	732	2.028	46.117	7.199	122.589

Table (1): Development of food and beverage products industry, volume of investments and number of labor between 1974 and 2019

Source: The database of operating industrial projects 2019.

As shown in the above table, the food industry in the Kingdom has expanded significantly over the past four decades. The number of factories operating increased

19 Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study

from 39 factories in 1974 to 732 factories in 2019. In parallel, the invested capital increased from SR 2,028 billion in 1974 to SR 46,117 billion in 2019. The number of workers increased from about 7,199 workers in 1974 to about 122,589 workers in 2019.

The bottled water industry is one of the products of the food and beverage industry in the Kingdom. It is considered a relatively modern industry and it began in the world in the early 1980s, and since then the industry has expanded substantially. Some observers point out that the industry has only recently made substantial profits to factories, due to the low cost of inputs used to produce bottled water, either by using mineral water sources on the ground or by using regular domestic water sources.

The water-bottling industry in the Kingdom started in 1966 with one factory in Riyadh followed by another factory in Makkah in 1967 with a production capacity of 3 million liters per year. The demand has increased significantly since 2005: the number of factories reached 56 factories, with 3,624 workers, with investments amounting to 1057.81 million riyals at the time, with annual production capacity of 3.09 million tons, and these factories were established in 28 cities (Alharrh, 2005). The increase in the population in the Kingdom and the increase in economic growth led to an increase in the number of factories. The volume of national investments in this sector was estimated at SR 8 billion for more than 450 national factories in the market with a production capacity exceeding 6.5 billion liters annually (Ministry of Commerce and Industry, 2019).

In view of the industrial sector in Al-Qassim region, we find that it is an important sector due to the large number of factories located in the region as well as the great diversity in its products. The latest statistics indicate that there are 193 factories in Al-Qassim region, representing 3.3% of the total number of factories in the Kingdom. These factories account for 1.6% of the total volume of funding in the Kingdom, and the number of workers in factories in the region is 2.6% of the total employment volume in the Kingdom until the end of 2019 (Ministry of Economy and Planning, 2019). As for the beverages and food industries in Al-Qassim region, they represent 5.8% compared to the number of factories in the Kingdom. The percentage of this industry in Al-Qassim area is 4.1% of the total financing of factories in the Kingdom. In terms of the number of workers in the food and beverage products factories in Al-Qassim region compared to the total number of factories in the Kingdom, they represent 3.8% of the total number of employees for the same industry in the Kingdom (Qassim Chamber, 2019). The following table shows the classification of the food and beverage industry in the study area:

Table (2) Classification of Food and Beverage Industries in Al-Qassim Region

R	Food Industries	Number of factories	Number of employment	%
١	Bottled water	١٠	١١٦٦	٣٨,٦٧
٢	Chocolate and sweets	٨	٥٣٩	١٧,٨٨
٣	Nutritional products	٣	٤٠٩	١٣,٥٧
٤	Dates Products	٥	٣٣٣	١١,٠٤
٥	Packaging of dates	٤	٣٢٨	١٠,٨٨
٦	Bakery	٥	١٧٤	٥,٧٧
٧	Dairy products	١	٣٥	١,١٦
٨	Juices	٢	٣١	١,٠٣
	Total	٣٨	٣٠١٥	١٠٠

Source: Qassim Chamber, 2019

The above table shows that the bottled water industry occupies the first rank in the number of existing factories in Al-Qassim region. The number of water-bottling factories has increased to 10 factories employing 1166 workers, representing 39% of the total number of workers in food factories in Al-Qassim region. The interest in the expansion of this industry may be due to the encouragement of the government to investors to pay attention to the industry and to provide all the means necessary to make it a success due to the availability of a large stock of groundwater in Al-Qassim region, characterized by good specifications in addition to the availability of raw material (water) near the factories, encouraging investors to expand the establishment of more water-bottling plants in the region.

In view of the importance of the bottled water industry in Al-Qassim, this study is an attempt to analyze the reality of this industry in the region in terms of its characteristics, constraints and difficulties, and the possibility of overcoming these difficulties, and the development of some proposals that contribute to the development of this sector in the region.

Aims of the study:

- To identify the reality and characteristics of the bottled water industry in Al-Qassim region.
- To analyze the distribution pattern of bottled water factories in Al-Qassim region and the factors influencing such distribution.
- To identify the problems faced by the bottled water industry in Al-Qassim region.

21 **Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study**

- To look ahead to the future trends of the bottled water industry in Al-Qassim region.

Research Methodology and Sources of Information:

This study focuses on the bottled water factories in Al-Qassim and is within the scope of surveys. Therefore, the inductive method has been used, which begins to study the phenomenon in its natural reality, and due to the lack of information on the bottled water industry in Al-Qassim, the study relies on sources that can be summarized as follows:

- 1 - General information in the literature of the subject was collected from Arabic and foreign sources.
- 2 - Data and statistics from government sources, which relied mainly on the statistics issued by chambers of commerce and industry.
- 3 - Visits to and interviews at f some of the factories as well as a number of officials in the Chambers of Commerce and Industry and the Ministry of Industry.

In addition, the survey questionnaire was designed to collect the necessary data to serve the objectives of the study. The questionnaire was then applied to all the bottled water factories in Al-Qassim region. The researcher used the following quantitative means: the degree of industrial settlement, neighborhood link efficiency, frequency and percentages. The study community consists of all the bottled water factories in Al-Qassim region, which were recorded through the Chamber of Commerce records and their number is 10 factories. The variables of the study included the address of the factory and its location, the characteristics of the labor force, the properties of raw materials used, the marketing of production and means of transportation of the product.

Literature Review:

Although there are many studies that dealt with topics about the industry in general and the food industry in particular in the Kingdom, there is no study on the bottled water industry in Al-Qassim region, which encouraged the researcher to carry out this study and survey the officials and workers and experts in this field to collect the scientific material in order to come out with an extensive geo-economic study in the field of industrial geography. The most important studies related to this study can be classified as follows:

Alsulai's study (1994) dealt with the industry in Al-Qassim region – its characteristics and potential future. The aim of this study in the first place was to identify the characteristics of the industry in general and pattern and distribution in Al-Qassim area in addition to identifying the most important problems facing the industry in the region and the proposed solutions for its development and future prospects without focusing on a specific industry such as food industries.

Alhudethy's study (1995) entitled 'Bottled water in the Kingdom of Saudi Arabia: study in the geography of industry'. This study aimed to identify the economic characteristics of the bottled water industry, such as the volume of production and money invested in that industry and the number of workers. The study pointed out that there are motives in consumers that make them dependent on drinking on bottled drinking water, the most important of which is the lack of confidence in the cleanliness of the water of the house, especially the source of the domestic reservoirs, and the study shows there are many problems facing the industry.

Zahid's study (2002) aimed to identify the extent of the local bottled drinking water quality imported into the Kingdom of Saudi Arabia compared to the specifications of bottled drinking water issued by the Saudi Arabian Standards Organization and the World Association of bottled drinking water and the US Food and Drug Measurements showed that the quality of standard levels of water varieties, where the results showed that local and imported bottled drinking water were identical to different specifications except for the pH in one local brand, and fluoride in 15 varieties locally, and manganese in 12 varieties locally and 6 varieties touched A rose.

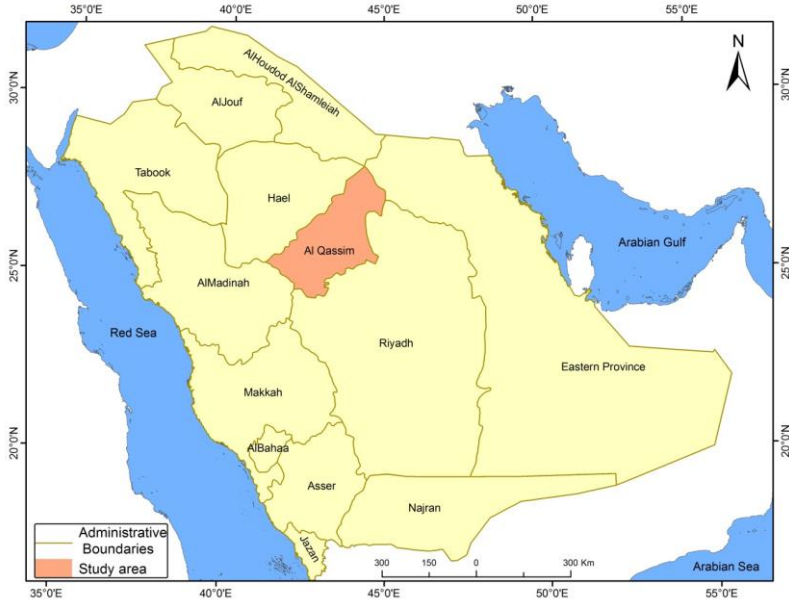
Habrah's study (2014) dealt with the manufacture and trade of bottled water in the Gulf Cooperation Council (GCC) countries. The study aimed to diagnose and analyze the current situation and future directions for the development of this industry in the GCC countries. The study reviewed the main characteristics and specifications of bottled water and the volume of trade and experiences of the GCC countries in the manufacture of bottled drinking water.

Aldagheiri's study (2015) entitled 'Food industries in Al-Qassim Region and future prospects: study in economic geography' aimed to analyze the spatial distribution pattern of these establishments and highlight the obstacles facing the food industry, and specifying its investing horizons and capabilities in Al-Qassim region. The study has shown that there are some obstacles facing the food industry in Al-Qassim region such as shortage in raw material, labor and marketing. The study focused on the food industries in Al-Qassim in general and did not focus on the water industry in particular.

23 Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study

The Study Area:

Al-Qassim Region, which is the target of this research, is located in the heart of the Kingdom of Saudi Arabia (see Map 1). It lies approximately 330 kilometers northwest of the capital, Riyadh, and occupies an area of about 70,000 square kilometers or nearly 3.7% of the total area of Saudi Arabia. It is geographically located between E40° 00', E45° 00' longitude and N23° 30', N28° 00' latitude. Furthermore, Al-Qassim consists of ten governorates and 155 local centers. According to the last estimate (2010), Al-Qassim's population totaled nearly 1,234,531, which gives a population density of 17.4 people per square kilometer, while KSA's density is 13 people per square kilometer. Moreover, Al-Qassim comes in seventh out of the thirteen provinces in terms of population and the main economic activity is agriculture.



Map 1: The Location of Al-Qassim Region

Source: Atlas of The Kingdom of Saudi Arabia 1999

Al-Qassim is characterized by a variety of underground water sources, where they provide almost all water consumed in the region for various uses. The groundwater Sag alone accounts for about 80% of the total water supply and the rest of the water is mainly from other newer sources, chiefly the Tabuk, Khuf and Jallah Formations. All these aquifers are located in the eastern part of the region, where they are organized in a row extending north-west / south-east across the region. In addition to another source, desalination of seawater, where a water pipeline was built from the Arabian Gulf to Riyadh with an extension to Buraidah. It has the most important natural phenomenon in the region of Al-Qassim which crosses the entire region from west to east and is the longest valley in the Arabian Peninsula, which has created a natural environment rich in natural vegetation.

The natural characteristics of Al-Qassim region and its astronomical location affect its climate as it is no different from the climate of the Arabian Peninsula. It is located within the dry and semi-dry range characterized by severe drought, low rainfall, and summer heat. The average summer temperature is about 36 degrees Celsius and in winter 20 degrees Celsius and summer temperatures can rise to more than 40 degrees Celsius and fall in winter to below zero degrees Celsius. The north-eastern and north-western winds blow in the winter season, and southwestern and southeastern winds prevail in the region as well.

Compared to other regions in the Kingdom of Saudi Arabia, Al-Qassim has a good road network of approximately 6465 kilometers linking its cities, towns and villages. The agricultural nature of the region requires an adequate road system to enable farmers to transport their products to market. Furthermore, the highway system in Al-Qassim was greatly expanded during the 1980s due to its geographical position in the Kingdom, as well as its importance as a prime agricultural area, and the region was given special attention in respect to road construction. As a result of its location, it became the hub of the road network with roads from the east linking with those from the west of Saudi Arabia. For example, the highway linking Dammam in the eastern part of Saudi Arabia with Yanbuh in the western part passes Riyadh, Al-Qassim and Madinah. Also as a result of its geographical location, the road network of Al-Qassim plays an important role in the movement of pilgrims, especially those from Gulf countries.

The historical development of the industrial sector in the Kingdom of Saudi Arabia and Al-Qassim region:

The industry flourished steadily and diversified since the beginning of the first five-year plan in 1970-1975, as well as the rest of the successive five-year development plans through unlimited government support for this sector with the direct support of establishing industrial cities and providing loans for establishing factories and establishing companies for the development of basic industries and developing them as SABIC. As well as indirect support through the exemption of customs on the machinery and the reduction of electricity and water prices for these factories in addition to the development of basic infrastructure such as roads, ports

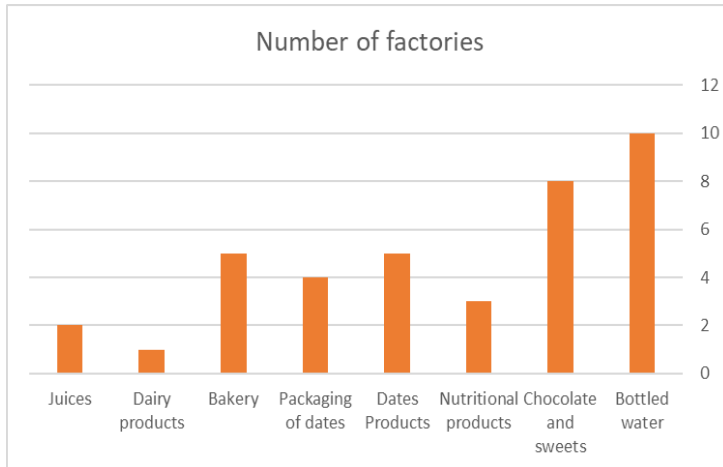
25 **Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study**

and airports, which helped the development of the industrial sector in most parts of the Kingdom (Alsulai, 1994).

During the successive five-year development plans, the Kingdom's industrial sector achieved significant achievements, which pushed most of the Kingdom's cities towards industrialization and the industrial development process. This was reflected in the increase in the number of factories which increased from 199 factories in 1970 to 3652 factories in 1999 and then jumped to 6519 factories in 2019 and the volume of investments amounted to 838.6 billion riyals. In view of the diversity of industrial establishments in the Kingdom, it seems that beverage and food industries dominate the largest number of factories and finance after the manufacture of non-metallic minerals. The number of food factories reached 732 factories at the end of 2019 with a large funding of SR 46 billion (Ministry of Commerce and Industry, 2019) (Ministry of Planning, 2004).

In view of the historical development of the water industry in the Kingdom, the water bottling industry in the Kingdom started in 1966 with one factory in Riyadh followed by another factory in Makkah in 1967 with a production capacity of 3 million liters per year, about 40 years ago. The demand has increased significantly since 2005, the number of factories reached 56 factories, with 3,624 workers, with investments amounting to 1057.81 million riyals at the time, with annual production capacity of 3.09 million tons and these factories were established in 28 cities (Alharrh, 2005). As for the industrial sector in Al-Qassim region, it is considered an important one due to the large number of factories located in the region as well as the great variety of products especially in the fields of beverages and food industries. The total number of factories in the region is 193 representing 3.3% of the total number of factories in the Kingdom. The total financing in these factories is 1.6% of the total volume of financing in the Kingdom. The number of workers in factories in the region is 2.6% of the Kingdom's population until the end of 2019.

Figure (1) Classification of food industries in Al-Qassim region and the number of factories



It is clear from the previous figure that the water bottling industry occupies the first place in the number of existing factories in Al-Qassim region. This section also ranked first in terms of the number of workers, which reached 1166 workers, representing 38.67% of the total number of workers. The reason for this expansion in the industry may be the encouragement of the government to investors to take care of the industry and to provide all the means to make it a success because of the availability of a large stock of groundwater in Al-Qassim area characterized by good specifications, which encouraged investors to expand in the establishment of more bottled water factories in the region.

27 **Geographical Analysis of the Bottled Water Industry in Al-
in the Industrial Geography Qassim Region: A Study**

**Figure (2) Classification of food industries in Al-Qassim region
and the employment**

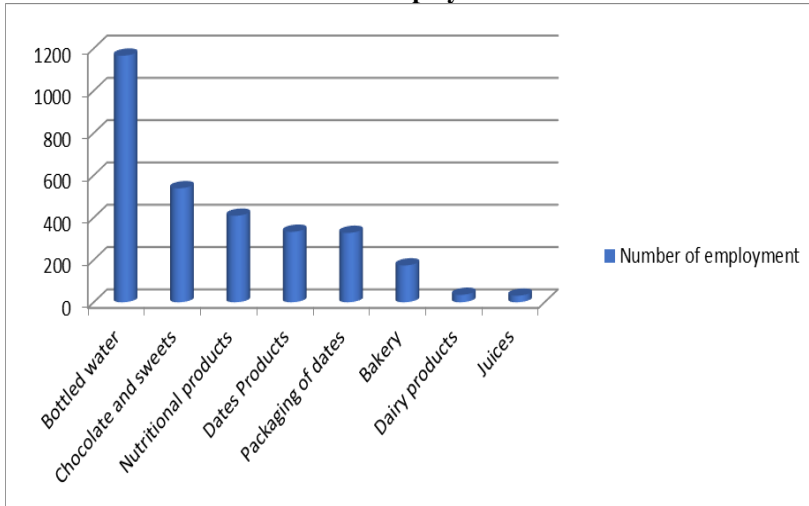


Figure 2 shows that the bottled water industry also ranked first in terms of employment, reaching 1166. In this regard, Al-Qassim Municipality has paid attention to the establishment of water bottling factories in the region and provided them with investment means, making it the first place in the food and beverage industry in Al-Qassim region in terms of the number of factories established and the number of workers in these factories, which gives this industry special importance to increase the number of these factories to ten factories according to the latest census in the region, representing 19.8% of the total number of factories in Al-Qassem and employing 1166 workers, representing 38.67% of the total employment number in the food and beverage sector in the region (Qassim Chamber, 2019).

**Analysis of the Characteristics of bottled water factories in Al-
Qassim region:**

1- Labour Force:

In order to determine the characteristics of the bottled water factories in Al-Qassim , the researcher applied the survey questionnaire to all the bottled water plants in the region, which are 10 factories distributed over the different governorates . In these factories, there are about 1166 workers, where the Saudi labor represented the lowest percentage of the nationalities working in these factories, which amounted to 17.91% of the total number of workers, and their tasks were concentrated in the administrative side of these factories by 59.81% of the 423 workers. This gives a clear indication of the lack of demand of national manpower

to work in the food industry, especially in the technical aspect, and confirms this as indicated by the statistics of normal labor in factories, where the ratio of regular employment to Saudis was 5.93% of the total regular employment in factories in the surveyed field as is clear from the following table:

Table (3) Total number of workers in bottled water plants in Al-Qassim region

Category nationality /	Number of employment	Saudi	%	Other nationalities					
				Arab	%	Asian	%	Others	%
Administrators	٢٦١	١٧٠	٦٥.١٣	٧٢	٢٧.٥٩	١٥	٥.٧٥	٤	١.٥٣
Technicians	٢٤٢	٤٤	١٨.١٨	٧١	٢٩.٣٤	١٢١	٥٠	٦	٢.٤٨
Skilled labor	٢٧٢	٣٥	١٢.٨٧	٦٧	٢٤.٦٣	١٦٨	٦١.٧٦	٢	٠.٧٤
Ordinary labor	٣٩١	١٣	٣.٣٢	٧٤	١٨.٩٣	٢٨١	٧١.٨٧	٢٣	٥.٨٨
Total	١١٦٦	٢٦٢	٢٢.٤٧	٢٨٤	٢٤.٣٦	٥٨٥	٥٠.١٧	٣٥	٣

Sours: Field Study 2019

Thus, these factories relied on contracting with Arab and Asian workers, where the Asian labor in the factories surveyed in the field 585 workers (by percentage of 50.17% of the total number of employment), most of whom work as normal workers in the factories, maybe due to the weak salaries of such employees and ease of recruitment, followed by Arab labor (284 workers) that comprises 24,36 % of the total employment.

2- The spatial distribution of bottled water factories in Al-Qassim Region:

As for the spatial distribution of bottled water factories in Al-Qassim region, it is noted that they are concentrated in the main cities of the region as well as in the industrial city, which is outside the urbanization areas, as shown from the following table:

Table (4) Geographical distribution of bottled water factories in Al-Qassim region

Geographical location	Number of factories	%
Buraidah	4	40
Alass	1	10
Alkhabra	1	10
Onaizah	2	20
Albadayia	2	20
Total	10	100

Sours: Field Study 2019

The above table shows that Buraidah, the largest city in the region, has the largest number of factories with four factories, with a concentration of 40% of the total factories in the region followed by the city of Onaizah, which has the two factories and similarly the city of Albadayia, the city of Alkhabra, and the city of Alass that all have one factory. This spatial distribution of factories is related to several factors. In addition to the economic factor, there are other factors, including

29 Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study

the historical and social change of the place, which in turn leads to the ability to attract industries depending on the civilization or social developments of the city.

3- Product Marketing:

An analysis of the survey found that there are no difficulties in marketing the product inside and outside the Kingdom because there are large market opportunities and a large demand for the product. The market for any industrial product is a major factor in determining the location of many industries. An analysis of the results revealed that 30% of the total factories are marketed within Al-Qassim region, while 50% of the total factories market their production within the Kingdom, and while 20% of the factories market their production within the GCC as shown in the table below:

Table (5) Marketing places of bottled water production in Al-Qassim region

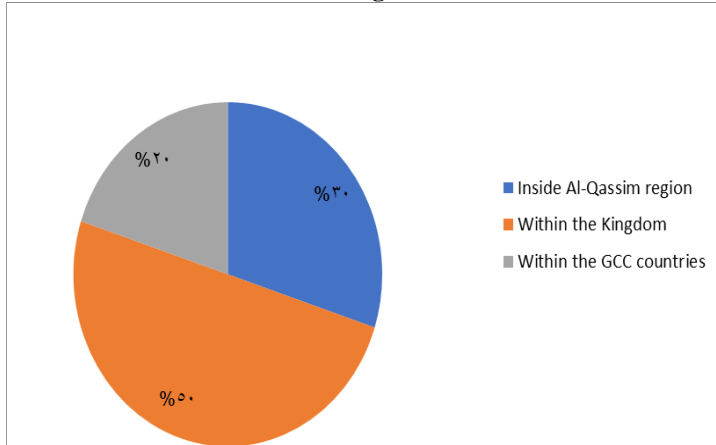
Marketing places	Number of factories	%
Inside Al-Qassim region	3	30
Within the Kingdom	5	50
Within the GCC countries	2	20

Sours: Field Study 2019

The above table shows that bottled water factories in Al-Qassim region are marketing part of their production outside the region to serve the neighboring ones, especially the central region of the Kingdom, near its relative location in Al-Qassim. The most important factors determining the external market of any product and how to benefit from it is the ability of that product to compete in foreign markets in addition to the specifications of the commodity in terms of price and quality.

As shown in figure (3), some of the GCC countries have received bottled water exports in Al-Qassim region due to the facilities related to the trade agreements between the Kingdom and the GCC countries, where two factories in Al-Qassim have adopted 20% of the export of part of their products to these countries.

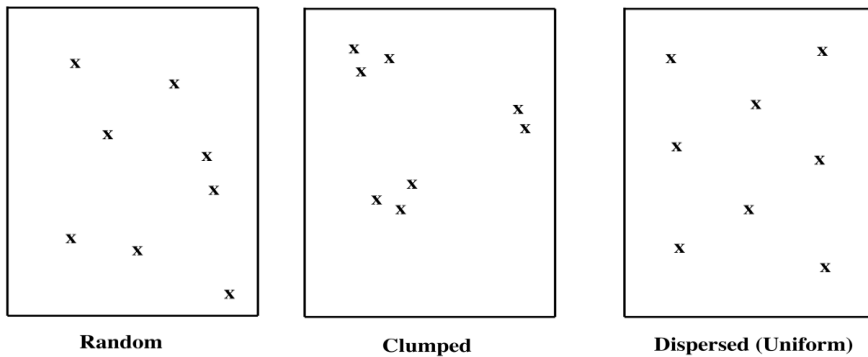
Figure (3) Marketing places of bottled water in Qassim region



4- Patterns of Geographical distribution of the bottled water industry in Al-Qassim region:

To identify the distribution of bottled water factories in Al-Qassim reigon, the Nearest Neighbor Standard was used, which is considered one of the best descriptive measures that can be used to describe the distribution pattern of factory sites as a spatial point phenomenon that might be random, clumped, or dispersed as follows:

Figure (4) the Nearest Neighbor Standard



R is a measure of the observed spacing pattern relative to a random pattern. R ranges from 0 to 2.1491, with random spacing having an R of 1. An $R < 1$ means clustered; and $R > 1$ means dispersed.

31 **Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study**

R is the ratio of the observed average nearest neighbor distance to the expected average nearest neighbor distance for a given density. The average expected nearest neighbor distance depends on the density.

N = number of factories that had a nearest neighbor measurement taken

r = nearest neighbor distance

p = the density of factories (in the same units as neighbor distances)

Calculate:

rA = the average nearest neighbor distance = (SUM of r)/N

rE = the expected average nearest neighbor distance IF factories were random
 $= 1/(2*(\text{sqrt}(p)))$

R = spacing measure = rA/rE

sigma rE = standard error of mean distance IF factories were random
 $= 0.26136/(\text{sqrt}(Np))$

c = standard variate of normal curve = (rA - rE)/sigma rE

If c is bigger than 1.96 or less than -1.96 then the chance of your observed departure from random happening by chance is less than 5%.

If c is greater than 2.58 or less than -2.58 then the chance of your observed departure from random happening by chance is less than 1% (Al-Jarash, 2004).

By applying the above equation to the bottled water factories in Al-Qassim region, it is noticed that these industries are concentrated in five main areas: Buraidah with 40% of the total number of factories, Onaizah with 20%, Alrass with 10%, Albadayia with 20%, and 10% of factories elsewhere. The correlation coefficient of the nearest neighbor standard was (1.36) and this value shows that the bottled water factories in the study area are closer to the dispersed from the clumped, where the average distance between the sites of these plants is between 28-km to 32-km. Therefore these factories are also characterized by a dispersed distribution pattern.

5- Localization factors of the bottled water industry in Al-Qassim region:

The term localization of industries means the tendency on the part of industries to be concentrated in regions which are most suited for their development in order to achieve the maximum rate of profit. There are many methods that can be relied upon in measuring industrial endowment, which include the added value, the total value of wages paid to workers and the number of hours in the industry, the total investments in the industrial sector, and the number of workers in industry (the most important bases on which to measure industrial endowment and the most common).

The degree of localization of industries can be measured by calculating the percentage of workers in the industry in the region to the total number of workers in the different industries in the same region. If the percentage of workers in a

particular industry in the region to the total number of workers in different industries in the same region is about 60% this indicates the severity of endemic industry, and if this percentage ranged between 60%-30% it means that there is a form of industrial concentration, but if the percentage fell from 30% there is a weak industrial presence.

By applying the above to the bottled water industry in relation to the food industries in Al-Qassim region, we find that the degree of localization of industries is medium, as shown in the following table:

Table (6) The degree of localization of industries of bottled water factories in Al-Qassim region

Number of workers in Food Industries	Number of workers in the bottled water industry	%	localization degree
٣٠١٥	١١٦٦	٣٨.٦٧	medium

The above table shows that the percentage of workers in the food industries to the total number of workers in various industries in Al-Qassim is 38.67%, and this indicates that there is a form of industrial concentration for the bottled water industry in the region. The following table shows the extent of the degree of localization of industries of the bottled water industry in Al-Qassim according to the spatial unit in the study area:

Table (7) The degree of variation of the degree of localization of industries of bottled water factories in Al-Qassim region according to the spatial unit in the study area

City	Number of workers in the bottled water industry	%	localization degree
Buraidah	٣٩٨	٣٤.١٣	medium
Onaizah	٣١٧	٢٧.١٨	weak
Alrass	١٢٢	١٠.٤٦	weak
Alkhabra	٩٨	٨.٤١	weak
Albadayia	٢٣١	١٩.٨٢	weak
Total	١١٦٦	٪١٠٠	

The above table shows that the degree of localization of industries is weak in all cities of the study area and do not differ among them in the degree of localization of industries except for the city of Buraidah, which has a medium degree of localization. It is therefore different from the rest of the cities in the region, due to the population density of the city and the availability of labor hands compared to other cities in the region as it represents the capital for the region and the large

33 **Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study**

number of markets facilitate the marketing of the product. There are several factors that are taken into account when determining the location of the industry and therefore have a significant impact in determining the degree of localization of industries, the most important of which are:

- **Raw material**

Raw material is an important basis for industries, where industries transform the form of raw material from its natural form into more sophisticated images that correspond to different human needs. The raw materials vary in their ability to attract their respective industries to their location according to their characteristics, nature and vulnerability. The availability of raw material near the location of the industry helps considerably in reducing the transport cost and so the total cost of production of the commodity. It is due to this reason that most of the industries are established in regions where the raw material is available in abundance (Kathuria and George, 2006).

The statistical analysis of the field survey revealed the type of raw material used in the bottled water industry in the study area, where it was found that 70% of the factories rely on groundwater to produce bottled water, while 20% of those factories rely on desalination and purification of municipal water, and, finally that 10% of those factories depend on springs to produce bottled water. The results also show that 60% of the factories do not have difficulties in obtaining the raw material, although there are some difficulties in the high transport costs and the scarcity of raw material. The results of the field study showed that the problems of raw material is the scarcity of natural drinking water. The bottled water factories in Al-Qassim suffer from shortage of fresh water and the quantity of water needed to operate the factories at full capacity. The analysis of the field survey revealed that 31% of the problems faced by the bottled water factories in Al-Qassim region are due to a lack of availability of well-water and lack of seawater for desalination.

- **Energy resources**

Availability of cheap energy resources is another important factor which influences the concentration of industries in particular areas. Energy sources are divided into two types:

1. Renewable energy sources such as hydro, solar and wind energy.
- 2- Non-renewable sources of depletion such as coal, oil and natural gas.

Industries vary in their energy needs, and energy sources differ in their attractiveness to industrial activity. The technological advances have contributed to reducing the amount of fuel used in industries as well as the multiplicity of energy sources. Many of these sources can be exploited economically and replaced elsewhere which led to the proliferation of industries in the world with different regions, although the different costs of different sources of energy from one place to another have a role in the distribution of industry and the degree of concentration (Nakajima, 2010). The results of the survey resulted in the use of all the bottled

water plants in Al-Qassim region for electricity as a source of operating power, which contributed to the increase in operating costs.

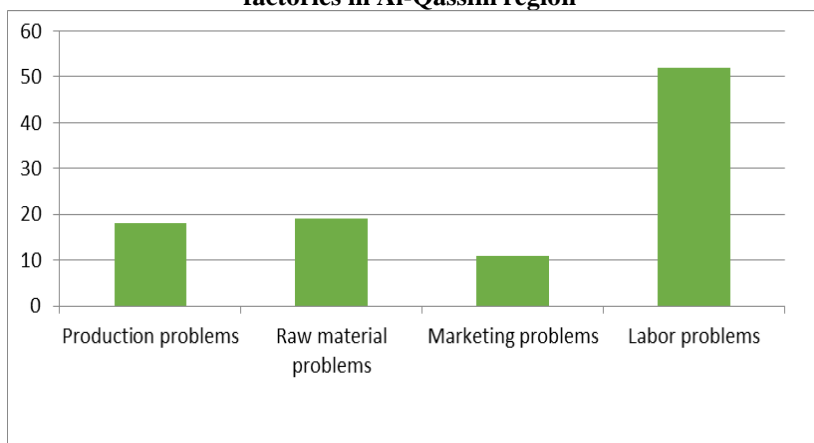
- **Availability of Labour**

The supply of cheap and skilled labor is another great attraction for the concentration of an industry in a particular area. The impact of this factor is to locate the industry in three things:

- 1- Availability of technical skills in the labor force.
2. Extent of the quantitative availability of labor.
- 3- Labor costs and their differences between governorates (Majeed, 2001).

The expansion of the use of automated methods in production has reduced the attractiveness of the labor force, especially skilled ones, in the field of localization of industries. The reliance on machine and semi-skilled workers in many industries led to the spread of industry clearly. However, the results of the survey showed that one of the most important problems experienced by bottled water factories is the lack of quantitative and qualitative availability of labor, where it was found that 52% of the total problems faced by bottled-water factories are labor-related problems, possibly because of the new policies imposed by the government to recruit foreign workers, while the problems related to marketing are 11%, production problems are 18%, and problems in the provision of raw material are 19%. This situation in turn contributed to the low degree of localization of industries in the places of the study area as shown in figure (5).

Figure (5) The most important problems facing bottled water factories in Al-Qassim region



Sours: Field Study 2019

35 **Geographical Analysis of the Bottled Water Industry in Al-
in the Industrial Geography Qassim Region: A Study**

Markets

Proximity to markets is an important factor in the localization of industries, as it contributes to lower transport costs in the distribution of the final product. Markets vary from region to region depending on the size of the population, which determines the size of the market and its ability. In addition, the standard of living determines the purchasing power and the level of public expenditure and its components (Kathuria and George, 2006). The following table shows the population in the study area:

Table (8) Population of Al-Qassim Region

City	Population
Buraidah	٦١٤٠٩٣
Onaizah	١٦٣٧٢٩
Alrass	١٣٣٤٨٢
Alkhabra	٥٧١٦٤
Albadayia	٣٤٤٩٧
Total	١٠٠٢٩٦٥

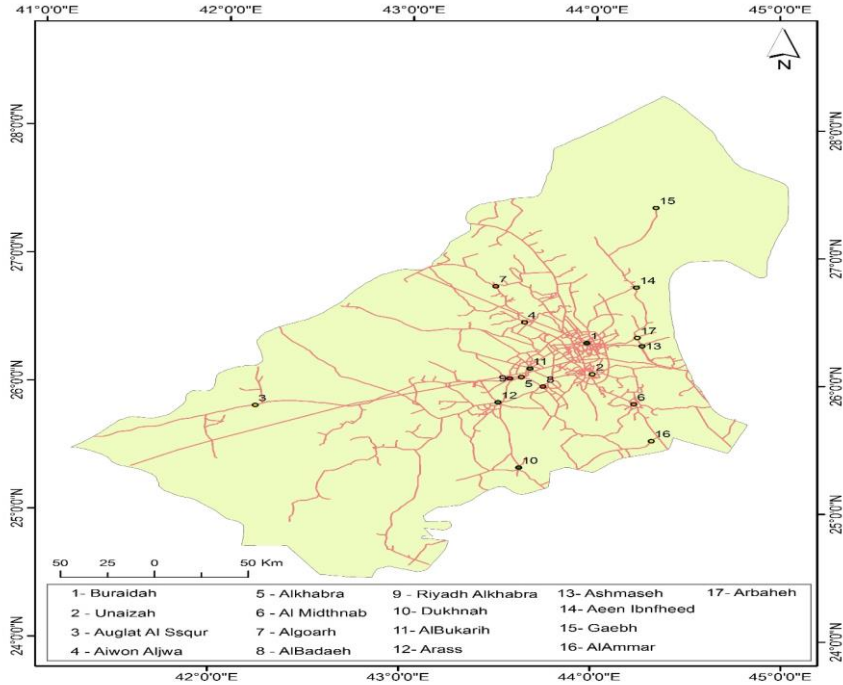
Source: Ministry of Economy and Planning (2019)

The above table shows that the city of Buraidah is characterized by high population density compared to other cities in Al-Qassim region, which helped to increase the degree of re-settlement and is concentrated in most markets, where markets are one of the important foundations that attract industries to settle in a region or somewhere to consume their products. The bottled water factories in the study area suffer from insufficient and efficient marketing services in the internal and external market due to the fierce competition faced by large factories within the Kingdom and also by the bottled water imported and filled with markets. The results of the field study showed that 40% of the total number of factories in the region suffer from this problem and the lack of distribution outlets sufficient to discharge the production with the small size of the internal market. Moreover, the survey showed that 30% of the total number of factories depends on Al-Qassim in marketing its products as well as 6% of the total factories that rely on wholesalers to market their products.

- **Transport Facilities**

The rapid development of roads and means of transportation has helped make the whole world more like a single market and the impact of transport costs has influenced the selection and identification of modern industries (Marius, 1998). There are many means of transport used in different industries depending on the nature of the goods transported and the location of the industrial establishment and these are all factors that contribute to industrial settlement and are taken into consideration when planning industrial development and the intensity and versatility

of transport provide an area of choice among them as well as their role in reducing transport costs. The total length of roads in the region is 6465 km (MOT, 2019) (see Map 2).



Map 2: The Roads Network of Al-Qassim Region 2019

Source: MOT 2019

An analysis of the field survey showed that 80% of the total number of factories in Al-Qassim use the means of transporting the product by their own car, while 20% of the factories use different cars in transporting their products. It is noted that all factories rely on cars to transport their products to the market because of the lack of other means of transport in the region and this contributes to high operating costs and high product prices and in turn effects the degree of industrialization in the region.

6- Future outlook for the bottled water industry in Al-Qassim region:

Although the industrial sector is of great importance in the Kingdom of Saudi Arabia in general and in Al-Qassim region in particular to a competitive ability to diversify the economic base and achieve self-sufficiency of industries and increase national income and create new jobs especially in the field of bottled water industry, there are some elements that may affect the process of industrial development in Al-Qassim , and to orient the future prospects for industrial development in Al-Qassim region. It is necessary to identify the elements effecting it such as infrastructure, raw

37 Geographical Analysis of the Bottled Water Industry in Al- in the Industrial Geography Qassim Region: A Study

materials, finance, investment environment, technology transfer, labor efficiency, where the future of industrial development in Al-Qassim depends on the extent of change in these elements, and the improvement of any element will positively affect the future of industrial development and vice versa.

The results of the study showed that 80% of the factories in the region have future plans to expand production of their factories and establish new production lines. This is a good indicator of the capacity of the local and regional consumer markets for bottled water, which is certainly associated with the high population density in the region. But this expansion of production must be a deliberate expansion consistent with the principles of sustainable development of those industries. The unjustified increase in the number of water plants, which represent the largest share in the number of food industries in the region may lead to pressure and depletion of groundwater. On the positive side, the expansion of this industry increases the circle of employment opportunities for citizens and the added value of the Saudi economy. Lack of capital and ease of establishment if the factors of success of the factory are available as management leadership to organize and serve customers and trained manpower and innovation as well as innovation in manufacturing.

The government has prepared promotional programs to support investment in production and industry in Al-Qassim region and the rest of regions in the Kingdom, the most important of which are the following:

- Government support in encouraging production industries that rely on local raw materials in general and food in particular.
- Providing medium-term, interest-free loans for the purchase of machinery, pumps and industrial equipment.
- Granting a subsidy on industrial equipment up to 50% of the value.
- For the exemption of customs for machinery and industrial machinery (Saudi Industrial Development Fund, 2014).

In light of the analysis of the elements effecting the equation of industrial development, it is clear that Al-Qassim region, with its components such as geographical location, availability of raw material and high population density, are moving in the right direction towards industrial development. Some key indicators, such as export performance, expansion of production and government encouragement, are also optimistic that the bottled water sector in Al-Qassim will witness a strong start and a qualitative industrialization in the near future, thus contributing to the economic balance programs that contribute to the development of the national economy in general.

Recommendations:

- The study showed that the industrial strategy in Saudi Arabia seeks to support the industrial sector and encourage it to enter new fields that achieve high added value and provide employment to as many citizens as possible, and the food industry sector from labor-intensive sectors that can contribute effectively to achieving the objectives of this strategy. Therefore, the researcher recommends the need to train and motivate national cadres to work in these factories in order to achieve the desired economic and social benefits.
- Despite the acquisition of bottled water factories in the Kingdom in general and Al-Qassim region in particular, the importance of this is reflected in the increase in the number of factories and increased employment, but the researcher recommends the need to focus on national employment to reduce the spread of the phenomenon of unemployment and provide employment opportunities for citizens.
- The researcher also recommends taking into account the dimensions of sustainable development through non-expansion in the water industry, which has the largest share in the number of factories in the region because of depletion of groundwater at the present time without taking into account future needs.
- The analysis of localization of industries and the pattern of distribution of bottled water factories in Al-Qassim showed that the city of Buraidah has a large proportion of the number of factories as a major hub in the region and by population density and markets as well as the existence of the industrial city equipped with all necessary services. Therefore, the researcher recommends the establishment of a similar industrial city in another axis, which is in the middle of the provinces of Al-rass, Albadayia and Alkhabra because of the relatively low location of these governorates, as well as its components, which may give an economic addition to the food industries in the region in addition to the population density in these urban centers.

**39 Geographical Analysis of the Bottled Water Industry in Al-
in the Industrial Geography Qassim Region: A Study**

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41 **Geographical Analysis of the Bottled Water Industry in Al-
in the Industrial Geography Qassim Region: A Study**

**التحليل الجغرافي لصناعة المياه المعبأة في منطقة القصيم :
دراسة في جغرافية الصناعة**

أ.د. محمد بن إبراهيم الدغيري

قسم الجغرافيا - كلية اللغة العربية والدراسات الاجتماعية - جامعة القصيم

ملخص البحث : تحتل صناعة المياه المعبأة المرتبة الأولى في عدد الصناعات الغذائية القائمة بمنطقة القصيم، إذ ازداد عدد مصانع تعبئة المياه إلى عشرة مصانع يعمل بها ١١٦٦ عاملاً بنسبة ٣٩٪ من إجمالي عدد العمالة بمصانع المواد الغذائية بمنطقة القصيم، مدفوعة بزيادة الطلب على هذه المياه، كنتيجة طبيعية لزيادة عدد السكان، كما أن تنامي الوعي الصحي لدى غالبية المواطنين أدى إلى تزايد القلق لدى قطاعات كبيرة منهم حول درجة جودة مياه المنازل وهذا يفسر النمو المتزايد على زباده الطاقة الانتاجية لتلك المصانع. وارتكزت الدراسة في منهجيتها على المنهج الوصفي التحليلي والمسح الميداني لمصانع تعبئة المياه بمنطقة القصيم باستخدام أداة الاستبانة المعدة لذلك، حيث بينت النتائج وجود تشتت في النمط التوزيعي لتلك الصناعة بمدن منطقة القصيم. كما أفادت النتائج بأن غالبية المصانع تتركز في المدن الرئيسية بمنطقة القصيم حيث تتوفر مقومات تلك الصناعة، وعلى الرغم من توفر تلك المقومات ودعم الدولة لتلك الصناعة إلا أنه توجد بعض المشكلات التي تعترض تلك الصناعة بالمنطقة من أهمها ارتفاع مصاريف التشغيل ومشكلات أخرى تتعلق بالتسويق وتوفر الأيدي العاملة المدربة، وقد قدمت الدراسة بعض الحلول والمقترحات التي قد تساعد على التغلب على تلك المشكلات وتطوير صناعة تعبئة المياه بالمنطقة.

الكلمات المفتاحية : الجغرافيا/ صناعة المياه/ المعبأة / منطقة القصيم