SPATIAL ANALYSIS OF POPULATION CONCENTRATION AND MEASURING METHODS AT AL-RUMAITHA CITY FOR PERIOD 2009-2022.

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Abstract:

The research aims to clarify the picture of population concentration in the city of Rumaitha, whether it is concentrated or widespread, for the purpose of benefiting from this in the planning and distribution of services in the city of Rumaitha, it came with an introduction and two sections. The introduction included the research problem, its hypothesis, methodology, objective, and the spatial and temporal boundaries of the study area. The study adopted the descriptive approach to describe the distribution of the population of the city of Rumaitha. The analytical approach to analyzing data and arriving at results. The first section dealt with the reality of the relative distribution of the city's population. The second section dealt with population concentration measures represented by the concentration ratio measure and the Lorenz curve. The study concluded with a set of conclusions and recommendations.

Keywords: Spatial analysis, population concentration, measuring methods, Al-Rumaitha city, period 2009-2022.

Introduction:

All geographical phenomena are linked to place. Therefore, geography aims to carefully explain the connection between these phenomena and the spatial space in which they exist. Population is one of the phenomena that the competent geographer must study in terms of its distribution and trends in change over time.

The population phenomenon is one of the most important phenomena studied by the geography of cities. There is almost no research in its research without studying the population characteristics of the area it studies, as population is a variable element across time and place. Naturally, there are functions that the city must perform, and the performance of these functions is measured through standards that depend on The demographic characteristics of the city, as the city cannot perform its functions properly if the distribution of those functions is not consistent with the distribution of the population and their characteristics.

Research problem:

The research problem is demonstrated by the following question:

(Is the population of the city of Rumaitha concentrated in one neighborhood, or is there a discrepancy in population concentration between its neighborhoods? What are the standards used to measure this?)

Research hypothesis:

The research hypothesis was represented by the following assumption: (The concentration of population in the city of Rumaitha varies from one neighborhood to another)

Research goal:

The main goal is to show the population distribution picture for the purpose of providing a database that supports the parties concerned with planning to be of the best assistance to them in advancing the development and construction process and providing services to the city's residents.

Research importance:

Population is the basis of the development process in any place, so it is necessary to prepare numerical values on which the parties concerned with planning services can rely. This study will provide the accurate population data that those parties need to plan economic and service projects in the city.

Study Approach:

The study adopted the descriptive approach to describe the distribution of the population of the city of Rumaitha, and the analytical approach to analyze the data and reach the results.

Spatial and temporal limits of research:

The spatial boundaries of the research are represented by the boundaries of the basic plan of the city of Rumaitha, which is located in the southwestern part of Iraq and the northern part of Al-Muthanna Governorate. It is bordered to the north by Al-Najmi District and to the south by Al-Majd and Al-Hilal Districts. To the east, it is bordered by Al-Warka District. Note map (1). The city is located astronomically. At the intersection of latitude (31.35) north and longitude (45.10) east.

As for the temporal limits of the study, it is represented by the period (2009-2022).

Study structure:

The study was divided into two sections preceded by an introduction. The first section dealt with the relative distribution of the population of the city of Rumaitha for the period (2009-2022), while the second section dealt with methods for measuring population concentration in the city. The study concluded with a set of conclusions and recommendations in which the researcher sees solutions to the problem of the study, and finally a list of footnotes. and the sources used by the study.
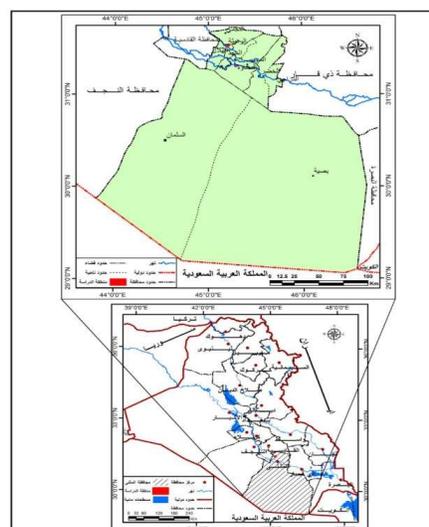
Map (1) The location of the city of Al-Rumaitha in Iraq and Al-Muthanna Governorate.

Source: 1. Ministry of Water Resources, General Directorate of Survey, Map Production Department, Digital Unit, Administrative Map of Iraq, scale (1000000:1), Baghdad, 2007.

2. Ministry of Water Resources, General Directorate of Survey, Map Production Department, Digital Unit, Map of Al-Muthanna Governorate, scale (500,000:1), Baghdad, 2007.

The first section: The first section: The size and growth of the population and their spatial distribution in the city of Rumaitha

Studying the size and growth of the population, its distribution and composition in the city helps planners in distributing services fairly, in addition to measuring the effectiveness and adequacy of those services is directly linked to the size and density of the population in the study area (1). Future estimates of the city's population numbers also enable planners to develop an efficient future plan for distributing services and projects in the city according to the expected number of residents in each part of it.

First: Population size and growth in the city of Rumaitha

Population growth in the city of Rumaitha has proceeded irregularly in the past decades, as it appears from Table (1) and Figure (1) that the population in the city of Rumaitha in (1977) reached (18,342) people, then it increased in (1987) to (30,726 people) with an absolute increase of (12,384 people) and a growth rate of (5.2%). This increase came as a result of the natural increase that resulted from the increase in the number of births and the decrease in the number of deaths due to the improvement in the health status of the population and the fight against many diseases and epidemics, and in a general census (1997 AD) The city's population reached (43,784 people), with an absolute increase of (13,058 people) and a growth rate of (3.6%). Despite its decline from the previous period, it remains one of the high growth rates. Population estimates for the year (2009 AD) indicate that the city's population It reached (68,781) people, an absolute increase of (24,997) people, and a growth rate of (3.8%). The increase in population growth rates in the city of Rumaitha during this period is attributed to the rise in the population's standard of living and the end of the economic blockade on Iraq after the year (2003 AD). Which exacerbated the poor economic and health conditions of the population. The city's population continued to increase until it reached, according to population estimates, about (95,374 people) in 2022, an absolute increase of (26,593) people. The growth rate during this period reached (2.4%). The city of Rumaitha is located among the medium cities according to the classification. Which depended on the size of the population*.

It is noted by tracking the percentages of the city's population to the governorate's population that these percentages increased during the population censuses from (8.5%-10.5%), which indicates the increasing relative importance of the city of Rumaitha and the expansion.

Table (1) Population size and growth in the city of Rumaitha for the period from (1977-2022 AD).

Year	Governorate's population size	City's population size	City to governorate population ratio	Population increase	Annual growth rate %
1977	215637	18342	8,5	--------	--------

1987	315816	30726	9,7	12384	5.2
1997	436825	43784	10	13058	3.6
2009	683126	68781	10,1	24997	3.8
2022	902480	95374	10.5	26593	2.5

Source:

1. Republic of Iraq, Ministry of Planning, Central Statistical Organization, results of the general census of the population of Muthanna Governorate for the years (1977-1987-1997)

2. Republic of Iraq, Ministry of Planning, Central Statistical Organization, Muthanna Governorate Statistics Directorate, Muthanna Governorate Population Estimates for the year (2009 AD), unpublished data.

3. Republic of Iraq, Ministry of Planning, Central Statistical Organization, Muthanna Governorate Statistics Directorate, Muthanna Governorate Population Estimates for the year (2022 AD), unpublished data.
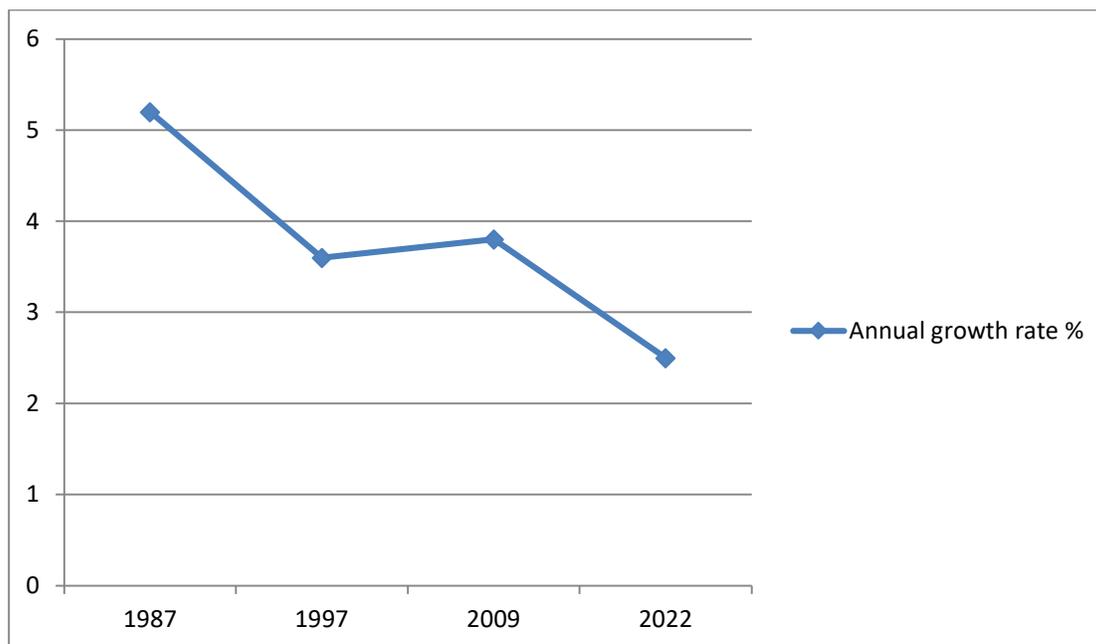

Figure (1) Population growth for the city of Rumaitha for the period (1977-2022). Source: Table (1)

Its regional and functional relations, as it has become an attractive administrative center for residents from the rest of the regions, especially the surrounding rural areas.

Second: The relative distribution of the population of the city of Rumaitha for the period (2009-2022):

For some geographers, the distribution is like the heart of geography, and it means the organization or arrangement that results from the distribution of phenomena in place according to special patterns (2).

As for the distribution of the population, it is defined as the way they spread within the natural place that they are able to exploit and settle in (3). All geographical phenomena must take a specific spatial location, and this is the core of the work of geography, as it is the science of place.

The population distribution is the starting point for population studies in any place, as it represents the first step to clarify or explain the interaction and interdependence between most of the phenomena present in the place and the population who inhabit that place (4). It is a priority to identify areas of high density and areas of low density as well as inhabited and uninhabited areas (5). The relative distribution of the city's population expresses the proportion of what afflicts the residential neighborhood from the total population of the city, and it represents a mirror reflecting the image of the population distribution and its spatial difference between the city's neighborhoods. the study(6).

It is clear from Table (2) that the relative distribution of the city's population varies between its residential neighborhoods in the years (2009) and (2022). In the year (2009), Al-Hussein neighborhood still occupies the lead in the percentage of population, which reached (15.5%). The reason for this is due to The emergence of these neighborhoods took place long ago, as they constitute the nucleus around which the city grew. The second place went to the (military) neighborhood, whose population percentage increased as a result of the state distributing housing plots to the military segment and the banking facilities it provided for the purpose of establishing new housing units. As for the neighborhoods with the lowest percentage, they were The neighborhoods of (Al-Jawadin and Al-Mustafa), which amounted to (4.7%) and (0.2%), respectively. This is due to the fact that they are among the newly established neighborhoods that lack the majority of services, so the neighborhoods of (Al-Jawadin and Al-Mustafa), which amounted to (4.7%) and (0.2%) respectively, and this is due to the fact that they are among the newly established neighborhoods that lack most services.

As for the year (2022), the Al-Hussein and Al-Askari neighborhoods are still topping the percentage of their population, reaching (12.5%) and (12.4%) respectively, as the early establishment of the Al-Hussein neighborhood, its proximity to the city center, and the completion of most of its services made the population concentrated there. As for the Al-Askari neighborhood, the completion of most of its services, in addition to the acceptability of the land price and rental fees, made the residents prefer to settle there. The price of one square meter in it ranged between (225,000-300,000) dinars, while the rental fees ranged between (150,000-200,000) dinars per month. (7), As for the neighborhoods with the lowest percentage, they were the neighborhoods of (Thawrat Al-Ashreen and Al-Mustafa), with their population percentages reaching about (5.3%) and (0.7%). The reason for the low population percentage of the Thawrat Al-Ashreen neighborhood is due to its proximity to the main street linking the central governorates. The south and the resulting noise made it an unattractive area for residents, while Al-Mustafa neighborhood is still considered one of the modern neighborhoods in the city whose services have not yet been completed, in addition to its distance from the city center compared to the rest of the neighborhoods.

Table (2) Spatial distribution of the population of the city of Rumaitha for the years (2009-2022).

Seq.	Neighborhood name	2009		2022	
		No.	(%)	No.	(%)
1	Al-Askari	8791	12,78	11831	12.4
2	Al-Amir	6735	9,79	8241	8.64
3	Al-Jihad	8622	12,54	11709	12.27
4	Al-Jawadin	3235	4,70	5736	6.01
5	Al-Hussain	10691	15,56	11933	12.52
6	Al-Hakeem	7217	10,49	10128	10.62
7	Al-Zahraa	6667	9,69	10295	10.79
8	Al-Shuhadaa	8319	12,09	10033	10.52
9	Al-Sadiq	4842	7,04	9663	10.13
10	Al-Mustafa	167	0,24	707	0.74
11	20 Thawra	3495	5,08	5098	5.36
Total		68781		95375	

Source :

1- Republic of Iraq, Ministry of Planning, Central Bureau of Statistics, Muthanna Governorate Statistics Directorate, Muthanna Governorate population estimates for the year (2009), unpublished data.

2- Republic of Iraq, Ministry of Planning, Central Bureau of Statistics, Muthanna Governorate Statistics Directorate, Muthanna Governorate population estimates for the year 2022, unpublished data.

The second section: Measures of population concentration in the city of Rumaitha

The study of the geographical distribution of population is one of the important topics that geographers are interested in, as it is the window that reveals the variation in the distribution of population between regions and the extent of the weight and pressure of the population over the cadastral space of the land on which they are located. Therefore, the study of population distribution and concentration is considered one of the closest population studies to geography, because of their connection. In place, some researchers say that studying population distribution represents the backbone of geography (8), and in the geography of cities, the importance of studying population concentration stems from the need to take it into consideration when planning services. Areas that witness population concentration must have the level of services in proportion

to the degree of population concentration. There are many statistical methods that can be used to detect population concentration or dispersion, the most prominent of which are the following:

First: population concentration ratio:

Geographic researchers were interested in the issue of population concentration in a specific place and time, as they described it as a process that is linked to place and changes over time, and the degree of population concentration increases as the population gathers in a specific place (9), and the concentration ratio (*) is a statistical method through which the concentration of population in a particular place is calculated. In a place, it is statistically equal to half the sum of the absolute difference between the percentage of area and the percentage of population in each administrative unit, neighborhood, or the like. The larger this percentage is, the more the concentration is severe. However, if the percentage is small, the population concentration decreases and is The distribution of the population is dispersed, and if the ratio is zero, the distribution is ideal (10). The concentration ratio is measured according to a numerical standard, the concentration ratio standard, which is an absolute numerical value confined between zero, which is the smallest value, and the largest concentration value, which is (100), which can be represented by the following degrees (11):

1. 0- Less than 24% Equal distribution: The population has a strong tendency to be evenly distributed throughout the region.

2. 25- 49 Fairly equal distribution: the tendency of the population to be spread fairly evenly.

3. 50-74 Average concentration: the tendency of the population to be concentrated to some extent.

4. 75-100 Highly concentrated: the tendency of the population to be highly concentrated.

It is noted from Table (3) that the concentration rate in the year (2009) amounted to (18.62%), which falls within the first criterion, which indicates a strong tendency of the population to be spread evenly throughout the region. As for the neighborhood level, we find a clear disparity between the internal neighborhoods. And the neighborhoods of the outskirts, as the proportion of population exceeds the proportion of area in the neighborhoods of (Al-Askari, Al-Jihad, Al-Hussein, Al-Zahra, and Al-Shuhada), and this means that there is a concentration of population in those neighbourhoods. As for the neighborhoods in which the proportion of area exceeds the proportion of population, they are the neighborhoods that are located on the outskirts of the city, which are the neighborhoods of (Al-Amir and Al-Jawadin). Al-Hakim, Al-Sadiq, Al-Mustafa, and the Revolution of the Twentieth) This is due to multiple reasons. In the Al-Amir neighborhood, we find that the factor of the high land price, which ranges between (200,000-250,000) per square meter (12), had a significant impact on the reluctance of families, especially those with limited income, to live in it, in addition to Its proximity to the commercial area, which made commercial use compete with residential use there. As for the Thawrat al-Ashreen neighborhood, its proximity to the train station and the main road that connects Al-Qadisiyah Governorate to the center of Al-Muthanna Governorate led to residents not preferring to live in it, and given the proximity of Al-Sadiq neighborhood to the industrial zone in the city as well as its The passage of a pipeline transporting oil and its derivatives through it made residents prefer to stay away from living there. As for the rest of the neighborhoods, they are new neighborhoods located on the outskirts of the

city(13), which are still incomplete with services and have not yet reached the point of urban fullness.

As for the year (2022), it is noted from Table (4) that the population concentration rate in the city reached (36.99%) and falls within the second criterion, which indicates that the population tends to be spread fairly evenly. It is noted that the concentration rate in this year increased by More than half compared to the year (2009), and this is due to the expansion of the city and the increase in its area, in addition to the increase in the number of its population. As for the neighborhood level, when tracking the concentration rates in them, we find that the population ratios still exceed the area ratios in the internal neighborhoods, and when comparing this with the year (2009), we find The population ratios in the neighborhoods of (Thawrat Al-Eshreen and Al-Sadiq) exceeded their area ratios in the year (2022) after the difference was in favor of the area ratios in the year (2022). This is due to the fact that the Al-Rumaitha train station moved to a new location far from the Thawrat Al-Eshreen neighborhood, in addition to the rise in The size of its population and the stability of its area. As for Al-Sadiq neighborhood, the acceptable price of the land in it compared to the rest of the neighborhoods played a role in the resort of families with limited income to live in it, as the price of one square meter in it ranged between (75,000-100,000) dinars, while the rent fees ranged between (100,000-150,000) dinar (14), which is an appropriate amount for people with limited income and acceptable compared to land prices and rent allowances in the rest of the neighborhoods.

Table (3) Percentage of population concentration in the city of Rumaitha in (2009).

Seq.	Neighborhood name	No.	(%)	Area (Hectare)	(%)	Difference
1	Al-Askari	8791	12,78	67.74	11.37	1.41
2	Al-Amir	6735	9,79	74.94	12.58	2.79
3	Al-Jihad	8622	12,53	47.1	7.91	4.62
4	Al-Jawadin	3235	4,70	39.08	6.56	1.86
5	Al-Hussain	10691	15,54	36.45	6.12	9.42
6	Al-Hakeem	6817	10,49	111.4	18.7	8.21
7	Al-Zahraa	6667	9,69	45.97	7.72	1.97
8	Al-Shuhadaa	8319	12,09	64.81	10.88	1.21
9	Al-Sadiq	4842	7,03	60.84	10.21	3.18
10	Al-Mustafa	567	0,24	2.47	0.41	0.17
11	20 Thawra	3495	5,08	44.64	7.49	2.41

Total	68781	-	595.44	-	37.25
Concentration ratio					18.26

Source: Table (2).

Table (4) Percentage of population concentration in the city of Rumaitha in the year (2022).

Seq.	Neighborhood name	No.	(%)	Area (Hectare)	(%)	Difference
1	Al-Askari	11831	12,4	67,74	6.50	5,9
2	Al-Amir	8241	8,64	90,3	8,67	0,03
3	Al-Jihad	11709	12,27	47,1	4,52	7,75
4	Al-Jawadin	5736	6,01	113,3	10,88	4,87
5	Al-Hussain	11933	12,52	36,45	3,50	9,02
6	Al-Hakeem	10128	10,62	293,5	28,20	17,58
7	Al-Zahraa	10295	10,79	45,97	4,41	6,38
8	Al-Shuhadaa	10033	10,52	64,81	6,23	4,29
9	Al-Sadiq	9663	10,13	78,4	7,53	2,6
10	Al-Mustafa	707	0,74	158,6	15,23	14,49
11	20 Thawra	5098	5,36	44,6	4,28	1,08
Total		95374		1040.7		73.99
Concentration ratio						36.99

Source: Table (2).

As for the neighborhoods located on the outskirts of the city, their area ratios still exceed their population ratios due to the incompleteness of their services and their relative distance from the city center, in addition to the fact that the new spaces that were added to the city in the third basic plan were added to those neighborhoods, which led to an increase in their area ratio.

The superiority of the population ratios over the area ratios in the center neighborhoods and the opposite occurrence in the new neighborhoods located on the outskirts throughout the study period supports the research hypothesis that there is a discrepancy in the distribution of population in the city. This requires the authorities concerned with planning services to take that discrepancy

into consideration so that there is justice in the distribution. Services according to population ratios in each neighborhood.

Second: Lorenz curve:

It is one of the standards or graphical methods that are used to measure the amount of equality in the distribution of many diverse phenomena. It is based on a comparison between the actual distribution of the phenomenon on the one hand and its ideal distribution on the other hand (15), and that is through comparison between population and area data during different periods of time for the purpose of highlighting the extent Variation in the distribution of population (16), and it is considered one of the most widely used forms of display. The idea of clustered frequencies of ascending percentages has been used in drawing this curve to identify the fairness of the distribution of various phenomena, including the phenomenon of population distribution (17).

It is clear from Tables (5) and (6) and Figures (1) and (2) that there are two variables, the (independent) variable that represents population and the (dependent) variable that represents area. To clarify the relationship between the two variables, that is, to find out the misdistribution of the independent variable (population) On the dependent variable, which represents (area), it becomes clear during the year (2009) that (50%) of the city's population is distributed over (83%) of the city's area. This means that the distribution of population at the city level tends to spread. While it will be noted during the year (2022) that (50%) of the city's population is distributed over (76%) of its area, this means that the fairness of distribution during this period is less compared to the previous period, as evidenced by the fact that the Lorenz curve moves away from the line of symmetry to a greater extent compared to the year (2022), and if we compare the population percentages for each neighborhood, we will find a clear discrepancy between the neighborhoods, especially between the center neighborhoods and the periphery neighborhoods.

Table (5) The ascending clustered frequency of population percentage and area percentage in the city of Rumaitha for the year (2009).

Seq.	Neighborhood name	population percentage	Ascendant clustered frequency of population ratio	Area ratio (%)	Ascendant clustered frequency of area ratio
1	Al-Askari	12.78	12.78	11.37	11.37
2	Al-Amir	9.79	22.57	12.58	23.96
3	Al-Jihad	12.53	35.10	7.91	31.87
4	Al-Jawadin	4.70	39.81	6.56	38.43
5	Al-Hussain	15.54	55.35	6.12	44.55
6	Al-Hakeem	10.49	65.84	18.70	63.26
7	Al-Zahraa	9.69	75.54	7.72	70.98
8	Al-Shuhadaa	12.09	87.63	10.88	81.87
9	Al-Sadiq	7.03	94.67	10.21	92.08

10	Al-Mustafa	0.24	94.91	0.41	92.50
11	20 Thawra	5.08	100	7.49	100

Source: Table (2).
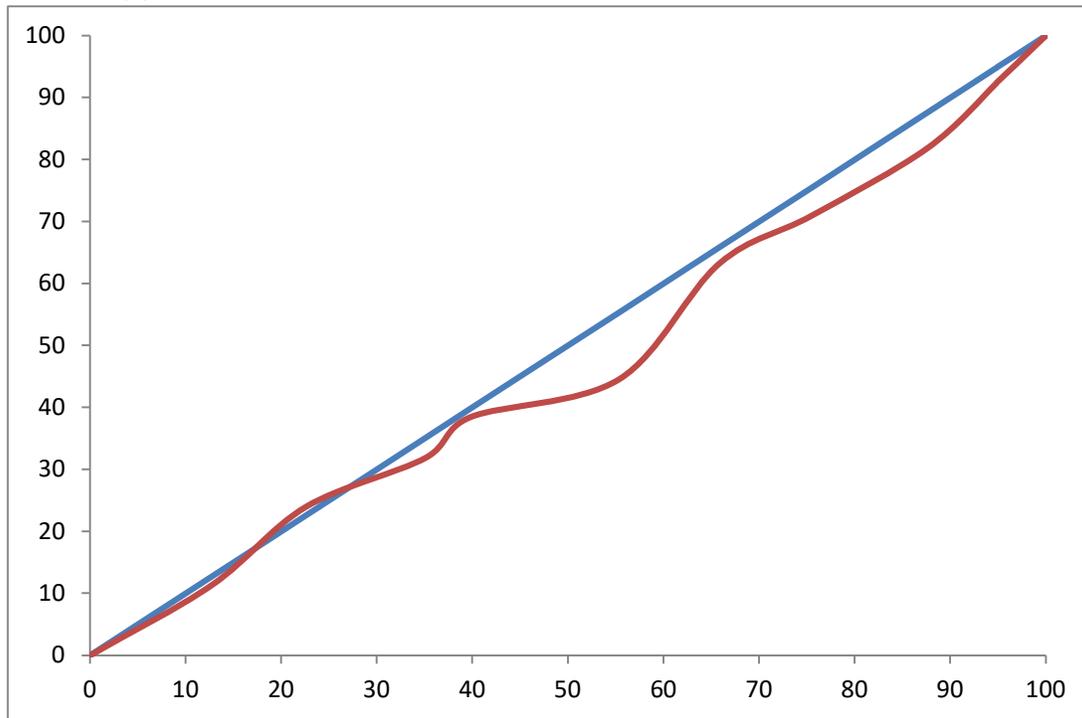
Figure (1) Lorenz curve for the population of the city of Rumaitha in 2009.

Table (6) The ascending clustered frequency of the population percentage and the area percentage in the city of Rumaitha for the year (2022).

| Seq.	Neighborhood name	population percentage	Ascendant clustered frequency of population ratio	Area ratio (%)	Ascendant clustered frequency of area ratio
1	Al-Askari	12.4	12.4	6.51	6.51
2	Al-Amir	8.64	21.04	8.68	15.19
3	Al-Jihad	12.27	33.31	4.52	19.71
4	Al-Jawadin	6.01	39.32	10.89	30.6
5	Al-Hussain	12.52	51.84	3.51	34.11
6	Al-Hakeem	10.62	62.46	28.2	62.31
7	Al-Zahraa	10.79	73.25	4.42	66.73
8	Al-Shuhadaa	10.52	83.77	6.23	72.96
9	Al-Sadiq	10.13	93.9	7.53	80.49
10	Al-Mustafa	0.74	94.64	15.23	95.72
11	20 Thawra	5.36	100	4.28	100
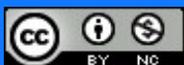
Source: Table (2).
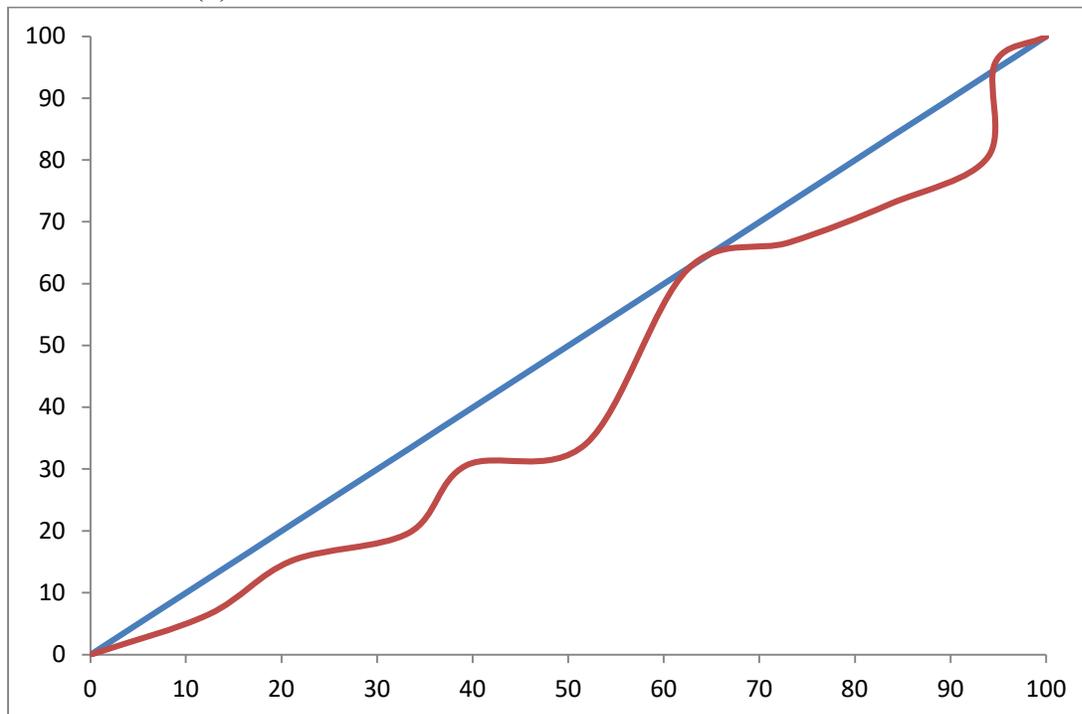
Figure (2) Lorenz curve for the population of the city of Rumaitha in 2022.

Conclusions

1. The study revealed differences in population growth rates between the city's neighborhoods over the period (2009-2022). Al-Mustafa neighborhood recorded a growth rate of (11.4%), while Al-Hussein neighborhood recorded a growth rate of (0.8%).

2. The study revealed a discrepancy in the concentration of population in the city. Al-Hussein neighborhood ranked first in the relative population distribution ranks, as its population percentage reached (15.5%) and (12.5%) of the city's total population during the years (2009-2022). Respectively, then the population percentages gradually decrease as we move away from the center towards the outskirts, so that Al-Mustafa neighborhood records the lowest percentage of population in the city, as it reached (0.2%) in 2009, while in (2022) it reached (0.7%). Of the total population of the city.

3. Data on the population concentration ratio in the city indicate that the population ratio exceeds the area ratio in the city center neighborhoods, and that the area ratio exceeds the population ratio in the periphery neighborhoods during the study period.

4. The use of Lorenz curve scale data revealed the equitable distribution of population in the city of Rumaitha in the year (2009). However, in the year (2022), the equitable distribution was less, as evidenced by the curve being further away from the line of symmetry compared to the year (2009).

Recommendations:

1. The need to conduct more urban studies on the issue of population concentration in cities, as the population is the most prominent phenomenon in the city. They are the ones who determine its

morphology, and they are the ones who control the type of activities and services and their levels. There is also a need to conduct studies on the population of the city of Rumaitha to provide a database for planners and decision-makers. Being the second largest urban center in Al-Muthanna Governorate.

2. Working to follow up on the completion of services in the neighborhoods on the outskirts of the city, represented by the neighborhoods (Al-Jawadin, Al-Hakim, and Al-Mustafa), and distributing plots of land to citizens therein for the purpose of alleviating population pressure on the neighborhoods of the center that are close to reaching the stage of urban filling.

Margins

(1)Riyad Kazem Salman Al-Jumaili, The efficiency of spatial distribution of community services in the city of Karbala, doctoral thesis, Ibn Rushd College of Education, University of Baghdad, 2007, p. 84.

* Cities are classified according to the size of their population into rural cities whose size ranges between (2000-5000) people, small cities (5000-20000) people, medium cities (20000-100000) people, and (100000) or more large cities. For more information, see

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(6) Duha Mahmoud Ayesh Al-Samarrai, Spatial variation in the distribution of the population of Samarra District for the period (1987-2020 AD), Master's thesis, College of Education, University of Samarra, 2021 AD, p. 53.

(7) Personal interview with Mr. Ahmed Ali Sharif, Director of the Real Estate Buying, Selling and Renting Office, on 3/2/2023.

* Al-Mustafa neighborhood appeared in the year (2009).

(8) Ayed Othman Abu Subha, Population Geography, Wael Publishing House, 1st edition, Amman, 2015, p. 48.

(9) John Clark, Population Geography, translated by Muhammad Shawqi and Ibrahim Makki, Mars Publishing House, Riyadh, 1984 AD, p. 74.

* The concentration ratio can be obtained using the following equation

Concentration ratio = 1/2 mg (x-y)

Where: x = the percentage of the area of the region to the total area of the total area, y = the percentage of the population of the region to the total population of the total area, M = the sum of the positive difference between these percentages.

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