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NETWORKS AS AN APPROACH FOR MEASURING URBAN DOMINANCE: A COMPARATIVE STUDY OF DOMINANCE IN TWO CITIES OF HILLA AND AL-MAHAWIL IN THE PROVINCE OF BABYLON-IRAQ

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Abstract

Urban dominance is one of the planning terms that indicate the appearance of the transformation of cities as a functional and physical entity within their urban and regional system. Cities redefine their existence within spatial systems according to developments in the technological, social, economic and spatial dimensions. City networks and connections refer to the state of city as an influencer at its regional context. The current research suggests that urban dominance is a result of the state of interaction achieved by the connections that cities create within their regional environment and city as an administrative node should be integrated physically by network systems. The dominant nodes in Iraqi cities were defined according to an administrative classification that defines various hierarchies in the urban system. Research hypothesis states that network approach introduces a new input that explaining the state of dominance between cities physically. Contemporary models and measurement methods provide a way to evaluate dominance with the various interactions and monitor their variations between cities. The study adopted a descriptive and quantitative measurement approach and adopted a nodal weight scale within the concept of urban networks to measure dominance from the perspective of functional interactions and city interdependencies. The research method was applied in two cities in the same administrative rank located in the governorate of Babylon, Iraq. The model is applied for the first time in Iraqi cities to be integrated with traditional indicators of urban dominance. The research concluded that city scale is a result of complex of socio-economic and spatial connections which can be demonstrated by city network connectivity.

Keywords:

Urban dominance;
Urban hierarchy;
Spatial structure;
Networks;
Nodal weight.

1 Introduction

In the field of urban planning and design, new concepts have emerged which require to re-read cities as the first entities to be concerned and impacted by these changes in the components of their spatial, social, economic, political, urban and environmental existence [1].

Iraqi cities rank with certain arrangement which classified city according to its size and population. According to the mechanism of urbanization, many cities are qualified for a transfer process towards higher urban rank. Dominance of cities, according to traditional planning theories, was explained with rules and variables and relied on linear relationships between cause and effect. It's important to re-study and rethink this subject in contemporary terms. In that case, many recent studies concentrated on the importance of dealing with city dominance and hierarchy as associated phenomena [2]. Recently, urban planning studies have expanded their variables to determine the administrative divisions. Some of these

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studies focused on the definition of types of intra-city borders that represent different contexts of the populace and their normal daily activities. presence of natural or man-made barriers. These boundaries tend to align with regions that exhibit varying levels of population density. One study emphasized that a dominant urban centre can be defined by its territorial influence; such a centre serves as a regional hub, facilitating urban functions, connecting the surrounding region, and maintaining accessibility. The smallest administrative unit should be determined based on trip density and the diversity of travel patterns to justify localized governance.

The study of Y, Zhou& Thill [3] found that the administrative delineation of districts differs significantly from socioeconomic regions, which are better understood through the spatial dynamics of human activity and the configuration of urban infrastructure.

At the level of inter-regional dominance, a study of Li, Chen& Liu 2021 [4] depended on many literatures and adopted techniques to monitor the dependent relationship between urban structure and city size. This study explained that any cities are regarded as a composition of nodes, and the relative distance between its nodes. It is possible to express the city and its size as statistical values to represent the weight of the network. The observation of results showed that as distance increased. In the geographic space, the likelihood of nodes existing tended to follow a log-normal distribution. Conversely, there was a positive correlation between the city size and the distance that corresponded to the possibility of dominant node existing. Other study [2] determined data of interconnectivity, productivity and innovation of micro-level of European and the United States' cities. According to the findings, intra-city distribution and urban growth relative to city size accounted for 36% to 80% of scaling effects and explained between 56% and 87% of the variation in scaling across indicators with differing levels of economic complexity. These results were attributed to a mechanism described as size-dependent cumulative advantage, highlighting a key pathway through which differences in city size influence developmental outcomes. The interpretation of urbanization and the production of heavy tails around major cities is linked to the benefits of clusters, especially for elite groups, where new trade-offs are made for the distribution of population across the city according to the process of replacement among the classes of society. A study conducted in Shandong Province, China, revealed a correlation between the internal layout of urban nodes and overall city size. The proposed model integrated three data types and included a visual representation of the relationship between datasets and population. The analysis produced a curve plotted in log-linear coordinates, revealing distinct spatial patterns within the urban structure [4].

Several studies included the concept of dominance at local levels within the sectors of cities as an example; the study of "White Zones in Kyrenia" which defined important issues. The results of the study showed that there are several problems related to the urban structure of the region. These problems were summarized by urban sustainability factors and tourist preferences. Decision makers were directed to adopt innovative solutions and growth alternatives to employ the available information from the application of space installation models in activating urban structure planning [5].

Urban dominance within different city zones is closely linked to the concentration of transportation networks. Among the most widely used public transit systems in major cities are taxicabs, which play a crucial role in shaping the structure of location-based networks and facilitating mobility within metropolitan areas[6].

In a study applied on the distribution of taxi and its link to the distribution of population densities within the city, there was a direct relationship between both variables, as the index of these movements determines the spread of community jobs, the patterns of movement of residents and mobility through urban spaces [3].

The concept of dominance according to the administrative dimension may not clearly and accurately express the reality of spatial dominance indicators and their disparities between cities. Therefore, the current research raises questions about the possibility of network models in expressing the dominance of the city within its urban surroundings and the actual variables affecting the classification of city size and influence. In recent years, network analysis of urban systems has gained traction across disciplines like sociology, economics, computer science, and urban planning [4]. The spatial configuration of cities represents a complex system composed of interlinked functions and structures. These studies often utilize urban layout analysis to explore the correlation between changes in intra-city networks and disparities among cities.

2 City dominance and hierarchy

Dominance usually, defined by city attraction; population size along with the significance of economic resources and capital availability, accessibility and the availability of the transportation network are the foundations for defining the region. Growth process in city relates to the development of its functions, such as the existence of specialized activities (trade, huge marketplaces, industrial, health, and education).

Urban dominance theories seek to forecast city rankings at a macro level. Disparities within cities arise due to the uneven nature of human networks and productivity, where certain individuals or groups contribute disproportionately to urban development and economic growth [2].

The expansion of cities is a process of to two contradictory processes depending on the specific spatial scale:

First: At the national scale, metropolization refers to expansion of the largest cities, primarily driven by the relative concentration of innovation, social capital, and productive activities within these urban centres [7].

Second: Locally, the processes of urban de concentration and sprawl have deep historical roots, originally emerging in major cities to meet urban dwellers' evolving needs. However, these processes have significantly accelerated with the advancement of transportation networks, which allow for extended commuting distances to employment hubs and central services without increasing travel time[7].

Dominance related to concept of urban and regional system. The definition of hierarchy in urban and regional system is accompanied by geographical variations. The spatial structures in (urban or regional) levels are still largely dependent on the deep history of settlement systems; first its scheme of utilities, or satisfactions, and second, it takes no account of income distribution [2].

The hierarchical functional structure of cities and their territorial configurations has long been a focal point of scholarly research, reflecting the complex interplay between spatial organization and urban function. Cities and urban settlements are defined according to a spatial system as a collection of highly interconnected cities whose development becomes mutually dependent and coevolves through their connections by various networks; for instance, the changes in the European system of cities associated with globalization since the Eastern European region's opening to the market economy after 1990 [7].

Concept of agglomerations can be conceived accompanied with concept of spatial distribution. Historically, spatial interaction was developed relatively with strong proximity constraints. Europe according to that is only when metropolitan agglomerations with more than 10,000 residents are considered is a region of small towns separated by an average of fifteen kilometres. The traditional form of spatial organization has been modified in concepts of factuality [8].

For instance, the spatial arrangement of built-up areas around European urban agglomerations has been analysed using Land Cover imagery. These studies revealed that population density and land prices in urban areas tend to follow negative power laws or exponential decay functions. They resulted in several types of centre-periphery deterioration; the degree of physical land occupancy varies with distance from the city centre along a two-fold linear gradient. Fractal analysis shows that central and peripheral zones of large urban areas exhibit distinct values, reflecting fragmented patterns similar to the Cantor dust model in mathematics [9]. The urban–rural spatial inequality (gap) To be dealt with by stimulating growth in the economic sector, only a municipality that comprehensively redistributes resources and potentials and enables access to technology in all sectors [4]. The spatial hierarchy expresses variations in characteristics, which determines varying degrees of dominance of several nodes within spatial space.

3 Explanatory models of urban dominance

The dominance is one of the results of expansion of metropolitan regions. It’s driven by population growth and urbanization which needs professional infrastructure building, planning, and service administration [10].

First: Spatial domination: explained by [11]:

Mark Jefferson developed a series of demographic models that explained the elements that contribute to population polarization (or service accessibility), with an emphasis on dominance features. People's motivations play a part in what makes cities appealing.

• Von Thunen and Webber's collection of economic models, which concentrated on the predominance of geographic nodes with unique economic activity (job availability). The presence of the unique economic pattern is necessary for the dominating characteristic to exist.

Second: Explains urban hierarchy and spatial dominance [12]:

• Several social change models that see cities as hubs for bringing about social change. Cities having a unique social structure that could change were examined by these models. A certain social type influenced the prominent feature of dominant cities [13].

• Relational network models emphasize the intricate internal structures of cities and how they interact within broader systems of urban growth. These frameworks analyse the dynamics of urban interconnectivity and the evolving nature of city networks over time.

• A set of models by (Burgers, Humreh, Harris, and Ullman); the internal structure of the city was analysed according to different uses of the land. The dominant feature of cities defined by diversity uses of urban land Metropolizatio used to be representing the direction of the evolution of city system. As city sizes changes over time notable inequalities in urban hierarchies will appear. Demographic characteristics are one of the basic measurements of city scaling. Paris and London are the two megacities in Europe (with size larger than 10 million inhabitants). Europe and Northeast America differ in human concentrations many continents have already developed megalopolises [7].

Bertaud (2004) made a calculation of the average densities for almost fifty cities that have reached several millions in population. He divided cities' populations by the built-up surfaces measured on satellite images (these measurements thus define "urban morphological agglomerations"). Contrast in the levels economies that captured by largest cities can be explained by two major processes caused by variation of concentration of linkage. The first one is (from the top) which causes the diffusion of the innovation's concentration and reducing the limits of the space-time. The other process of urban hierarchies is bottom-up in which the smaller cities catchment areas are not effective functionally as the zone of the influence of larger cities is increasing due to the adoption of a more efficient and fast transport media that enhances connectivity and ease of access [7].

3.1 Network as an approach of analysing urban dominance

The concept of functional regionalization was associated with the Christaller theory of central places, which are an explanation of functional relationships and an analysis of the scope of social-economic influence of urban centres and their functional territories. These nodes are the centres of population concentration, and most of them all play the role of nodal centres and central places, due to the direct interaction between the city and its functional region. It is the spheres of influence of the different functions of this city in a cadastral distribution that can be determined by what can be called "equal function lines." The diversity of the city's functions and the strength of its influence in its territory depend on the size of the city's population. Urbanism and the type of economic activities that distinguish it from neighbouring cities or located within their territory, for example, dominance represents the contrast in the rural -urban types, contact and the mutual influences between these two types. When studying a particular city and its value and economic status in its territory, specialized functions that the city offers to its suburban help to shape the framework of the general territory of the city. Functions have a major role in the building of the connection between cities and rural surrounds which indicates the shape of regional boundaries. The expansion of urban centres territory, even some small one, indicates their role in achieving current and future urban development. In the 21st century, cities, as a functional entity, act in two methods to achieve preference in the global-national ranking. These methods manifest in the adaptation to globalization and introducing local into wide world. In many cases both methods were applied.

"Cities are approximately scaled versions of one another" [14]. The acceleration of the pace of urban life and with the increase in the size of cities assumes the emergence of a similar increase in the number and type of job opportunities, which means that this is reflected on the levels of the economic and social life of the population. The factors and incentives for innovation are also increasing, which depend on knowledge infrastructure and are often measured by the patents relative to the population, and this is explained in terms of "increasing pace of life" [15].The urban elite are the core of focus in recent study of city dominance as they attracted by types of jobs and quality of life.

The diffusion of innovation across urban spatial systems illustrates how new technologies, behaviours, and practices initially emerge in large cities. The advantages offered by city size—such as access to information, financial infrastructure, productive capacity, and skilled labour—create favourable conditions for early adoption. A study examining 25 indicators across major European cities revealed strong links between urban systems and global networks. Most of these indicators exhibit super-linear scaling with population size when modelled using power-law functions. In this regard, the size of the city is no longer has a decisive impact on its location in the global rank of innovation system [16].

The ongoing complexity of lifestyles has produced a similar complexity in urban structures. Therefore, the traditional model of urban fractal has been enriched with new types of data that rely on accessibility information generated by social media, providing broad possibilities for analysing social dynamics of urban and community networks [4].

Urban function quantization based on variables like:

• Mobile phones and social media.

• Geotagged social media comments have been used to measure the popularity of public spaces and traffic routes.

• Smart card transaction data has been applied in weighted, directed graph models to map the spatial layout of city hubs, central zones, and urban boundaries. City size is typically defined through variables such as population, household count, investment volume, employment figures, regional GDP, and media presence, including local newspapers.

• Street networks derived from OpenStreetMap were analysed at metropolitan, municipal, and neighbourhood levels, focusing on network characteristics to understand spatial patterns and connectivity.

Network science was introduced as recent approaches to identify complex relations that shaped by socioeconomic urban communities and regions and examine clusters that produced by socioeconomic connections. This approach suggested that the segmentation of urban space into nodal regions or communities on the based on origins and destinations of trips, as these trips showed the functional correlations between clusters. So, the dominance of any node will be expressed by the density of the networks that it creates with other nodes in the spatial system. Previous studies applied this approach in different context around the world [3] (Fig.1).

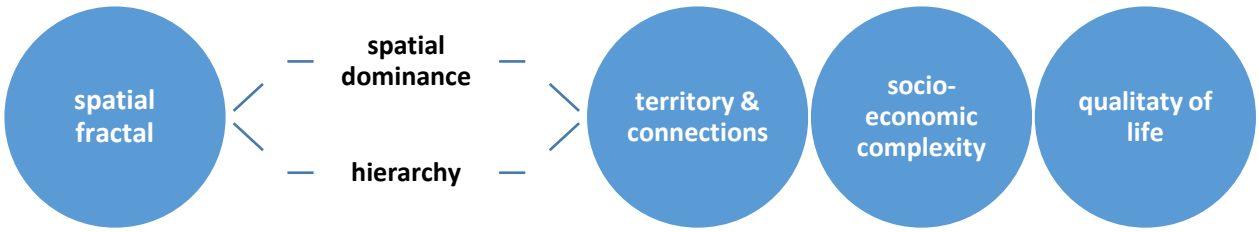


Fig. 1: Spatial dominance according to a multi-layered variable [the researcher].

4 Methodology

The attempt to determine the city's territory and its spatial structure, network approach introduces many models of assessment depending on spatial interaction of nodes and the strength of links. The distance between two cities can be imitated by measured units of distance or the time or the cost of transport. The hierarchy is a relational structure among the specified components, and the transformation process is contingent upon the inequalities that characterize the urban configuration within the regional system [10].

The methodology of this study is based on the components of the urban network; nodes and the links which represent according to the research hypothesis, the actual representation of the bonds

possessed by the city within its spatial context and are reflected in the strength and impact of the city economically and socially in this context.

In network spatial analysis, mathematical methods are used for calculation to express spatial dominance. The main argue of our study that is that; the spatial dominance characterize city spatial complexity and expressed its connections, and it can express city impact in its context more than its administrative rank. The network model will be examined in spatial structure of the study areas (two cities located in Babylon in Iraq, Hilla and Al- Mahawil, which are classified equal in their administrative rank).

4.1 Model of measurement

City's nodes and edges are represented by roads and intersections, facilitating the analysis of city connections with its region. The city with densely connected nodes in regional network tends to be more dominant in its context [5].

This hypothesis must be integrated with a wider and more integrated framework. Urban structure can be interpreted through the lens of community networks, consisting of highly interconnected nodes and multiple sub-networks that exhibit shared characteristics [17]. This approach places particular emphasis on the spatial patterns and connectivity within the physical road network of cities.[18]. The urban network includes community structure approach.

The integrated approach of scaling dominance should be based on the identification of functionally critical nodal points in cities and across regional transportation system that represents people's activity spaces on the aggregate [19], [4]. Infrastructure that facilitates the trips represent an important indicator of city dominance because enhances urban communities outlined solely on the basis of physical transportation network topologies [3].

The goal of urban studies is to ascertain the territorial spatial structure of the city based on its spatial interactions with its surroundings. A city's size is determined by its population, number of houses, investments, number of workers, regional gross product, and scale of daily operations or local media. The time or expense of transportation, or measured units of distance, can be used to simulate the distance between two cities. The transformation process depends on the disparities that define the urban configuration inside the system, and the hierarchy is a relational structure among the designated components [10].

- The irregularity of urban road networks means that each node plays a different role in the system's overall functionality.
- The complex interaction between land use and traffic patterns contributes further to the varying importance of road network nodes.
- Node rankings are determined by integrating multiple attributes to calculate a comprehensive importance score for each network element, offering a nuanced understanding of urban transportation hierarchies.
- Clustering is a topology diagram of the road network tendency to consternate links around certain nodes.
- Clustering represents the degree of city dominance spatially and functionally in two scales: intra - city and inter-city.
- The different topological characteristics (e.g. node centrality measures) help to compare inter and intra - city spatial dominance.

Table 1: Proposed framework of urban dominance (the researcher).

Terms of city dominance		Proposed method of measuring urban dominance	Indicators
Quantitative variables of city	Population	Land use diversity that enhances city attractiveness	Demographic concentration
	Economies		Attractive land use; industries, education and technology infrastructure, etc...
Models of scaling	Spatial network	Node	Centrality; structure of a road network collective behaviour
		Connectivity	Edge between two nodes; distance between centres of two nodes (links)

5 Applied study

The governorate of Babylon located in the middle west of Iraq. Administrative classification of the governorate includes four quarters and sixteen areas and has an area of 5119 square meters. The population of Babylon governorate reached 2288454 people with a population growth rate of 2.7% [21]. The four major districts of Babylon Province are Hashimiyah, Mosayib, Al-Mahawil, and Hilla. A centre, villages, or municipalities of various kinds are in each of these districts, which together comprise many locations totalling twelve districts. The Province is positioning in the middle of Iraq connected the east-west and north-south regions [20]. Demographic concentration in urban centres is showed in the below graph, Fig. 2 and Fig. 3.

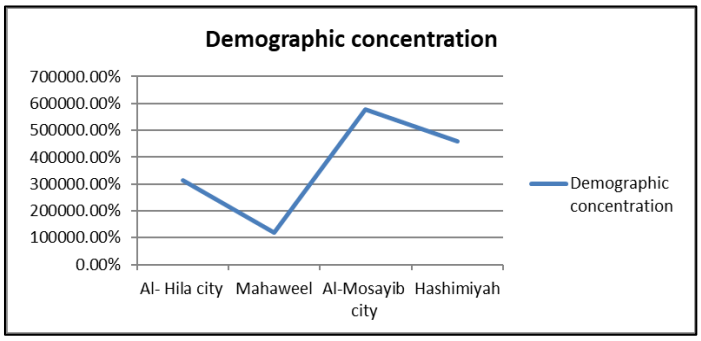


Fig. 2: Demographic concentration in Babylon province (the researcher according to statistics of 2024) [21].

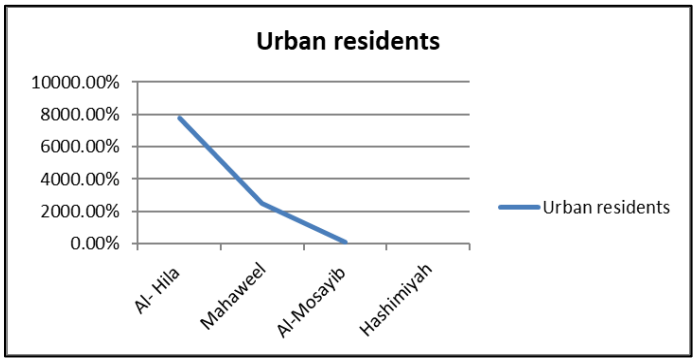


Fig. 3: Urban residents (the researcher according to statistics of 2024) [22].

The study will simplified road networks of two cities in the province of Babylon; Hilla and Al-Mahawil that the two cities represented the higher and the lowest rank according to Zipf rule.

Table 2: Population density (the researcher according to statistics of 2024) [22].

City	Area [km^2]	population	Growth rate
Hilla	161	932291	2.6
Al-Mahawil	608	392413	3.1
Al-Mosayib	257	527642	2.7
Hashimiyah	620	436108	2.4
Total		2288454	

Table 3: The four city ranks according to Zipf rule (the researcher) [23].

City	Arranged	Population	$\frac{\text{Lowest city population}}{\text{Largest city population}}$
Hilla	Largest city population	932,291	
Al-Mahawil	Lowest city population	392,413	0.42
Al-Mosayib		527,642	0.57
Hashimiyah		436,108	0.47

The city of Hilla has the privileged location linking major cities such as (Karbala, Diwaniyah, Najaf, Kut, Baghdad). It represents the administrative centre of Babylon Governorate with its large population size that exceeds the rest of the cities of the study area, and to meet the requirements of transport movement between the city of Hilla and its region. District centres are characterized by the concentration of the main administrative institutions in the judiciary, such as municipal departments, courts, real estate registration and Qaimaqamiya, which are departments that provide services to the residents of the city and its urban centres, not from the rural areas of each district, with the exception of the city of Hilla, which is characterized by the presence of government administrative departments competent to provide services to all residents of the governorate [24].

The city of Hilla has major commercial centres and secondary commercial centres within the old city. The city of Hilla is having its economic, social and historical characteristics and a great diversity of services and institutions that provide services to the residents of the region as well as contributed to the development of regional relations [21]. The increase influence of industrial activities in Hilla region are supporting the process of urban development and encouraging investments [25].

Al-Mahawil is a district in Babil Governorate, Iraq. It is centred on the city of Al-Mahawil. Al-Mahawil occupied about a third of its governorate. There are three subareas related to the administrative of Al-Mahawil; Al –Imam city, Al Nile city, and Al Meshrou city. Most of the city's area is occupied by agricultural land, residential and commercial use, and a low percentage of industrial use and services.

Cities of Babylon province showed a variety in urban variables that led to different scales of dominance. Hilla city dominates over its regional surroundings within the province of Babylon according to the previous scales, like, area, demographic and economic variables. The dominance of Hilla city will be analysed within the spatial dimension according to links which city built within the urban network in a comparison with Al-Mahawil city which had the lowest rank according to Zipf rule [Table 3] [Table 4].

The transport function is one of the main functions in any city; it is a way to increase the interaction between the city and its territory. This function represented by transport garages and roads, as well as garages and parking lots. The area of the use of transport in the cities of the study area (Hilla, Hashimiyah, Al-Mosayib, Al-Mahawil) reached (422 hectares, 1,212 hectares, 60.24 hectares, 42.2 hectares) respectively, with rates of (21%) 1,1,12,2%,1,60%2) %. In the city of Hilla, transport function is one of the basic functions that enhance its urban dominance over the rest of the cities of Babylon governorate [26].

Table 4: Main road in Babylon governorate (Directorate of roads and bridges of Babylon governorate, technical division, unpublished data).

No.	Route name	Route length in Babylon province [Km]	Total length [Km]
1	Hilla-Baghdad	50	100
2	Hilla-Dewaniya	50	80
3	Hilla-Karbala	22	45
4	Hilla-Najaf	35	65
5	Haswa-mussayab-Karbala	23	50

Table 5: Secondary road in Babylon governorate (Directorate of roads and bridges of Babylon governorate, technical division, unpublished data).

No.	Route name	Route length [Km]
1	Mussayab-Suwera	56
2	Medhatia-Shomely-Nuomanai	90
3	Kakal-Karbalaa	7
4	Mahawil-Sadah	12
5	Sadah-Mussayab	2.9

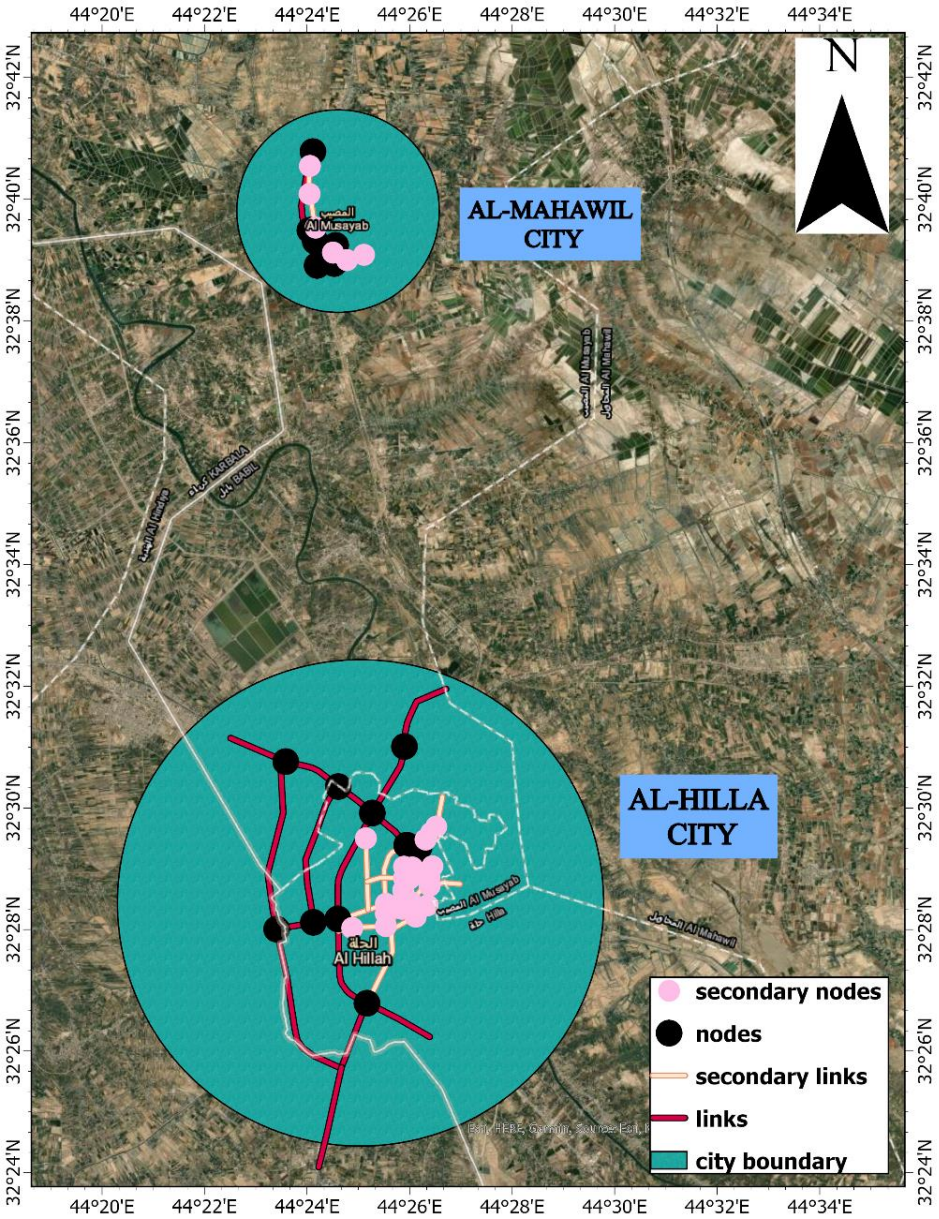


Fig. 4: Spatial dominance analysis according to network indicators. Network circularity map for two cities: Hilla and Al-Mahawil.

As it is the administrative centre of Babylon Governorate, the city axes crowded with internal trips and the passing throw trips from Baghdad, Diwaniyah, Najaf, Karbala), and other cities. The city has large areas of transportation infrastructure from highways and internal roads that connect the city to its interlocutors, like; (Hilla line - Baghdad, Hilla - Karbala, Hilla - Diwaniya, Hilla - Najaf, Hilla - Kufa, Hilla - Samawa, Hilla - Al-Qasim, Hla - Basra, Halla – Nasiriya. The garage of Marab Bab Al-Hussein contains the lines transferred to the cities of (Al-Musayb, Abi Ghagh, Al-Mahawil, Jabla (Kothi), El-Saouira). The garage of Murab Al-Naziza contains transport lines to (Nile, Al-Madhatiya) as well as other transport garages used for transportation between the city of Hilla and the surrounding rural areas.

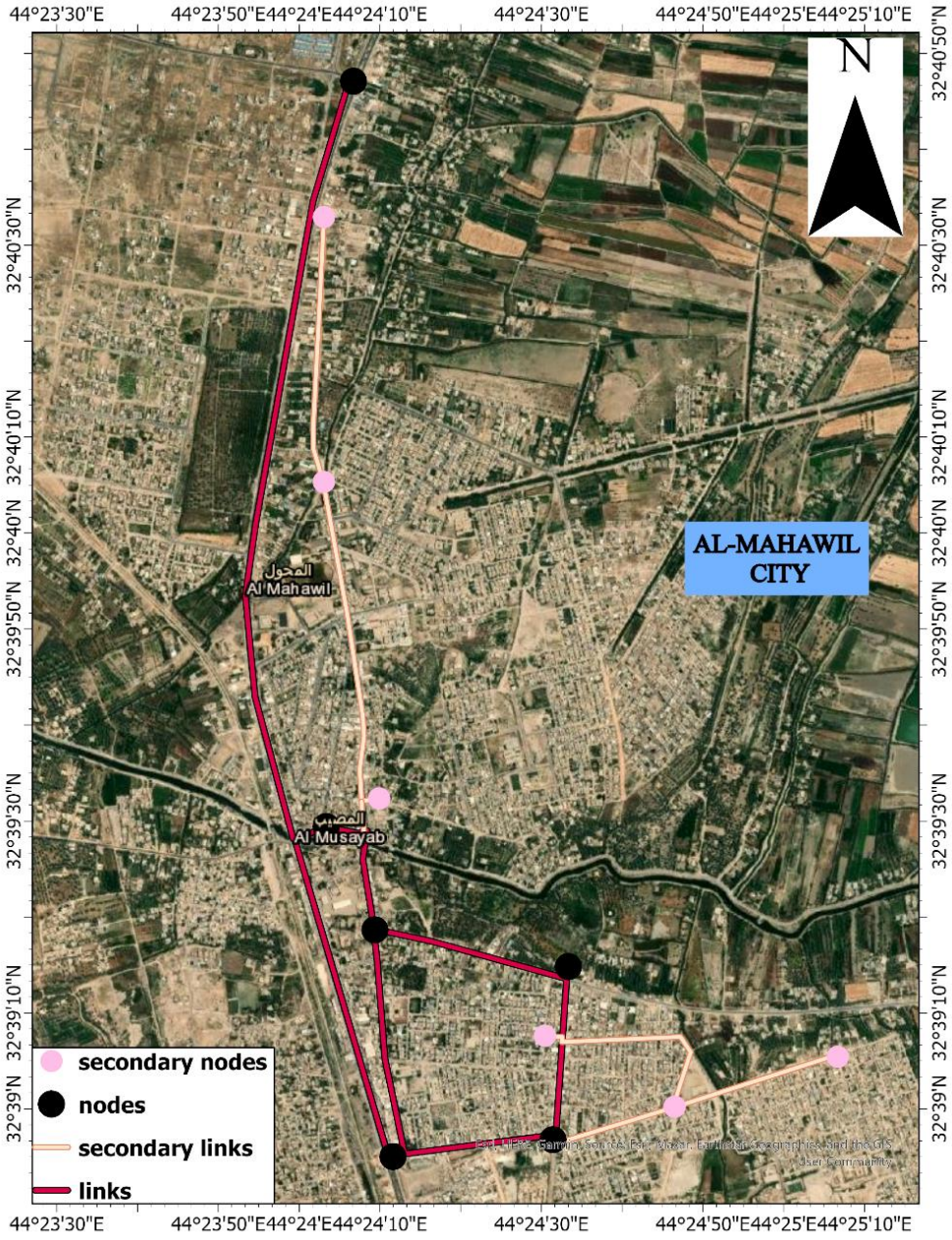


Fig. 5: A map for Mahawil city nodes and links (the researcher depending on GIS maps).

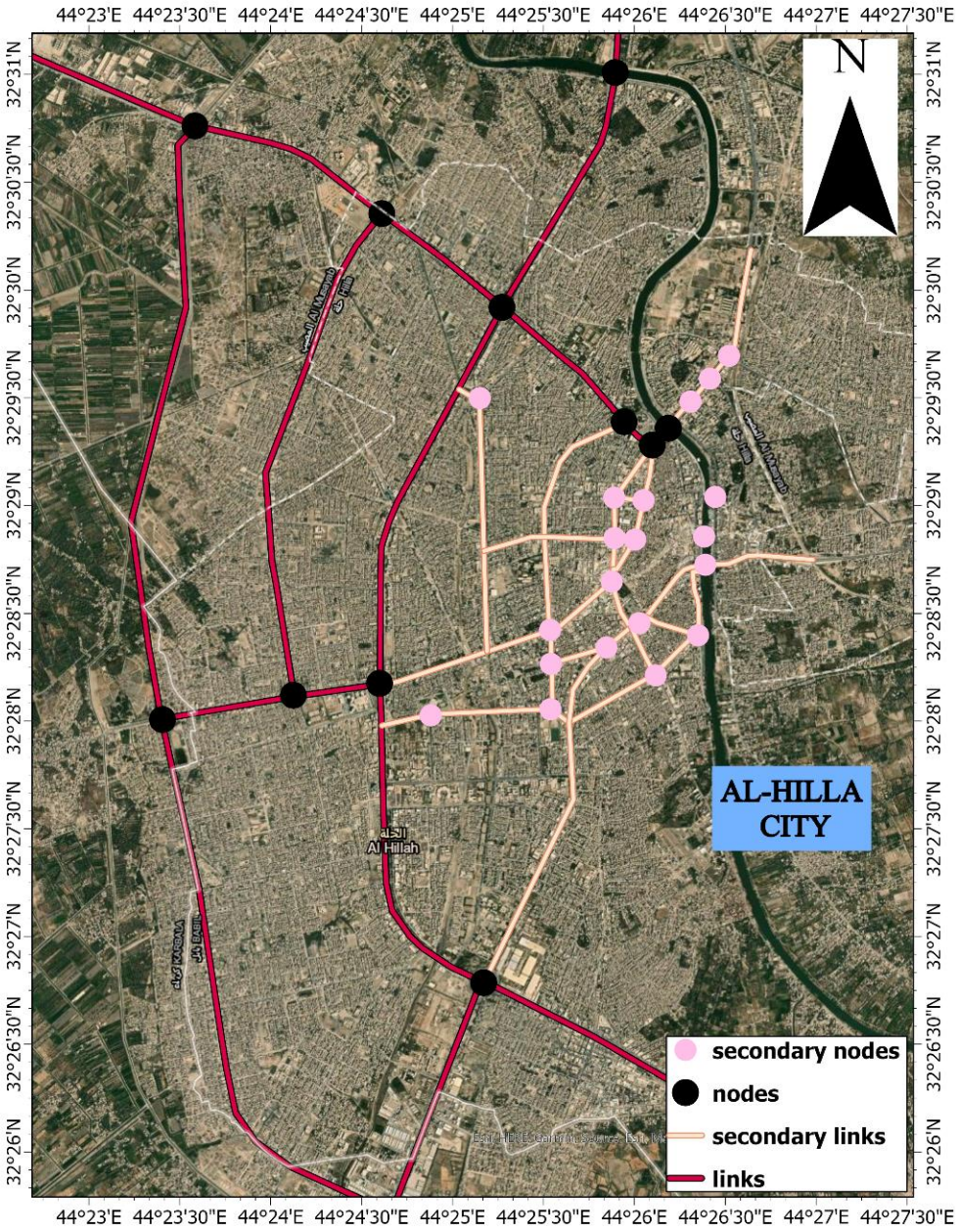


Fig. 6: A map for Hilla city nodes and links (the researcher depending on GIS maps).

6 Results and discussion

Measurement methodology based on determining road network for each city according to the geographical information system [GIS]. The elements of the network were classified as major and secondary nodes and links according to their importance. The main nodes are the ones that represent the links of local networks to the regional network, and the secondary nodes are limited to the local connection, while the links are classified according to the dimensions of the tracks and the intensity of the mobility movement in addition to the number of the main and secondary nodes.

The results of the maps show a high variation in the number of nodes in general and in the number of nodes and in the number of local and regional links. A comparison will be made between the map results of both cities according to the nodal relative weight index and network rotation.

The size of the city, according to the Zipf rule, is a basic starting point for evaluating dominance, while the network is the closest expression to reality about the importance of the city spatially, represented by the links it has with its surroundings. On the other hand, dominance represented by the degree of complexity that the urban and regional network of the city achieves. It reflects the size of the city and the diversity of its functions.

The nodal relative weight is an indication of the strength of the city's influence in its surroundings by being a regional bond complex; the inverse proportion between the closure of the network in the rotation scheme and the number of local and regional nodes contained in this network (Tables 6 and 7).

Table 6: The circularity measurement of the two cities (the researcher).

The city	**α=(L-V+1)/ 2V -5**	
Al-Mahawil	α= (13-12+1)/ 2*12-5	0.05
Hilla	α= (44-31+1)/ 2*31 -5	0.2

L= links, V= nodes (vertix).

Table 7: Nodal relative weight (the researcher).

The city	**Main nodes / total no. of nodes**		**Secondary nodes/total no. of nodes**	
Al-Mahawil	6/12	0.5	6/12	0.5
Hilla	11/31	0.35	20/31	0.64

MAIN NODES= connect local and regional routes or regional routes, **SECONDRAY NODES**= connect local within city administrative borders.

An analysis of the study area graphs shows the lack of spatial structure to the strength of the network, as the values of network rotation and the resulting chart shape indicate the weakness of the correlations between the urban nodes within the city of Hilla and the city as a node with the rest of the cities of the governorate. This is explained by the weakness of the transportation structure and the longitudinal growth that dominates the expansion of the city. By comparing the two cities, Hilla achieved the higher nodal relative weight for secondary nodes. The results showed an inverse proportion between the enclosure of the network and the relative nodal weight, which indicates that the network with high closure achieves its links at the local level and the main and secondary nodes are numerically close, which is the case in the city of Al-Mahawil. The results of applying Circularity measurement in both cities showed that the value of closing the network of Hilla was the highest, and this result represented the integration of network elements within the boundaries that covered by city network.

The current research examined indicators of dominance according to the concept of urban networks between two cities that are equalized administrative rank. The two cities achieved a higher and lower rank according to the Zief law and had different results in the scale of network circularity and nodal relative weight. In future research, a link between the nodal weight and gravity equations can be found for the purpose of investigating city dominance. Future research can expand the comparison to include several cities within a region representing various ranks according to the same rule.

7 Conclusion

1) Urban dominance is the planning perspective of the city's transformation according to multiple dimensions. It is the result of the city's spatial growth.

2) City is an administrative unit a natural and urban boundary, a demographic reality with socio-economic characteristics.

3) The dominance of the city depends on the complex urban structure and appears in the complexity of the interconnections of the urban and regional networks of the city and its nodes.

4) This study described the conditions that determine city dominance variables and examined urban structure according to these variables.

5) Functional regions are used to describe actual human interactions and should be expressed by urban planning activities and urban management.

6) The study examined city dominance according to spatial data that explain the relationship between city size and its urban structure, which affect city ranks within the regional system. Empirically, as the population increases, the city area expands. Between cities of the same administrative rank, the network explains graphically the extension and body of links established by the city that dominates its surroundings.

7) The investigated of urban node and network structure, it showed that there is inequality in urban and suburban development the study area (Governorate of Babylon).

8) High-density urban networks represent one of the data about the strength and durability of the city as an attractive node. The city's ranking is an expression of the levels of economic, social and urban integration, which qualifies the city to intensify its regional interactions.

9) The measurement of spatial networks indicates the characteristics of urban fractal. It is one of the important indicators of distribution of diverse economic and human capitals, which is one of the elements of the integration of cities within national and global levels.

10) Network is an approved effective approach to identify socioeconomic communities within urban contexts because it re-defines city size by the real variables that explain functional dominance within region.

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