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Maps of Geographical Distribution Patterns of Industrial Facilities in Dhi Qar Governorate

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Abstract

This study investigates the spatial distribution of industrial facilities within Dhi Qar Governorate. By analyzing geographical patterns, the research aims to identify clusters, hotspots, and potential areas for industrial development. The study utilizes geographic information systems (GIS) to visualize and analyze the distribution of industrial establishments across the governorate. The findings contribute to a better understanding of the industrial landscape, informing future planning and decision-making for economic development and resource allocation in Dhi Qar.

Keywords: Dhi Qar, Industrial Distribution, Geographical Patterns, GIS, Spatial Analysis

1. Introduction

Geographers are interested in studying geographic phenomena and their distribution on the Earth's surface, whether these phenomena are discrete or continuous, in order to understand regional character. Therefore, distribution represents the starting point for understanding the existence of any geographic phenomenon through its study and the identification and analysis of the factors that contributed to its presence, along with interpretation. In other words, the distribution of phenomena is the result of spatial and functional relationships that have been reflected in other phenomena (Tammas, 1997, p. 95).

Spatial analysis represents one of the applications of the modern geographic method. Practically, it relies on the analysis of quantitative data for spatial study by converting this data into information that is useful for decision-makers and investors in the industrial field. Statistical analysis also represents one of the important means of measuring spatial distributions and their relationship to the distribution of natural and human phenomena in a given area, along with understanding the reasons for this distribution on the Earth's surface using Geographic Information Systems and its methods in spatial and statistical analysis (Sharif, p. 218.)

"The aim of using these statistical methods is to determine the spatial distribution of industrial establishments in the study area, to identify the degrees of concentration and diversity in the various industrial sector establishments that make up the industrial structure in Dhi Qar Governorate, and to assess the extent to which these geographic factors influence the degrees of variation across the entire study area (Al-Amri, previous source, 158). This variation reflects the actual picture of the distribution of industries in the fifteen districts of the study area, in order to obtain results through what the map reflects as a visual means with quick results in cartographic analysis, with the researcher relying on statistical means such as measures of industrial concentration and diversity, by using the criterion of the number of employees in the industries distributed in Dhi Qar Governorate".

"Number of Employees: This criterion is distinguished by being the most common for indicating the levels of concentration and diversity at the level of industries in a given area, and it is the focus of attention because the number of employees represents the most commonly used criterion, and extensively in quantitative measures of industries due to the ease of obtaining information and also the classification of data and information through cartographic representation in the districts of the study area, within different industrial sectors, and therefore it is one of the good indicators for measuring the structure of the industrial base and its distribution, as the number of employees is one of the fixed values not subject to price changes that accompany other criteria, and it is thus a criterion consistent with geographic studies that take humans as a geographic material, and through knowing these criteria and the data and information they contain for the study area and represented cartographically, the patterns of this industrial distribution become clear, as follows":

"Industrial Concentration: Industrial concentration refers to the concentration of various types and classes of industries in a specific area, such that their concentration exceeds that of neighboring areas (Rasul, p. 149, 1981). The term "industrial concentration" means "the clustering of similar industries with spatial linkages in a geographic area." It also refers to the clustering of companies and industrial establishments in a given area to benefit from a set of economic and operational factors, such as the provision of shared infrastructure, increased opportunities for cooperation and innovation, and the mutual exchange of resources and human expertise (Porter, M. E. (1990)). Alternatively, it is the region that takes a larger share than other regions, and this concentration may be from a group representing similar or complementary industries, or it may be in the form of a single industry that occupies a significant position in its spatial distribution, such as brick manufacturing facilities. Concentration takes various forms resulting from the interdependence of combined factors in an environment that differs from others, which is reflected in the variation in distribution. Therefore, geographers have relied on measures to clarify the spatial distribution of various industries, and to know this, it is necessary to conduct quantitative measurement equations. To measure industrial concentration, we rely on the following equation"...

- C: Concentration coefficient
- A: Cumulative percentage for the district
- Q: Cumulative percentage for the study area

- T: Total percentage

"Through this equation, we can determine the industrial concentration coefficient for the industrial sectors in the study area for the districts. Through the concentration map (1) and table (1), we find a clear variation in the degrees of concentration coefficients of the industrial sectors from one district to another, as shown in the appendices (1-15). The concentration degree reached (1) in each of the districts (Shatra, Al-Islah, Al-Garaf), and the number (1) is basically correct for the localization or concentration of industry. The higher the value, the higher the concentration, and if the result is less than one, then the industries exist but are not localized or concentrated compared to the other districts in the study area. In order to determine the pattern of concentration in the study area, we resort to dividing the data set in the appendices into four categories, as follows":

"The First Category (1.00 - 0.94): This category includes districts with very high industrial concentration, including the districts of (Al-Islah, Al-Garaf, Sayyid Dakhil, Qalat Sukkar, Al-Fajr), with concentration coefficients of (0.93, 0.97, 0.98, 1, 1), respectively. These districts are characterized by an absolute concentration limited to the non-metallic industries sector, with a workforce of (1494) and a percentage of (8%) of the total industrial workforce in Dhi Qar Governorate, as shown in Table (33). This indicates the limited natural resources in these districts and their reliance on the brick, block, and other concrete industries, in addition to the limited presence of the food industries sector and gas filling industry with a workforce of (132) workers".

*"The Second Category (0.93 - 0.68): This category contains districts with high industrial concentration, although it is less concentrated compared to the first category. This category included the districts of (Suq Al-Shuyukh and Al-Nasiriyah) with concentration coefficients of (0.67 and 0.89) respectively. These districts are characterized by the presence of most of the establishments in the food industries sector, the textile and ready-made clothing sector, the wood and furniture sector, and the petrochemical and oil industries, represented by oil extraction, in addition to the concentration of the non-metallic industries sector. The workforce in Suq Al-Shuyukh reached (457) workers, while in Al-Nasiriyah, it reached (12031) workers.

Map (1). Spatial Distribution of Industrial Sector Concentration Coefficients for Districts in Dhi Qar Governorate for the Year 2023

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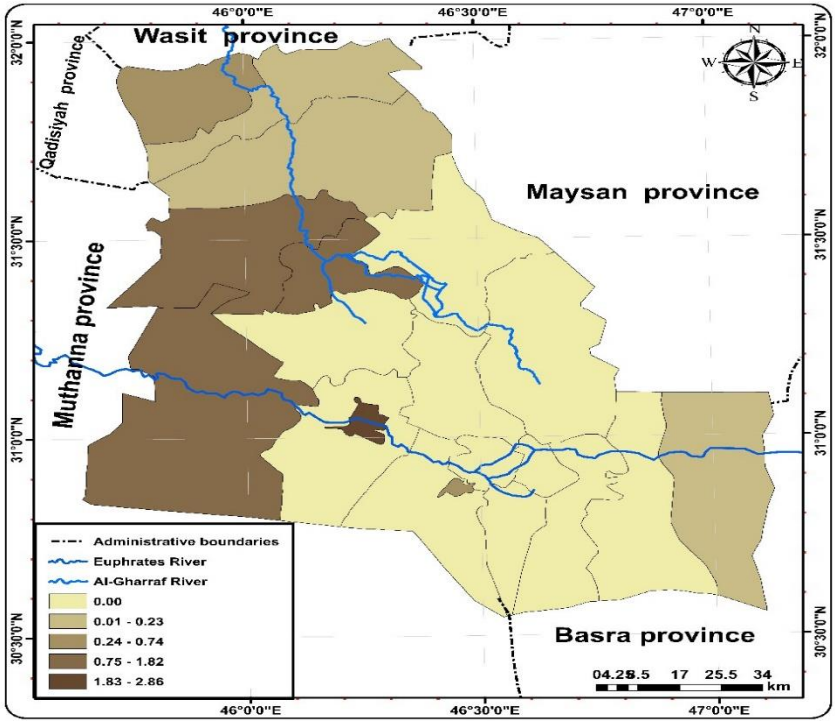

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Table 1. جدول12023 معامل تركز القطاعات الصناعية في اقضية منطقة الدراسة للعام

#	Districts	Concentration coefficient
1	Al-Islah District	1
2	Al-Gharraf District	1
3	Sayyid Dakhil District	0.98
4	Qal'at Sukkar District	0.97
5	Al-Fajr District	0.93
6	Suq al-Shuyukh District	0.89
7	Al-Nasiriyah District	0.67
8	Al-Rifa'i District	0.48
9	Al-Nasr District	0.48
10	Al-Batha' District	0.48
11	Al-Jabaysh District	0.48
12	Al-Shatrah District	0.22
13	Al-Fuhood District	-
14	Karma Bani Said District	-
15	Al-Dawaiyah District	-

"Subsequently, the non-metallic minerals sector employs 151 workers, and the food sector follows with 142. This suggests that there is no dominant industrial sector across all these districts, indicating similar levels of industrial concentration in each."

"The fourth category (0.48 - 0.23) includes Shatrah district, which has a low industrial concentration index of 0.22. Four industrial sectors diversified in the district: non-metallic minerals, electricity, gas, food, and petrochemicals/oil, collectively employing 355 workers. In contrast, Al-Fuhood, Karma Bani Said, and Al-Dawaiyah districts lacked any industrial activities."

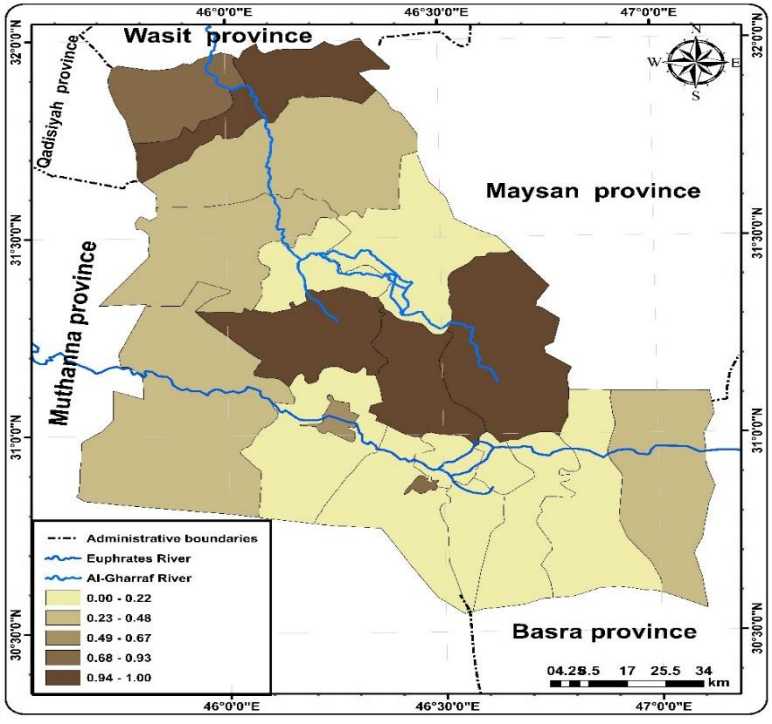
"Secondly, the pattern of industrial diversity (Gibbs-Martin) Industrial diversity refers to the presence of a group of industries in a specific region, or the existence of a large number of industries with different product types in a particular province or district. Industrial diversity contributes to the stability and sustainability of industries in resisting unemployment and economic crises compared to regions with specialized industries (Rasoul, previous source, p. 141). By examining the industrial structure of Dhi Qar Governorate, it becomes clear that there is a significant variation in the number of employees. Therefore, it is necessary to employ statistical methods for analytical purposes and to illustrate the patterns of labor distribution in Dhi Qar Governorate. To measure the level of industrial diversity, several methods exist, including the Martin index, which is one of the most important measures of industrial diversity. It is calculated as follows:

Diversity Index (DI) = $1 - \Sigma(x^2) / (\Sigma x)^2$

Where:

- DI = Diversity Index
- $\Sigma(x^2)$ = Sum of the squares of the number of individuals in each category
- $(\Sigma x)^2$ = Square of the sum of the total number of individuals

If the diversity index is equal to (0), it indicates a high concentration of the phenomenon. However, when it approaches (1), it suggests a diverse phenomenon. Therefore, we can measure the industrial diversity of a district compared to other districts. The aim is to determine the extent to which the diversity index corresponds to the concentration coefficient. If the diversity in a district is equal to (0), this indicates that it specializes in one industrial sector or a specific industry, while a concentration coefficient of (1) means that the district has diverse industries. When applying this index to the industrial sectors in the study area, we obtain Industrial Diversity Map No. (1) for the governorate's districts. By examining Appendices (16-28), it becomes clear that the diversity index in the study area is closer to diversity than concentration. The proportions of the districts in Dhi Qar Governorate are as shown in Table (34).



Map 2: Spatial distribution of industrial diversity index in Dhi Qar Governorate, Iraq 2023

Table 2 Industrial diversity index by district in Dhi Qar Governorate, Iraq (2023)

جدول22023 دليل التنوع للقطاعات الصناعة في اقضية محافظة ذي قار للعام

#	Districts	Concentration coefficient
1	Al-Islah District	2.86
2	Al-Gharraf District	1.82
3	Sayyid Dakhil District	1.55
4	Qal'at Sukkar District	1.50
5	Al-Fajr District	0.74
6	Suq al-Shuyukh District	0.56
7	Al-Nasiriyah District	0.23
8	Al-Rifa'i District	0.21
9	Al-Nasr District	0.11
10	Al-Batha' District	0
11	Al-Jabaysh District	0
12	Al-Shatrah District	0
13	Al-Fuhood District	-
14	Karma Bani Said District	-
15	Al-Dawaiyah District	-

As a result, four categories of diversity patterns emerged in the study area, which allowed us to draw the following industrial diversity map.

"The very high industrial diversity category (2.86 - 1.82) was exclusive to Nasiriyah and Batha districts based on the very high industrial diversity index. Nasiriyah district had the highest index (2.86), making it the administrative center of the governorate. It has accommodated all industrial sectors and attracted all economic, social, and service activities. The district also benefits from a high daily population movement from other districts, which has encouraged the emergence of various types of industries. Batha district followed with an industrial diversity index of (1.82). Several factors contributed to this level of diversity, including..."

a- Geographic Location:

Nasiriyah district's geographic location has contributed to attracting numerous industries targeting the local market within the district's center. Nasiriyah is the only district in the governorate that encompasses most of the industrial sectors.

b- Population:

Nasiriyah district has a population of (690994) individuals, constituting approximately 30% of the governorate's population. This increase in population growth rate indicates that Nasiriyah is an attractive area for settlement due to its economic stability, which has positively impacted the industrial sector in the governorate.

c- Government Economic Policy:

The economic policies of both the central government and the local government in the governorate aim to encourage investment in the industrial sector through investment support from the Dhi Qar Investment Authority and the Industrial Bank, in addition to the available natural resources that feed various industrial sectors in the governorate.

"The high industrial diversity category (1.81 - 0.75) included the districts of Al-Nasiriyah and Al-Shatrah. These districts had diversity indices of 1.55 and 1.50, respectively, falling within the high diversity category.

1- They both contained food industries employing 56 workers and non-metallic industries employing 204 workers. Additionally, both districts had petrochemical and oil industries employing 38 workers. Al-Nasiriyah and Al-Shatrah also had gas filling plants, part of the electricity and gas industry sector, employing 146 workers. Al-Shatrah district had a population of approximately 276,198, representing about 30% of the governorate's population, ranking second after Nasiriyah district".

2- "The medium industrial diversity category (0.74 - 0.24) includes the districts of Suq al-Shuyukh and Al-Fajr. Their diversity indices are 0.74 and 0.56, respectively. Non-metallic industries dominated these districts, employing 385 workers. The electricity and gas industry employed 34 workers, while the food industry employed 66 workers".

3- "The low industrial diversity category (0.23 - 0.01) comprises three districts: Qal'at Sكر, Al-Rifa'i, and Al-Jibaysh. These districts are characterized by specialized industries. Al-Jibaysh and Al-Rifa'i districts specialize in oil extraction, with the Sabba oil field located in Al-Jibaysh and the Northwest Al-Rifa'i fields (Al-Gharraf oil field). Qal'at Sكر district, on the other hand, focuses on non-metallic industries."

"The specialization category (0) included three districts: Al-Islah, Al-Garaf, and Sayyid Dakhil. These districts specialized in non-metallic industries, employing a significant number of 1406 workers.

Through the industrial concentration and diversity maps, we clearly observed the validity of the criteria used in the study area. The diversity and concentration indices showed inverse relationships, as demonstrated in the maps, confirming the accuracy of the equations for the study area. For instance, the three districts (Al-Islah, Al-Garaf, and Sayyid Dakhil) had a diversity index of 0 but ranked highest in terms of industrial concentration with an index of 1. This clearly demonstrates the inverse relationship between the concentration and diversity indices in the study area".

2. Conclusion

The analysis of geographical distribution patterns of industrial facilities in Dhi Qar Governorate reveals distinct spatial clusters and disparities. [Briefly summarize the key findings, such as dominant industrial zones, areas with high/low industrial density, and any identified patterns

The study underscores the importance of spatial analysis in understanding the industrial landscape of Dhi Qar. The results provide valuable insights for policymakers, planners, and investors in identifying potential areas for industrial development, infrastructure improvement, and targeted support.

To enhance the industrial sector's growth, it is recommended to [provide specific recommendations based on your findings, such as developing industrial parks in specific locations, improving transportation networks, or offering incentives to attract investment]. By strategically leveraging the geographical distribution of industries, Dhi Qar Governorate can optimize resource utilization, create employment opportunities, and contribute to overall economic development.

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