*Muthanna Journal of Engineering and Technology*, Vol. (10), Issue (2), Year (2022)

**Muthanna Journal of Engineering and Technology**

*Website:* *https://muthjet.mu.edu.iq/*

***Submitted 10 November 2022, Accepted 28 November 2022, Published online 28 November 2022***

# Euphrates river impact on the transformation of Samawah spatial organization

**Zainab Razaq Mahdi[a*] and Firas Alrawi[a]**

[a]*Center of Urban and Regional Planning for Post Graduate Studies / University of Baghdad*
**Corresponding author E-mail:* ***Zrm1995.itrdc1@gmail.com***

***DOI:10.52113/3/eng/mjet/2022-10-02/22-30***

**Abstract**

The city represents a dynamic spatial organization formed by a group of inhabitants, elements and activities that are interrelated and interacted to form a special urban system. As a result of the accumulation of changes over time in urban land uses, some urban changes take place, which are reflected on changing its spatial organization and urban uses. Riverbank cities, like other cities, are spatially and interactively regulated by many effects. However, having a river as an integral part of the urban composition of the city, it has an impact on these uses and their organization over time. the research problem is exposed from this idea which is represented by the unclear functional relationship of the Euphrates River on the regulation of the land uses in the City of Samawah. The study assumes that the river has an impact on the functional relationship affecting the regulation of land uses in the city of Samawah. Using GIS, urban transformations of land use around the river in the city of Samawah have been monitored, using the multiple linear regression method, the functional relationship between the distance from the river as a subordinate variable and the land uses as independent variables is analyzed. Thus, to arrive at explanatory regression equations that reflect the effect of shifts in the organization of the spatial structure of the sample study area to achieve the research objectives. The study has concluded that the urban uses of the city of Samawah were inversely related with moving away from the river.

***Keywords***: *River cities, multiple linear regression, spatial organization, land use, impact*

## 1. Introduction

River cities represent a social, political, economic, cultural organization that develops and grows within its spatial environment. Like other cities, they are linked with their parts in a certain way to form their own urban system. Their elements are interrelated with each other in constant and variable relationships and are subject to be affected by many factors and influences. According to the intensity and nature of these impacts and factors, the size of the city and its social, economic and urban system are changed. This is besides the relationships of these impacts with each other, with the surrounding factors and natural environment within the boundaries of that city. As a result of these changes over time, the city's spatial organization shifts from one form to another.

River cities vary in terms of the location of the river passing through. The functional linkages of the city uses and their relationship with the river vary according to the river location within the city. Therefore, the uses that are functionally related to the river vary from city to city and from country to another. The various factors affecting the change of city systems contribute to the urban transformation of land uses. Due to these accumulations and shifts, the functional relationships and associations affecting the river city are in regular changing.

## 2. River Cites

Urban rivers are one of the most important elements of the city's structure. They are an artery that fuels natural resources, contributing in the protection of nature and promotes the presence of public and recreational uses. They have many uses by humans such as access to drinking water, industry, irrigation of agricultural crops, transportation, energy and mineral production, swimming, recreation, fishing and so on [1].

Many of the world's cities have been established along the banks of rivers to demonstrate man's need for the river in all activities and circumstances, as well as the social and cultural interaction of all societies with the use of river [2].

## 2.1. River location

River cities vary by the location of the river passing by. Some cities may originate at one side of the river and others around its banks making it as integral part of the urban structure. With the passage of time went the cities expand making it clear that there is a relationship between that expansion with the river passing by. This indeed affects the nature of activities practiced in the city and its socio-economic aspects. The location of the river in the city is classified into the following [3]:

### 2.1.1. Outer Suburbs

When the river connects to the periphery of the city and is far from its center, it often represents an area of environmental, natural and ecological protection, for example the Ural River in Kazakhstan as shown in Figure1.

**Fig. 1:** River Ural - Kazakhstan

### 2.1.2. Border

When the river borders the urban area as well as its environs, an example is the Trinity River in Dallas, a site often characterized by low human density, increased industrial activity and high environmental pollution as shown in Figure 2.

**Fig. 2:** Trinity River - Dallas , America

### 2.1.3. Downtown

When the river flows downtown, this site is characterized by high population and urban density, the nearby areas are usually commercial, or administrative with high density of construction, and high flows of traffic, as well as narrow space on the river as the Tigris River in Baghdad as shown in Figure 3.

**Fig. 3:** Tigris River, Baghdad, Iraq

## 3.Classification of River Cities According to Their Geographical Conditions and their Relationship with the River:

River cities are classified according to their relationship to the river and their geographical conditions into four main types: cross shape, net shape, circular shape and linear shape. The features of each city are different from the other according to their type:

### 3.1. Cross-Shape

This shape is characterized by the flow of the river downtown, these cities usually have urban river fronts and the river takes the shape of the river corridor as the river Seine in Paris. Human activity flows frequently through the city center, as well as a complex transport network and high building densities with narrow urban spaces and more exposed to pollution. These cities usually resort to protecting themselves from river flooding. They are often characterized by having multiple of constructive patterns.

### 3.2. Net Shape

Having this shape, river water spreads throughout the urban area and is distributed completely or partially into a net within the city. An example is the Spree River in Berlin. These cities are characterized by recurrent human activities at the water rims. The views of nature are not prominent, and are usually more prone to river flooding. Thus, the inhabitants often build high dams to control their flood. Their banks are also characterized as being an area with frequent human activities and are usually easily contaminated [4].

### 3.3. Circular Shape

This shape is formed when the city or half of it is surrounded by river water and it is a circular or semi-circular shape. It is also formed when the city is situated on a peninsula and overlooks river water. An example of such type is New York City, or Lapik City in Germany which is surrounded by the Treff River. These cities are also characterized by their heterogeneous shape and their landscape is open to the river at the edge of the city. The banks of these cities are more easily designed, and produce more vibrant forms with flexibility to intervene and construct them. Therefore, they may be more vulnerable to industrial intervention than other river cities.

### 3.4. Linear Shape

The linear shape is formed when the river flows through the suburb of cities and does not pass through, Like the city of Dallas and Vienna. Such cities have features similar to river cities with circular-shaped banks. They have an open and transitional landscape between the natural and urban environments. their design is more flexible and vibrant. They are characterized by a low rate of pollution and human activities where the construction density is lower and their banks usually appear in a general uniform design. The banks of linear cities retain natural manifestations. Green areas and nature are usually spread along the banks [5].

## 4. Study Area

### 4.1. The City of Samawah

Samawah is one of the ancient areas inhabited by humans, where human settlement traces from the ancient Stone Age in Al-Qusayr valley, an area 2 km south-west of its short castle in the southern desert of Samawah. The city originated as a simple village and a government castle on the right side of the Euphrates River in 1492. Its river location contributed to its creation and development greatly. The city's move to its current location came after a major flood and a change in the Euphrates River in 1700 [6].

### 4.2. Astronomical Location

Samawah is astronomically located at the intersection of the 31.07 projection circle north with the longitudinal line 44.58 east.

### 4.3. Geographical Location

The city of Samawah is situated between two natural territories, varying in economic and natural conditions, as it represents an intrusive position between plain Deposited region and Desert Plateau region, which has made it an important center for trade exchanges [7].

### 4.4. The Use of Scope in Determining the River's Impact on the Transformation of Uses in the Study Area

Scope is an instrument that defines an area within a certain distance of a landmark or set of landmarks of the same type and has many names such as a barrier, scope and spatial sanctuary. It is used in fields such as studying areas covered by services like schools and hospitals. Using this tool, one could identify what area needs to increase services. Also, it is used to determine the street view to know whether there are problems or not. In this study, the tool has been used to determine the type and space of uses depending on their proximity or remoteness to the river in order to reach a vision about the total changes in land uses across the time stages of the study area.

In this regard, the transformations of land use in the City of Samawah is studied in 2020,1993 (for the third and fourth morphological stages). Each year, the transformation of use is adopted as a morphological transformation of the structure of the city. Each year marks the end of the morphological phase of the City of Samawah, and 2020 marks its final transformation. The proximity and dimension of the land use from the river is measured by dividing the city at each stage of its growth over time on a number of barriers or ranges using the instrument (Buffer) in the GIS Access Program. the uses in each range relative to its distance from the river is measured by adopting the distance of 250 meters as a distance away from the river. This is because it represents one morphological step (Half the approved walking distance in the residential area) . The process is repeated to cover the entire area of the city in all stages this in turn, clarifies the transformation in land uses that took place at every point in time and led to the city's current usage as shown in figures 4 and 5, and tables 1 and 2.

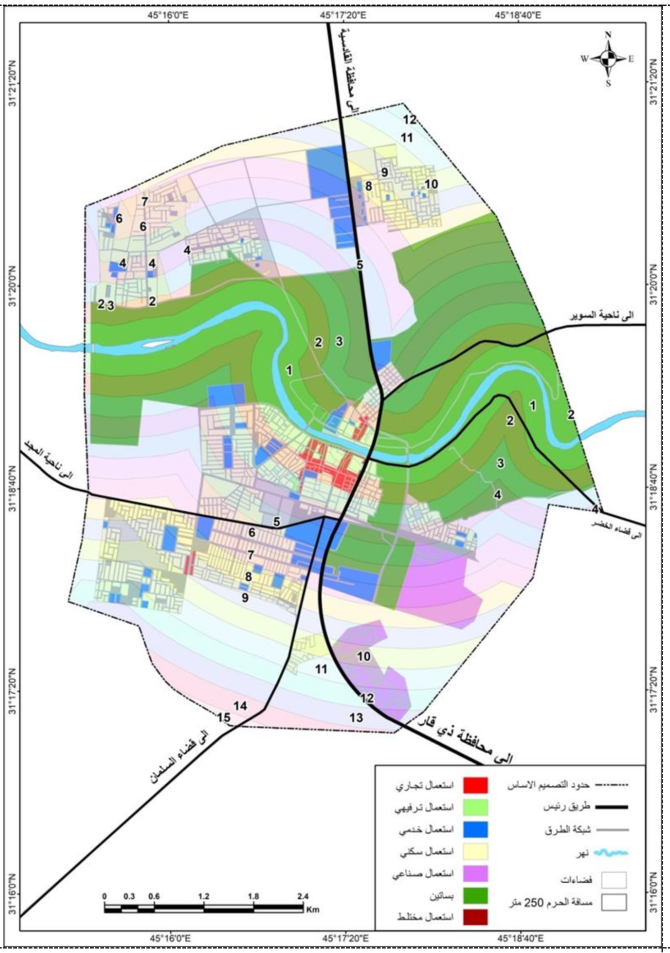


**Fig. 4:** Map Scope of river impact in uses for 1993, Source: Researchers

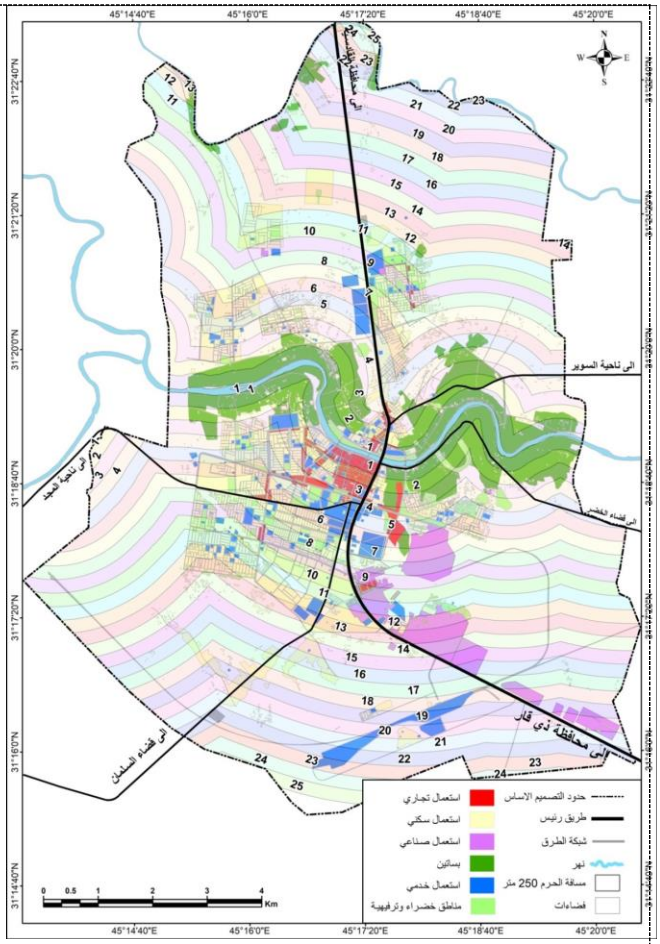


**Fig. 5:** Map (2) River Impact Range in Uses 2020, Source: Researchers

**Table 1:** Scope of River Impact in Uses 1993 Source: Researchers Based on Map (1)

| Morphological Phase III | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Buffer number | River effect meter length Y | Land Use (Hectare Area) | | | | | | Sum |
| | | Open areas x1 | Services x2 | Transport x3 | Industrial x4 | Commercial x5 | Residential x6 | |
| 1 | 250 | 364.833 | 2.973 | 26.942 | | 8.779 | 26.582 | 430.109 |
| 2 | 500 | 316.269 | 9.323 | 28.039 | | 11.269 | 33.116 | 398.016 |
| 3 | 750 | 248.442 | 12.192 | 35.078 | | 0.607 | 74.208 | 370.527 |
| 4 | 1000 | 225.303 | 13.188 | 45.383 | 0.264 | | 64.488 | 348.626 |
| 5 | 1250 | 217.75 | 25.288 | 31.626 | 8.659 | | 52.917 | 336.24 |
| 6 | 1500 | 185.799 | 25.594 | 26.086 | 18.515 | | 48.065 | 304.059 |
| 7 | 1750 | 156.036 | 31.969 | 27.511 | 21.005 | | 43.668 | 280.189 |
| 8 | 2000 | 116.871 | 17.802 | 31.85 | 19.477 | 0.151 | 56.31 | 242.461 |
| 9 | 2250 | 106.992 | 6.663 | 23.711 | 10.172 | 1.699 | 51.814 | 201.051 |
| 10 | 2500 | 119.717 | 0.346 | 20.291 | 7.892 | 0.023 | 26.104 | 174.373 |
| 11 | 2750 | 100.355 | 1.818 | 16.632 | 13.753 | | 21.059 | 153.617 |
| 12 | 3000 | 93.333 | 2.349 | 11.396 | 11.607 | | 8.018 | 126.703 |
| 13 | 3250 | 92.653 | 0.021 | 3.262 | 2.288 | | | 98.224 |
| 14 | 3500 | 53.496 | | 2.66 | | | | 56.156 |
| 15 | 3750 | 8.909 | | 2.552 | | | | 11.461 |
| 16 | 4000 | | | | | | | |
| 17 | 4250 | | | | | | | |
| 18 | 4500 | | | | | | | |
| 19 | 4750 | | | | | | | |
| 20 | 5000 | | | | | | | |
| 21 | 5250 | | | | | | | |
| 22 | 5500 | | | | | | | |
| 23 | 5750 | | | | | | | |
| 24 | 6000 | | | | | | | |
| 25 | 6250 | | | | | | | |
| Sum | | 2406.758 | 149.526 | 333.019 | 113.632 | 22.528 | 506.349 | 3531.812 |

**Table 2 :** River Impact Range in Uses 2020 Source: the Researchers depending on Map (2)

| Morphological Phase IV | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Buffer number | River effect meter length Y | Land Use (Hectare Area) | | | | | | Sum |
| | | Open areas x1 | Services x2 | Transport x3 | Industrial x4 | Commercial x5 | Residential x6 | |
| 1 | 250 | 422.454 | 7.4763 | 27.346 | 0.049 | 19.645 | 28.338 | 505.308 |
| 2 | 500 | 369.365 | 10.532 | 30.312 | | 23.038 | 37.985 | 471.232 |
| 3 | 750 | 279.899 | 18.686 | 38.51 | 0.579 | 18.208 | 73.754 | 429.636 |
| 4 | 1000 | 212.851 | 25.731 | 48.589 | | 13.585 | 80.268 | 381.024 |
| 5 | 1250 | 153.711 | 33.581 | 43.764 | 1.863 | 7.042 | 110.926 | 350.887 |
| 6 | 1500 | 150.821 | 28.367 | 41.536 | 16.436 | 4.49 | 105.654 | 347.304 |
| 7 | 1750 | 166.32 | 33.88 | 35.285 | 22.887 | 1.916 | 77.19 | 337.478 |
| 8 | 2000 | 121.773 | 19.532 | 32.227 | 27.426 | 0.632 | 57.142 | 258.732 |
| 9 | 2250 | 89.668 | 16.212 | 31.968 | 17.747 | 4.363 | 61.798 | 221.756 |
| 10 | 2500 | 103.725 | 6.977 | 24.483 | 11.176 | 3.071 | 79.376 | 228.808 |
| 11 | 2750 | 105.466 | 8.202 | 25.257 | 18.289 | 0.065 | 94.203 | 251.482 |
| 12 | 3000 | 109.274 | 13.15 | 18.714 | 31.95 | | 79.3 | 252.388 |
| 13 | 3250 | 130.482 | 6.502 | 12.002 | 29.955 | | 55.534 | 234.475 |
| 14 | 3500 | 148.095 | | 5.037 | 22.298 | | 24.141 | 199.571 |
| 15 | 3750 | 142.948 | 0.176 | 4.401 | 18.378 | | 10.906 | 176.809 |
| 16 | 4000 | 132.987 | 0.017 | 5.663 | 7.145 | 0.024 | 19.999 | 165.835 |
| 17 | 4250 | 141.536 | | 4.901 | 4.736 | | 17.292 | 168.465 |
| 18 | 4500 | 129.865 | 12.033 | 4.757 | 9.17 | | 20.617 | 176.442 |
| 19 | 4750 | 117.164 | 15.449 | 5.226 | 8.311 | | 18.392 | 164.542 |
| 20 | 5000 | 87.705 | 12.034 | 4.474 | 18.385 | 0.026 | 17.741 | 140.365 |
| 21 | 5250 | 68.066 | 8.384 | 4.482 | 3.057 | | 11.082 | 95.071 |
| 22 | 5500 | 69.852 | 12.49 | 7.903 | | | 1.506 | 91.751 |
| 23 | 5750 | 31.994 | 8.498 | 2.132 | | | 2.889 | 45.513 |
| 24 | 6000 | 16.942 | 0.656 | 0.547 | | | 0.609 | 18.754 |
| 25 | 6250 | 2.998 | | | | | | 2.998 |
| Sum | | 3505.961 | 298.565 | 459.516 | 269.837 | 96.105 | 1086.642 | 5716.626 |

### 4.5. The Design of the Regression Equation

Multiple linear regression is a mathematical formula that expresses the relationship between two variables and is used to estimate past values and predict future ones. It is also the Y variant regression on many independent variables Xk +........ + X2 + X1 so it is used to predict the variables of the affiliate variable that several independent variables affect. So, multiple linear regression is used to clarify and explain the relationship between a continuous subordinate variable and two or more independent ones. Independent variables can be intermittent or persistent. Thus, the idea depends on the semantic relationships that use what is known as dispersion or proliferation [8]. The data are analyzed and interpreted using the multiple regression method in the (spss) statistical analysis program, and the regression equation is designed as follows:

**Approved Variable Y**: A distance from the Euphrates River (a steady distance of 250 m from the river and a single morphological step)
Independent Variables X:
**X1**: Open areas (includes green and recreational areas, orchards, expansion areas and empty spaces)
**X2**: Services (comprising all the city's health, education, religious, administrative and cultural services)
**X3:** Transport network (comprising main roads, main and secondary streets, service streets, as well as the Hodeidah railway station)
**X4** Industrial usage (includes cement plant, block plants, asphalt municipal factory, ice mills, auto repair workshops, blacksmiths and carpentry shops)
**X5** Commercial use (includes all commercial services such as shops, popular markets, wholesale markets, offices, restaurants and malls)
**X6** Residential use (includes houses in neighbourhoods, old and new residential areas, as well as residential buildings and apartments)

### 4.6. Application of Multiple Regression Method Using Spss Software in the Analysis of the Functional Relationship of Land Uses With the River Stage

#### 4.6.1. Morphological Phase III – 1993

#### 4.6.1.1. Hypothesis test, first relationships

As a preliminary step to test the main research hypotheses, the research relied on the Pearson coefficient to test correlations between research variables. Table 3 shows Pearson's matrix between these research variables for the third morphological phase.

**Table 3:** Linkages and descriptive statistics of research variables for 1993, Source: Researchers

| Correlations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | x1 | x2 | x3 | x4 | x5 | x6 | y |
| x1 | Pearson Correlation | 1 | | | | | | |
| | Sig. (2-tailed) | | | | | | | |
| | N | 25 | | | | | | |
| x2 | Pearson Correlation | .172 | 1 | | | | | |
| | Sig. (2-tailed) | .410 | | | | | | |
| | N | 25 | 25 | | | | | |
| x3 | Pearson Correlation | .509** | -.172- | 1 | | | | |
| | Sig. (2-tailed) | .009 | .410 | | | | | |
| | N | 25 | 25 | 25 | | | | |
| x4 | Pearson Correlation | .957** | .322 | .485* | 1 | | | |
| | Sig. (2-tailed) | .000 | .116 | .014 | | | | |
| | N | 25 | 25 | 25 | 25 | | | |
| x5 | Pearson Correlation | .773** | .027 | .706** | .739** | 1 | | |
| | Sig. (2-tailed) | .000 | .897 | .000 | .000 | | | |
| | N | 25 | 25 | 25 | 25 | 25 | | |
| x6 | Pearson Correlation | .748** | .672** | .251 | .861** | .558** | 1 | |
| | Sig. (2-tailed) | .000 | .000 | .227 | .000 | .004 | | |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | |
| y | Pearson Correlation | -.818-** | -.492-* | -.420-* | -.899-** | -.634-** | -.924-** | 1 |
| | Sig. (2-tailed) | .000 | .012 | .037 | .000 | .001 | .000 | |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 |

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Note from table (3) that there is a strong correlation at a moral level (0.01) and (0.05) between the search variables as the correlation factor between the independent variables (x1, x2, x3, x4, x5, x6) and the dependent variable (y) respectively( -.818-**, -.492-*, -.420-*, -.899-**, -.634-**,-.924-**)

### 4.6.1.2. Impact relationships (second main hypothesis test)

According to ascertaining the validity of the second main hypothesis, there is a general effect (river) in (regulation of land uses), tables (4, 5) have been drafted as a first step to determine the impact of independent variables on the dependent ones.

**Table 4:** Summary of Multiple Regression Model, Source: Researchers

| Model Summary | | | | |
|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .953a | .909 | .879 | 640.70775 |
| a. Predictors: (Constant), x6, x3, x2, x5, x1, x4 | | | | |

**Table 5:** Anova Analysis, Source: Researchers

| ANOVAa | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 73860884.450 | 6 | 12310147.410 | 29.988 | .000b |
| | Residual | 7389115.546 | 18 | 410506.419 | | |
| | Total | 81250000.000 | 24 | | | |
| a. Dependent Variable: y | | | | | | |
| b. Predictors: (Constant), x6, x3, x2, x5, x1, x4 | | | | | | |

When extrapolating indicators in tables (4) and (5), we note that generally independent variables exert a moral influence on the dependent variable. Table (5) of the variance analysis shows that the model is moral according to F's calculated value of (29.98), which is greater than the tabular value at a moral level (1). The interpretive capacity of this model is relatively good at a value ($R^2$ = 0.909). This indicates the ability of independent variables to explain the amount (91%) of variations in the adopted variable, thus achieving the second main hypothesis.

### 4.6.2. Morphological Phase IV 2020

### 4.6.2.1. Hypothesis test, first relationships

As a preliminary step to test the main research hypotheses, the research relied on the Pearson coefficient to test correlations between research variables. Table (6) shows Pearson's matrix between these research variables for the fourth morphological phase.

**Table 6:** Linkages and descriptive statistics of research variables for 2020, Source: Researchers

| Correlations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | x1 | x2 | x3 | x4 | x5 | x6 | y |
| x1 | Pearson Correlation | 1 | | | | | | |
| | Sig. (2-tailed) | | | | | | | |
| | N | 25 | | | | | | |
| x2 | Pearson Correlation | .276 | 1 | | | | | |
| | Sig. (2-tailed) | .182 | | | | | | |
| | N | 25 | 25 | | | | | |
| x3 | Pearson Correlation | .338 | -.430-* | 1 | | | | |
| | Sig. (2-tailed) | .098 | .032 | | | | | |
| | N | 25 | 25 | 25 | | | | |
| x4 | Pearson Correlation | .861** | .616** | .042 | 1 | | | |
| | Sig. (2-tailed) | .000 | .001 | .842 | | | | |
| | N | 25 | 25 | 25 | 25 | | | |
| x5 | Pearson Correlation | .712** | .325 | -.021- | .778** | 1 | | |
| | Sig. (2-tailed) | .000 | .112 | .920 | .000 | | | |
| | N | 25 | 25 | 25 | 25 | 25 | | |
| x6 | Pearson Correlation | .211 | .885** | -.207- | .477* | .163 | 1 | |
| | Sig. (2-tailed) | .312 | .000 | .322 | .016 | .437 | | |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | |
| y | Pearson Correlation | -.745-** | -.749-** | -.117- | -.894-** | -.543-** | -.765-** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .579 | .000 | .005 | .000 | |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | | |
| *. Correlation is significant at the 0.05 level (2-tailed). | | | | | | | | |

We note from table (6) that there is a strong correlation at 0.01) and (0.05) between the search variables as the correlation coefficient between the independent variables (x1, x2, x3, x4, x5, x6) and the dependent variable (y) respectively (-.745-**, -.749-**, -.117- , -.894-**, -.543-**, -.765-**).

#### 4.6.2.2. Impact relationships (second main hypothesis test)

In the light of ascertaining the validity of the second main hypothesis, there is a general effect (river) in (regulating land uses), tables (7, 8) have been drafted as a first step to determine the impact of independent variables in the dependent variable.

**Table 7: Summarize Multiple Regression Model, Source: Researchers**

| Model Summary | | | | |
|---|---|---|---|---|
| **Model** | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| **1** | .995[a] | .989 | .986 | 219.46591 |
| **a. Predictors: (Constant), x6, x5, x3, x1, x2, x4** | | | | |

**Table 8 : Represents Anova Analysis, Source: Researchers**

| ANOVA[a] | | | | | | |
|---|---|---|---|---|---|---|
| **Model** | | Sum of Squares | df | Mean Square | F | Sig. |
| **1** | Regression | 80383024.860 | 6 | 13397170.810 | 278.150 | .000[b] |
| | Residual | 866975.140 | 18 | 48165.286 | | |
| | Total | 81250000.000 | 24 | | | |
| **a. Dependent Variable: y** | | | | | | |
| **b. Predictors: (Constant), x6, x5, x3, x1, x2, x4** | | | | | | |

When extrapolating indicators in tables (7) and (8), we notice that generally independent variables exert a moral effect on the dependent variable. Table (8) of the variance analysis also shows that the model is moral according to F's calculated value of (278.15), which is greater than the tabular value at a moral level (1). The interpretive capacity of this model was relatively good at R2 = 0.989. This indicates the ability of independent variables to explain the amount (99%) of variations in the adopted variable, thus achieving the second main hypothesis.

### 4.6.3. Regressive equations of the formative stages of Samawah city

**Table 9:** Regressive equations of the formative stages of Samawah City, Source: Researchers

| stages | Distance from the river | A | X1 open areas | X2 services | X3 transport network | X4 industrial use | X5 commercial use | X6 Residential Use |
|---|---|---|---|---|---|---|---|---|
| 1993 | Y= | 4941.040 | -5.252X1 | +48.645X2 | -41.085 X3 | -21.812X4 | +18.972X5 | -13.137X6 |
| 2020 | Y= | 6209.193 | -5.881X1 | +22.780X2 | -20.680 X3 | -80.987X4 | +26.620X5 | -10.119X6 |

Table (9) shows the multiple linear regression equations that have emerged for each stage of time, which demonstrate the functional relationship between the autonomous variables (open areas, services and transportation network, industrial use, commercial use, and residential use) on the dependent variable that is (the effect of the distance from the river).

## 5. Conclusion

The relationship proceeded to stabilize the formative pattern of the two phases of time (1993, 2020), finding the emergence of all independent variables in influencing the functional relationship between them and the river, and the continuation of the same stereotypical relationship in the multiple linear regression equations

This is due to the expansion of the main transport lines and the city's inland transport network, including the Baghdad-Basra Road, which affected the transformation towards the expansion of residential areas that expanded parallel to the river's previous expansion

This turned into a vertical picture on the river parallel to the main transport lines. The decline of the industrial zone on the south-east side of the city and the emergence of new Neighbourhoods in the way of jumping at the end of the third and beginning of the fourth phases with a significant transformation of central and near areas of the river to diverse commercial and service uses. The fact that orchards spread around the riverbanks are specific to the expansion of residential areas.

The stability of the impact relationship between independent variables and the distance from the river in the last two stages of analysis is certainly due to the urban integration of the city at least within the surrounding area of the river. Besides that,

the stability of the identity of uses and the pattern of competition between different land uses and the scarcity of land in the perimeter of the Euphrates River within the city is also noticed.
What is remarkable is that the value of the constant in the multiple linear regression equation is somewhat stable, which gives the idea that the effect of the river is almost constant in regulating the uses of the land at stages where the urban pattern of the city is not a wobbly or variable effect with a certain pattern that is upward or downward. In other words, the river retains its ability to regulate land uses around it within the mechanism of competition between major land uses.
Whatever increases in the value of the independent variable coefficient has its effect on the whole multiple linear regression equation slightly, that is, it needs more units than others to affect a single unit value on the approved variable. The phase III and IV formula show that the functional regulatory relationship of these uses with the river has been established.
The research recommends that the planning methods should be adopted significantly when making the planning decision on the transformations of land uses in cities, in particular the multiple linear regression method. Also, when distributing urban events in the city, workers are interested in raising commercial events and malls near the river to the main commercial streets and secondary centers in the neighborhoods because these events are not connected to the river.
It also recommends that green areas should be distributed in residential areas, so as to maintain homogeneity and balance when generally distributed within the city. Besides that, increasing the distribution of recreational areas near the river, as it is a functionally related use of the river, as well as adopting the city's final interpretative formula as a guide to direct the competent authorities in the future distributing of uses around the Euphrates River and a starting point for future studies.

## Acknowledgement

This Article is Extracted from an M.A. Thesis / Urban Transformations of Land Uses and their Impact on the Spatial Organization of River Cities / Center of Urban and Regional Planning for Post Graduate Studies / University of Baghdad /2021.

## References

[1] Grimm .N & others ,(2008) Global Change and the Ecology of Cities, Made available (AAAS) , Vol 319 , pp. 756-760 , http://dx.doi.org/10.1126/science.1150195
[2] Cengiz. B ,( 2013 ) Urban River Landscapes, Chapter from the book Advances in landscape Architecture , INTECH ,p551 , http://dx.doi.org/10.5772/56156
[3] Tang .Z & Zhang .D ,2006, Urban riverfront landscape design ,Beijing University ,China Architecture and Industry Press , p50
[4] Liu .B ,2005, Urban Riverfront Landscape Space Design, Dongnan University, Translated by Chen, Nanjing , China , p33-35
[5] Chen .C ,2011, Study on sustainable river front landscape design, A theses master , Architectural Studies , University of Florida ,p39-42
[6] Dheerb, A, 1997, Jihadi nuggets from Muthanna's history, Walsam Press, 1, Baghdad,p26
[7] Hussein, A, 1977, Geography of Cities, Asad Press, Baghdad, P26
[8] Shahrani, Mohammed, March, 2018, Multiple linear regression, Date of entry 15-11-2020, https://m-shahrani.com/1_multiple_linear_regression