Urban expansion in Baghdad governorate and its impact on increasing pollution Under constancy the stability of the infrastructure

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Abstract

The continued increase in the population, one of the enormous problems of the world’s people and the problem of accelerated population growth, is the cause of any other problem and the aim of the research is to measure the urbanization (modern housing complexes), its impact on the national electrical grid, the waste water disposal and treatment system, the capacity to raise and process waste, the collection plants and their impact on infrastructure, although they have been stable over the last three years of research and have been collected from statistical data of the Central Statistical Organization/Statistics Section, data of the Baghdad Secretariat and data of the Ministry of Reconstruction and Housing.

Keywords: Baghdad Secretariat, Baghdad parties, Waste, Drainage Systems, Power Stations.

1. Introduction

Some studies have shown that some 3,500 people are born every 20 minutes, and certainly this huge increase in the population leads to the exploitation of natural resources and the destruction of structures as a result of the imbalance between the two owing to population inflation, on the one hand, offset by the lack of resources, food and adequate housing on the other. There are factors such as growth and population distribution as well as high migration between cities for various reasons combined with patterns of human consumption that have implications for the environment with limits and capacity to absorb waste, continuing logging, population expansion and the need for freshwater for irrigation or human consumption. The time needed to recycle organic waste, land degradation, water, air and soil pollution and loss of biodiversity is the result of indiscriminate population growth. The world's population is likely to reach 9.2 billion in 2050. Of course, with the environmental degradation that has taken place for years, it will generate further pressure on the environment and its resources with the age of industry and scientific progress, coupled with poor development planning and healthy methods of waste management. Humans used fossil fuel sources from coal and petroleum for industrial purposes, starting with aircraft, trains, cars, factories, and the removal of trees and forests to secure cities and streets. As the human environment and the provision of the necessary food continue to overflow, owing to the high
numbers of the population and the lack of arable land, the use of chemicals and pesticides on an annual basis and without interruption has had a negative impact on the quality of the soil and the loss of its capacity to produce, thus affecting the lack of agricultural crops, which inevitably disrupts the national economy. The negative effects of population growth are due to poor distribution, as well as to the concentration of people in cities and capitals, which puts considerable pressure on resources and thus on the destruction of the environment. We mean the use of agricultural land as a population complex and at random, as well as the expansion of slums, as well as the increase in unemployment due to the high demand for labour.

The massive growth disproportionate to the available natural resources leads to the collapse of agriculture and results in low and difficult management of economic and social development. It is therefore reflected at the living level and generates high unemployment and poverty. The unbalanced distribution between urban and rural areas is one of the negative indicators of basic service infrastructure and its weak capacity to absorb population growth. Rural-urban migration and natural population growth are due to the high birth rate compared to the reduction in mortality as a result of the development of the health sector in most countries of the world and even limited in poor countries. It has added the indiscriminate expansion of cities, which extends to fragile lands that are not suitable for construction and housing and includes farmland and seaside shores, affecting low rates of agricultural and animal production and the migration of birds and animals. The proportion of the population in urban areas accounts for more than half of the population. This puts a lot of pressure on cities. This is currently the case in Iraq, where its indiscriminate population growth, particularly in urban cities, has led to an increase in the demand for food, housing and water. Consequently, it has required the annual depletion of agricultural land, which has deteriorated rapidly and is equipped for desertification as a result of the ingestion of marginal lands around cities. Many of the factors generated by accelerated population growth, which have a significant impact on the destruction of the environment and the significant exploitation of resources, including urbanization and the construction of fragile lands, will inevitably qualify them to be vulnerable to floods and earthquakes. The second effect is to increase pressure on natural resources to meet the growing needs for population growth, drinking water supply and sewage treatment. Therefore, the need to plan for human development and optimal population distribution by Governments is the only solution to stop randomly increasing populations within cities with a massive population explosion that is also accompanied by a miscalculation of the distribution of natural resources per capita (1).

2. What infrastructure

Because of what infrastructure forms as a large part of the investment climate and has an important impact on the economy as a whole, it plays a significant role in economic stability or absence. Infrastructure is a set of tools used to provide the basic services that society needs and cannot give up. Infrastructure includes drinking water and irrigation systems, sanitation systems that improve health, roads and bridges that provide access to markets and airports that approach distances between States and are limited in time, as well as power plants that light houses and power industry, Internet and mobile networks that help to spread and spread communications, among others (2).

3. Importance of infrastructure
The importance of infrastructure comes from the impact it has on the country in general and the economy in particular, namely, the issue of economic growth and the generation of opportunities, which is clearly reflected in economic stability. Indeed, it has been seen by some as the key to economic growth and employment. Economic growth and the generation of opportunities, which are reflected in economic stability, cannot be achieved without significant progress in the quality of infrastructure, as well as its initial existence. The World Bank launched its report "Lifeline: The Opportunity for Flexible Infrastructure " on 19/6/2019 to demonstrate its importance and prepare it as "the core of life and livelihood that can improve the functioning of schools, hospitals, businesses and industry, as well as access to jobs and prosperity," as the Chairman of the World Bank Group states.

4. What is economic stability

The situation in which the economy does not suffer from the volatility of the economic cycle, in other words, it does not suffer from stagnation or inflation. The absence of economic stability means more unemployment or a higher overall level of prices, or both, as occurred in the 1970s and 1980s and has been called "stagnant inflation."

5. Why and how infrastructure leads to economic stability

Infrastructure plays a significant role in economic stability as long as it forms a large part of the investment climate. But the question is why and how do you exert this influence? This influence is exercised because it reflects the confidence of the investor through channels that cost production, prices and the level of profits higher or lower, which are the focus of investor attention and confidence. The mechanism of such influence is positive and negative as follows:

a. When a country's infrastructure is available in an integrated manner This results in lower prices and higher demand for these goods and services, and increases the level of profits. The country is the focus of investors' attention and confidence in it, increasing the volume of their investment, creating more jobs, increasing economic growth and finally achieving economic stability.

b. The opposite occurs in the absence or poor infrastructure in terms of lack of integration, poor quality or high prices. The cost of producing goods and services will rise, the price will rise, and the profits will fall. Investors' confidence in the country will decline and investment will decline, followed by lack of stability as a result of increased unemployment and lower economic growth.

6. How is infrastructure achieved?

The roles of the public and private sectors in infrastructure development have evolved considerably over time. While the provision and financing of infrastructure services by the private sector date back to the nineteenth century, for much of the twentieth century there has been a worldwide trend towards public sector infrastructure development. However, the reverse trend towards private sector participation and competition in infrastructure sectors began in the early 1980s,(3) spurred by technological development and expansion of domestic and international capital markets in conjunction with the level of indebtedness and budget constraint that limits the ability of the public sector to meet infrastructure needs. Infrastructure can be achieved through three routes, namely, the public sector or the private
sector or the partnership between them. Each of these roads has both the pros and cons to deal with(4).

7. Infrastructure in Iraq

At a time when Iraq is suffering from the near-total collapse of its infrastructure, which has been reflected in the rise in the exclusion of families from their services, with 58.95% in 2010. By world standards, this proportion is very high. That collapse was due to accumulated and interrelated causes that fuel each other, most notably ongoing wars, economic blockade, internal conflict and government corruption, under which Iraq ranks 168th out of 180 States in the Global Corruption Cognition(5). Its economy suffers from the dichotomy of oil and the State, which reflected negatively on infrastructure and, finally, on economic stability. The economy's dependence on oil and the neglect of other sectors mean that it generates more unemployment, which is starting to constitute frightening figures from 10% to 40%, especially since its industry is capital-intensive rather than labour-intensive. (Infrastructure) is an important part of the investment climate in which Iraq ranks 171st out of 190 countries in 2019(6).

8. Infrastructure in Iraq and economic stability

The completion of Iraq's infrastructure is the key to economic stability. Since the State's finances depend very heavily on volatile and low-priced oil revenues. It seems that its price flight has become unsustainable for reasons of alternatives. This means that the State will allow the private sector, particularly the foreign sector, to settle them on the one hand, to avoid the negative effects of their orientation to other sectors and to make other sectors an opportunity for the national private sector. There could be a public-private partnership to finance infrastructure projects, as the World Bank has argued in recent years, particularly Islamic financing for public-sector partnership in infrastructure, as the latter requires large investments, described by some as a "sinking cost that cannot be recovered" in the sense of long-term and risky investments. Since Islamic finance is based on a risk-sharing philosophy, the financier must share certain forms of risk. Islamic finance should promote social and economic development through the creation of real assets. And not just by generating financial transactions. Therefore, public-private partnership projects for infrastructure are suitable for Islamic finance. Financing such projects requires a certain level of risk sharing with other project parties. Projects serve the greater purpose of social and economic development by creating essential assets in the public interest(7).

9. Practical side

On the practical side of the research, the data available from the Central Bureau of Statistics/Statistics Section and the data available from the Baghdad Secretariat, as well as the data available from the Ministry of Municipalities, Reconstruction and Housing for the last three years. For the purpose of clarifying how the indicators are calculated in the different tables in the research, see table(1,2).

Table (1) shows how indicators are calculated for tables in the research (8)

| No. | Indicators                  | Calculation Method               |
|-----|-----------------------------|----------------------------------|
| 1   | per capita tab water produced | Actual production/population     |
|   | Description                                                                 | Formula                                                                 |
|---|-----------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 2 | Electricity per capita sold (M Watt. h/year)                                | Total sales/population                                                  |
| 3 | Amount of waste generated per person (kg/day)                               | Amount of waste removed (kg/day)/population served by waste collection service |
| 4 | Amount of waste removed (waste, rubble, scrub) (1,000 tons/year)           | We collect waste, rubble and scrub                                     |
| 5 | Percentage of actual to design power of CPUs (central processing units)     | Total actual capacity                                                   |
|    |                                                                             | M3/day/total design capacity M3/day x 100                                |
| 6 | CPUs to station generation                                                  | Total amount of waste water treated m3/day/total amount of water generated m3/day x 100 |
| 7 | Percentage of actual to design energy of small processing units             | Total actual capacity                                                   |
|    |                                                                             | M3/day/total design capacity M3/day x 100                                |
| 8 | Percentage of waste water treated in small processing units                 | Total amount of waste water treated m3/day/total amount of water generated m3/day x 100 |
| 9 | Percentage of the population served by sewer systems (combined exhaust rains) | Population served/Total Population × 100                                 |
| 10| Percentage of water used in the sector                                      | Quantity used for water from sector M3/day/Total quantities used for all sectors M3/day x 100 |
| 11| Percentage of water released from the sector                                | Water discharge for sector M3/day/total water discharge for all sectors M3/day x 100 |
| 12| Percentage of solid waste from sector                                      | Amount of solid waste from sector kg/month/total solid waste for all sectors (kg/month) x 100 |
| 13| Losses of Baghdad Secretariat                                               | Actual production x 35/100                                              |
| 14| Per capita electricity (MW). hour/year(                                    | Amount of electricity for sale/population                               |
| 15| Per capita electricity (MW). Hour(                                         | Per capita electricity (MW). hours/year )/365 days x 24 hours           |
| 16| Percentage of electricity sold by items of consumption (household,         | Amount of electricity sold for any item/total sales x 100              |
|    | commercial, government, agricultural, industrial and outlier) distributed   |                                                                         |
|    | in the governorates of Iraq                                                |                                                                         |
| 17| Percentage of population served by waste collection                         | Population served/Total Population × 100                                 |
| 18| Amount of waste removed (1 ton/day)                                        | Amount of waste removed (1 ton/year )/365 days                          |
| 19| Amount of waste generated per person (kg/day)                               | Amount of waste removed (kg/day)/population served by waste collection service |

**Table(2) Demographic indicators for 2018(9)**
| No. | Description                                                                 | Value  |
|-----|------------------------------------------------------------------------------|--------|
| 1   | Total population of Iraq according to population estimates for 2018/person   | 38,124,182 |
| 2   | Total area of Iraq (km²)                                                     | 435,052 |
| 3   | Population density for 2018 person/km²                                       | 87.6   |
| 4   | Sex ratio for the population of Iraq for 2018(%)                             | 102.1  |
| 5   | Percentage of urban population in 2018(%)                                     | 69.8   |
| 6   | Percentage of rural population in 2018(%)                                     | 30.2   |
| 7   | Population growth rate for 2018                                             | 2.58   |

Table (3) Summary of municipal service sector indicators for the years 2010-2018 on Iraq (cso2018)(10)

| Years | Number of municipal institutions | Number of regular and irregular transformational stations (temporary cantonment sites) | Number of sites of destruction that have not received environmental approval | Proportion of population served by waste collection |
|-------|---------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------|
|       |                                 |                                                                                       |                                                                               | Urban | Iraq |
| 2010  | 425                             | 28,640.0                                                                               | 133                                                                           | 389   | 91.3 | 65.7 |
| 2011  | 253                             | 22,343.0                                                                               | 103                                                                           | 147   | .    | 62.8 |
| 2012  | 257                             | 23,137.0                                                                               | 104                                                                           | 144   | 91.1 | 61.2 |
| 2013  | 257                             | 22,752.3                                                                               | 101                                                                           | 138   | 92.5 | 62.4 |
| 2014  | 257                             | 22,506.8                                                                               | 100                                                                           | 144   | 92.5 | 62.6 |
| 2015  | 369                             | 31,866.7                                                                               | 108                                                                           | 236   | 88.4 | 67.0 |
| 2016  | 204                             | 26,070.3                                                                               | 65                                                                            | 156   | 87.1 | 63.9 |
| 2017  | 251                             | 24,622.2                                                                               | 82                                                                            | 205   | 87.7 | 61.9 |
| 2018  | 261                             | 26,370.2                                                                               | 87                                                                            | 213   | 88.8 | 63.5 |

Note:

1. Data for 2010 for all governorates including Kurdistan region (Iraq Environmental Survey of Water, Sewerage, Municipal Services) for 2010.
2. Data for the years (2011 2013) except Kurdistan region.
3. Data for 2014 except governorates (mousl, Anbar and Salahuddin) due to the deteriorating security situation in it and Kurdistan region.
4. Data for 2015 except mousl and Anbar provinces due to deteriorating security.
5. Data for 2016 except mousl and Anbar provinces due to deteriorating security and Kurdistan region.
6. Data for 2018 other than Kurdistan region/Department of Environmental Statistics/Central Bureau of Statistics/Iraq.

In table 3, we note that the number of municipal institutions has been reduced to almost half, as well as the number of transformational stations (temporary cantonments). There has been a decline in the number of burial sites throughout Iraq, while we note the increase in the...
number of residential complexes in Iraq, particularly in Baghdad province, which is of interest to us in the search. Table (4a,4.b) represents some of the modern residential complexes in Baghdad province, which represent a burden on all infrastructure except the Bismayyah residential complex(11).

Table (4.a) represents the location of some housing complexes, the area, the number of housing units and the area per housing unit(11)

| Compound            | Bismayyah | Al-Zuhoor | Iraq Gate Complex |
|---------------------|-----------|-----------|-------------------|
| Geographic Location | 10km southeast of Baghdad | Southeast of Baghdad along the Muhammad Qasim Highway | alMuthanna Airport on the one hand and Al-Zawra Park on the other. |
| Area for compound /m2 | 18,300,000 | 435,500 | 300,000 |
| Number of units/apartment | 100,080 | 5200 | 3269 |
| Apartment Area/m2 | 100/120/140 | 80/100/125/150 | 167/ 172/ 199/ 215/ 252 |

Table (4.b) represents the location of some housing complexes, the area, the number of housing units and the area per housing unit(11)

| Compound            | JawaherDijla | Al Ayadi Complex | Al Yamamah city Compound |
|---------------------|--------------|------------------|-------------------------|
| Geographic Location | The city of Kazemiya, on the banks of the Tigris River, is 700 metres from the front. | West Baghdad/Amiriya District/Al-Qadi District | District of Justice/Locale 645 |
| Area for compound /m2 | 125,000 | 120,000 | 80,000 |
| Number of units/apartment | 1500 | 1300 | 868 |
| Apartment Area/m2 | 203/182/137 | 400/350/195/163 | 165 /125 |

From the tables(5,6,7,8) we note that there has been no change for two consecutive years.(2017 and 2018) In terms of the number of landfill sites, as well as sites within and outside the design, and through available data, there must be an increase in landfill sites, as well as an effort to ensure that all of them have environmental approvals in the increase in the number of residential complexes in Baghdad Governorate belonging to the Baghdad Secretariat and the parties to Baghdad.

Table (5) Number of municipal institutions and percentage of population with waste collection service by environment in Baghdad Governorate 2017(12)
The population is estimated by the (CSO), and based on Iraq's reported campaign of murder and genocide by ISIS and terrorist forces against Iraqis and the destruction of the country due to the precarious security conditions in the country, new population projections have been prepared based on population assumptions that are appropriate to the country's realities in terms of reducing fertility and predicting the age of birth.

Table (6) Number of municipal institutions and percentage of population with waste collection service by environment in Baghdad Governorate 2018

| Governorate       | Number of municipal institutions | Population * | Proportion of population served by waste collection | Population Served | Population * | Proportion of population served by waste collection | Population Served |
|-------------------|----------------------------------|--------------|-----------------------------------------------------|-------------------|--------------|-----------------------------------------------------|-------------------|
| Baghda d Secretariat | 15                               | 5,838,251    | 95.0                                                | 5,546,338         | 0            | 0.0                                                 | 0                 |
| Baghda d Parties   | 16                               | 1,088,342    | 66.5                                                | 723,72            | 2            | 11.5                                                | 113,80            |

Table (7) shows the number of waste landfills received and not approved by location relative to the base design of the municipality for the 2017

| Governorate       | No. of landfills | Environme ntal approval | non-environment al approved | Inside Design | Out Design | Inside Design | Out Design |
|-------------------|------------------|-------------------------|---------------------------|---------------|------------|---------------|------------|
| Baghdad Secretariat | 1                | 2                       | 1                         | 0             | 0          | 2             |            |
| Baghdad Parties   | 0                | 2                       | 0                         | 0             | 0          | 2             |            |
Table (8) shows the number of waste landfills received and not approved by location relative to the base design of the municipality for the 2018(13)

| Governorate       | No. of landfills | No. of waste landfills with environmental approval relative to the basic design of the municipality | No. of waste landfills with non-environmentally approved waste landfills relative to municipal base design |
|-------------------|------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
|                   | Environmenal approval | non-environmental approved | Inside Design | Out Design | Insid e Design | Out Design |
| Baghdad Secretariat | 1                 | 2                             | 1             | 0           | 0               | 2          |
| Baghdad Parties   | 0                 | 2                             | 0             | 0           | 0               | 2          |

From the tables(9,10) we note an increase in the number of provinces with problems in the municipal services sector, including those of(Poor and unsustainable mechanism maintenance, lack of backup materials for waste machinery; The institutional performance of the provinces in the allocation of funds for the implementation of waste recycling plant projects within the budget for the development of the regions is weak; Poor coordination among the financial services that give fundamentalist approvals to landfill and manufacturing plant projects; The difficulty of covering the typical transformer stations of all municipal institutions, the problems of the indiscriminate dumping of waste and the insufficient availability of such plants to cover the actual need for daily quantities of detachment; The lack of studies and research on the sanitation sector to develop a sound waste management mechanism, the weakness of the local private sector specializing in this area, as well as the low involvement of the specialized sector of global companies specializing in this area, limited availability of containers for waste collection, lack of modern specialized containers to be affected by use, delayed compensation for those affected and other problems) The Baghdad secretariat and the Baghdad parties were among them. This affects the municipal services sector in view of the increase in the number of housing complexes, while all governorates were experiencing the problem of the lack of a system for sorting waste from the source, the lack of use of bags by citizens, and the lack of use of such bags for collection of waste except for the outskirts of Baghdad because of the presence of a screening and recycling plant in almahmodia(16).

Table (9) Percentage of major problems in the municipal services sector by Governorate in 2017(14)

| No. | Problems in the sector Municipal services | No. of Governorates | Governorates names |
|-----|--------------------------------------------|---------------------|--------------------|
| 1   | The small number of mechanisms (CAPSAT, etc.) in municipal institutions in the area of waste in terms of collection and transport and the ageing of some of them. | 16 | All Governorates |
| 2   | The lack of specialized mechanisms in a number of municipal institutions in the area of | 15 | All Governorates except alMuthanna |
|   | Problem Description                                                                 | Governorates                                                                 |   |
|---|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---|
| 3 | Weak and unsustainable maintenance of mechanisms                                     | All Governorates except Baghdad Secretariat, Babylon, Salahuddin, Al-Qadisiyah, Al-Muthana | 8 |
| 4 | Shortage of backup materials for waste machinery                                       | All Governorates except Baghdad Secretariat, Baghdad Parties, Salahuddin, Karbala | 11 |
| 5 | The lack of financial allocations for the implementation of projects for intensive work, as such work is within the budget of the prefecture. | All Governorates | 16 |
| 6 | The limited number of personnel allocated to the number of mechanisms for collection and transport of waste | All Governorates except Baghdad Secretariat | 15 |
| 7 | Low pay for waste workers                                                               | All Governorates except Baghdad Secretariat | 15 |
| 8 | Lack of availability of supplies (bags) for waste collection                           | All Governorates except Baghdad Secretariat, Salahuddin, Karbala               | 13 |
| 9 | Lack of environmental awareness and a lack of commitment by citizens to the timing of waste collection, resulting in disruption of the collection and transportation system. | All Governorates | 16 |
|10 | Random dumping of waste by citizens and shops and throwing it into unearmarked locations | All Governorates | 16 |
|11 | The institutional performance of the provinces has been weak in the allocation of funds for the implementation of waste recycling plant projects within the regional development budget | All Governorates except Baghdad Secretariat, Karbala, Mesan, Basra, | 12 |
|12 | Poor coordination among the financial services that give fundamentalist approvals to landfill projects and manufacturing plants | All Governorates except Baghdad Secretariat, Basra, Salahuddin, Al-Muthana | 12 |
|13 | The non-use of bags for collection of waste distributed to citizens and the poor standards established for monitoring cleaners | All Governorates except Baghdad Secretariat, Baghdad Parties, Karbala, Mesan, Basra, Thyqar | 10 |
|14 | The difficulty of covering the typical transformer stations of all municipal            | All Governorates except Salahuddin, Al-Anbar, Baghdad Parties, Al- | 11 |
Table (10) Percentage of major problems in the municipal services sector by Governorate in 2018(15)

| No. | Problems in the sector | No. of Governorates | Governorates names |
|-----|------------------------|---------------------|--------------------|
| 1   | The small number of mechanisms | 16 | All Governorates |
| 15  | The lack of studies and research on the sanitation sector to develop a sound waste management mechanism, the weakness of the local private sector specializing in this area, as well as the low involvement of the specialized sector of global companies specializing in this area | 13 | Al-Muthana, Mesan, thyqar, Al-Anbar, Baghdad secretariat, Baghdad parties, Karbala, Babylon, Wasit, Salahuddin, Najaf, Qadisiyah, Muthanna, thyqar, Mesan |
| 16  | Lack of a system for sorting waste from source, low use of bags by citizens and lack of use for waste collection | 16 | All Governorates |
| 17  | cleaners services for residential areas are free of charge, with the attendant indifference of service recipients, poor awareness of the impact of the negative response of the citizen and the lack of cooperation between the service provider and recipients | 14 | All Governorates except Wasit, diyala |
| 18  | The geographical size of the cities, their horizontal reach and the resulting large waste releases that are disproportionate to the existing machine and human effort (self-help and rental) of all municipal institutions to cover the required services | 14 | All Governorates except diyala, Baghdad parties |
| 19  | The spread of informal residential communities that outstrip agricultural use has a significant impact on the level of service delivery, including sanitation services and frequent abuses of public service land (such as schools, health centres, hospitals, parks and other services), thereby reducing the space allocated to these vital events | 15 | All Governorates except Baghdad Secretariat |
| 20  | low availability of containers for waste collection, lack of modern specialized containers for use and delayed compensation for those affected | 12 | All Governorates except Baghdad Secretariat, Karbala, Wasit, Salahuddin |
| 21  | Other | 5 | Baghdad Secretariat, Wasit, thyqar, Karkuk |

Table (10) Percentage of major problems in the municipal services sector by Governorate in 2018(15)
|   | Issue                                                                                                      | Governorates                                                                 |
|---|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 2 | The lack of specialized mechanisms in a number of municipal institutions in the area of waste in terms of collection and transport | All Governorates except Basra                                                  |
| 3 | Weak and unsustainable maintenance of mechanisms                                                        | Baghdad Secretariat, Baghdad Parties, Wasit, thyqar                           |
| 4 | Shortage of backup materials for waste machinery                                                         | Baghdad Secretariat, Baghdad Parties, Wasit, thyqar                           |
| 5 | The lack of financial allocations for the implementation of projects for intensive work, as such work is within the budget of the prefecture. | All Governorates                                                             |
| 6 | The limited number of personnel allocated to the number of mechanisms for collection and transport of waste | Baghdad Secretariat                                                           |
| 7 | Low pay for waste workers                                                                                  | Baghdad Secretariat                                                           |
| 8 | Lack of availability of supplies (bags) for waste collection                                              | Baghdad Parties, Salahuddin, Wasit                                             |
| 9 | Lack of environmental awareness and a lack of commitment by citizens to the timing of waste collection, resulting in disruption of the collection and transportation system. | All Governorates                                                             |
|10 | Random dumping of waste by citizens and shops and throwing it into unearmarked locations                  | All Governorates                                                             |
|11 | The institutional performance of the provinces has been weak in the allocation of funds for the implementation of waste recycling plant projects within the regional development budget | All Governorates except Baghdad Secretariat, Baghdad Parties                   |
|12 | Poor coordination among the financial services that give fundamentalist approvals to landfill projects and manufacturing plants | All Governorates except Baghdad Secretariat, Baghdad Parties, thyqar, Salahuddin, Al-Muthana |
|13 | The non-use of bags for collection of waste distributed to citizens and the poor standards established for monitoring cleaners | All Governorates except Baghdad Secretariat, Baghdad Parties, thyqar, Salahuddin, Al-Muthana |
|   |   |   |
|---|---|---|
| 14 | The difficulty of covering the typical transformer stations of all municipal institutions, the problems of the indiscriminate dumping of waste and the insufficient availability of such plants to cover the actual need for the daily quantities of detachment | Muthana, Wasit, thyqar |
| 15 | The lack of studies and research on the sanitation sector to develop a sound waste management mechanism, the weakness of the local private sector specializing in this area, as well as the low involvement of the specialized sector of global companies specializing in this area | All Governorates except Basra |
| 16 | Lack of a system for sorting waste from source, low use of bags by citizens and lack of use for waste collection | All Governorates except Baghdad Parties |
| 17 | Cleaners services for residential areas are free of charge, with the attendant indifference of service recipients, poor awareness of the impact of the negative response of the citizen and the lack of cooperation between the service provider and recipients | All Governorates except karkuk, alQadisiyah |
| 18 | The geographical size of the cities, their horizontal reach and the resulting large waste releases that are disproportionate to the existing machine and human effort (self-help and rental) of all municipal institutions to cover the required services | All Governorates except Baghdad parties |
| 19 | The spread of informal residential communities that outstrip agricultural use has a significant impact on the level of service delivery, including sanitation services and frequent abuses of public service land (such as schools, health centres, hospitals, parks and other services), thereby reducing the space allocated to these vital events | All Governorates except BaghdadSecretariat |
| 20 | Low availability of containers for waste collection, lack of modern specialized containers for use and delayed compensation for those affected | All Governorates except BaghdadSecretariat, Salahuddin |
| 21 | Other | BaghdadSecretariat, muselthyqar, karkuk, Alanbar, alNajaf |

From the tables (11, 12) we note that there has been no change in data for the years 2017-2018, as well as before, where the number of factories is constant, as well as those under construction. We also note that there has been no change in the rest of the data, and that this affects the infrastructure as growth and urbanization in Baghdad province have been lost.
Table (11) shows the number of waste sorting and recycling plants by working situation, number of working days, recycled quantities and percentage of screening for 2017(12)

| Governorate          | Worker | Parked | Underc | Number of working (days per year) | Recycled quantity (ton/day) | Recycled quantity (ton/year) | Location |
|----------------------|--------|--------|--------|-----------------------------------|-----------------------------|------------------------------|----------|
| Baghdad Secretariat  | 0      | 0      | 2      | 0                                 | 0                           | 0                            |          |
|                      |        |        |        |                                   |                             |                              | factory on the side of alkhrrh and factory on the side of alresafa |
| Baghdad Parties      | 1      | 0      | 0      | 121                               | 65                          | 7,955                        |          |
|                      |        |        |        |                                   |                             |                              | alMuhamudi yah/Yousafi District |

Table (12) shows the number of waste sorting and recycling plants by working situation, number of working days, recycled quantities and percentage of screening for 2018(13)

| Governorate          | Worker | Parked | Underc | Number of working days per year (day) | Recycled quantity (ton/day) | Recycled quantity (ton/year) | Location |
|----------------------|--------|--------|--------|--------------------------------------|-----------------------------|------------------------------|----------|
| Baghdad Secretariat  | 0      | 0      | 2      | 0                                    | 0                           | 0                            |          |
|                      |        |        |        |                                      |                             |                              | factory on the side of alkhrrh and factory on the side of alresafa |
| Baghdad Parties      | 1      | 0      | 0      | 121                                  | 65                          | 7,955                        |          |
|                      |        |        |        |                                      |                             |                              | alMuhamudi yah/Yousafi District |

From the tables(13,14) we note that there has been no change in the data for the years 2017-2018, as well as in the number of transformational stations that are constant, as well as those with environmental approvals, while the number of irregular stations has been reduced by one and has not been converted into a regular station. This affects the infrastructure as the growth and urbanization of Baghdad province has weakened.
Table (13) Number of regular and irregular transformational stations (temporary cantonment sites) have or not have received environmental approval for 2017(12)

| Governorate     | Number of transformational stations | Number of regular transformational stations | Number of irregular transformational stations |
|-----------------|-------------------------------------|---------------------------------------------|----------------------------------------------|
|                 | reg | Irreg | have received environmental approval | not have received environmental approval | have received environmental approval | have received environmental approval |
| Baghdadi Secretariat | 9  | 14    | 9  | 0  | 0  | 14  |
| Baghdadi Parties  | 0  | 2     | 0  | 0  | 0  | 2   |

Table (14) Number of regular and irregular transformational stations (temporary cantonment sites) have or not have received environmental approval for 2018(13)

| Governorate     | Number of transformational stations | Number of regular transformational stations | Number of irregular transformational stations |
|-----------------|-------------------------------------|---------------------------------------------|----------------------------------------------|
|                 | reg | Irreg | have received environmental approval | not have received environmental approval | have received environmental approval | have received environmental approval |
| Baghdadi Secretariat | 9  | 13    | 9  | 0  | 0  | 13  |
| Baghdadi Parties  | 0  | 2     | 0  | 0  | 0  | 2   |

From the tables (15,16) we note an increase in the number of governorates experiencing problems in the water sector. (Source water contamination, poor maintenance and unsustainable, scarce and volatile electrical power for operation, poor security conditions and other problems) While on the other hand, these include (project incompetence, project production does not fill the need, the scarcity of backup tools and raw materials, the incompetence of the technical cadre, citizen excesses on the network, lack of financial allocations) and the same problems for the above two years. This affects infrastructure in the wake of the increase and urbanization in Baghdad province.

Table (15) Percentage of major problems affecting the water sector in the governorate for 2017(17)

| No. | major problems                                      | No.of governorate | Governorates names                                      |
|-----|-----------------------------------------------------|-------------------|---------------------------------------------------------|
| 1   | Project not inefficiency                            | 7                 | Al Anbar, Babylon, Salahuddin, Najaf, theqar, Mesan and Basra |
| 2   | The scarcity of tab water in the water source       | 12                | Salahuddin and Basramusel,Diyala, Al Anbar, Baghdad Secretariat |
| 3   | Source water pollution                              | 7                 | musel, Babylon, Salahuddin, |
Table (16) Percentage of major problems affecting the water sector in the governorate for 2018 (18)

| No. | major problems                                      | No.of governorate | Governorates names                                                                 |
|-----|-----------------------------------------------------|-------------------|------------------------------------------------------------------------------------|
| 1   | Project not inefficiency                            | 6                 | Al Anbar, Babylon, Salahuddin, thyqar, Misan, Basra                                |
| 2   | The scarcity of tab water in the water source       | 12                | Kirkuk, Diyala, the outskirts of Baghdad, Babylon, Karbala, Wasit, Salahuddin, Qadisiyah, Muthanna, DhiQar, Misan, Basra |
| 3   | Source water pollution                              | 11                | musel, Diyala, Baghdad parts, Babylon, Salahuddin, Najaf, Qadisiyah, Muthanna, thyqar, Misan, Basra |
| 4   | Old Network and Weakness                            | 11                | musel, Al Anbar, Baghdad parts, Babylon, Wasit, Salahuddin, Qadisiyah, Muthanna, thyqar, Misan, Basra |
| 5   | Project production does not fill the need           | 9                 | musel, Kirkuk, Diyala, Anbar, Karbala, Wasit, Salahuddin, Qadisiyah, Muthanna     |
| 6   | Poor maintenance and unsustainable                  | 5                 | Baghdad parts, Babylon, Qadisiyah, Misan, Basra                                    |
| 7   | Limited backup tools and raw materials              | 11                | musel, Diyala, Baghdad Secretariat,                                                |
and raw materials

| 8 | Lack of technical and administrative worker | 9 | musel, Kirkuk, Al Anbar, Baghdad parts, Karbala, Salahuddin, Najaf, Misan, Basra
| 9 | inability of the technical cadre | 1 | Basra
| 10 | Scarce and fluctuating electrical power for operation | 16 | musel, Kirkuk, Diyala, Al-Anbar, Baghdad Secretariat, Baghdad parts, Babylon, Karbala, Wasit, Salahuddin, Al-Qadisiyah, Muthanna, thyqar, Misan, Basra
| 11 | Citizen Abuses on the Web | 15 | musel, Kirkuk, Diyala, Al-Anbar, Baghdad Secretariat, Baghdad parts, Babylon, Karbala, Wasit, Salahuddin, Al-Qadisiyah, Muthanna, thyqar, Misan, Basra
| 12 | Poor citizen awareness of consumption rationalization | 16 | musel, Kirkuk, Diyala, Al-Anbar, Baghdad Secretariat, Baghdad parts, Babylon, Karbala, Wasit, Salahuddin, Najaf, Qadisiyah, Muthanna, thyqar, Misan, Basra
| 13 | Lack of financial allocations | 14 | musel, Kirkuk, Al Anbar, Baghdad parts, Babylon, Karbala, Wasit, Salahuddin, Najaf, Qadisiyah, Muthanna, thyqar, Misan, Basra
| 14 | Poor security condition | 5 | musel, Kirkuk, Anbar, Salahuddin, Basra
| 15 | Other | 3 | Baghdad Secretariat, Salahuddin, Misan

From the tables (17,18)we note a decrease in average per capita processed water. (Drinkable) The total population is rising, according to estimated statistics, due to low imports of Tigris and Euphrates rivers, as well as the annual rainfall scarcity, which has affected per capita annual imports per cubic meter of water, as per capita water year has fallen from 1,542.63. (2009-2010) to be 870.84 in the water year (2017-2018), almost half (source: Ministry of Water Resources/Planning and Follow-up Service/Environmental Policy Section/Statistics Section - Central Bureau of Statistics/Iraq).

Table (17) Total population and population with drinking water distribution systems and average per capita water processed for total population and population served by environment and location for 2017(17)

| Govern orate | Total population* | Average per capita water processed for total population (water sold) L/day(drinkable) | Population with drinking water distribution systems (population) |
|-------------|------------------|----------------------------------|------------------|
|             | Urban and rural  | Urban    | rural   | Urban | Rural |
| Baghda d Secretariat | 5,838,251 | 497     | 0       | 5,838, 251 | 0     |
| Baghda d Parties   | 2,078,596 | 368     | 1,12    | 653,00 | 396,105 |

*Population estimated by the CSO.
Table (18) Total population and population with drinking water distribution systems and average per capita water processed for total population and population served by environment and location for 2018(18)

| Governorate   | Total population* | Average per capita water processed for total population (water sold) L/day (drinkable) | Population with drinking water distribution systems (population) |
|---------------|-------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------|
|               | Urban and rural   | Urban | Rural | Urban | Rural |
| Baghdad Secretariat | 5,993,043  | 484   | 0     | 5,993,043 | 0 |
| Baghdad Parties | 2,133,712      | 247   | 181   | 670,315 | 406,608 |

For the Baghdad Parties, the reason is that municipal institutions carry out additional campaigns to raise waste weekly from the areas of service, as well as to raise waste from the agricultural areas as well as from the areas of the Baghdad Parties in the squatter areas see table (19,20).

Table (19) Quantity of regular waste removed and rate of quantity of waste generated per person by province for 2017(12)

| Governorate     | Population with waste collection service | Amount of regular waste removed (ton/day) | Average amount of regular waste removed (kg/day) | Regular waste quantity rate Generated by each individual (kg/day) |
|-----------------|-------------------------------------------|------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------|
| Baghdad Secretariat | 5,546,338                             | 5,932.5                                   | 5,932,530.1                                    | 1.1                                                               |
| Baghdad Parties  | 837,622                                 | 1,195.5                                   | 1,195,487.7                                    | 1.4                                                               |

Table (20) Quantity of regular waste removed and rate of quantity of waste generated per person by province for 2018(13)

| Governorate     | Population with waste collection service | Amount of regular waste removed (ton/day) | Average amount of regular waste removed (kg/day) | Regular waste quantity rate Generated by each individual (kg/day) |
|-----------------|-------------------------------------------|------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------|
| Baghdad Secretariat | 5,693,391                             | 6,635.1                                   | 6,635,090.4                                   | 1.2                                                               |
| Baghdad Parties  | 892,341                                 | 1,215.2                                   | 1,215,238.4                                   | *1.4                                                             |

Table (21) Quantity of waste removed (regular waste, rubble and scrub) and relative distribution by province for 2017(12)

| Location | Amount of waste removal | Relative distribution of |
| Location          | Amount of waste removal | Relative distribution of lifted residues |
|-------------------|-------------------------|------------------------------------------|
|                   | regular waste (ton/year) | rubble (demolition and construction waste (ton/year)) | Scrub (ton/year) | regular waste | rubble (demolition and construction waste (ton/year)) | Scrub |
| Baghdad Secretariat | 2,465.373.5 | 59,766.4 | 20.0 | 97.3 | 2.7 | 0.0 |
| Baghdad Parties    | 436.35 | 117,424.0 | 0 | 64.1 | 17.2 | 1.87 |

Note: Removed wastes include (regular waste + rubble and include demolition and construction residue + scrub).

Table (22) Quantity of waste removed (regular waste, rubble and scrub) and relative distribution by province for 2018 (13)

| Location          | Amount of waste removal | Relative distribution of lifted residues |
|-------------------|-------------------------|------------------------------------------|
|                   | regular waste (ton/year) | rubble (demolition and construction waste (ton/year)) | Scrub (ton/year) | regular waste | rubble (demolition and construction waste (ton/year)) | Scrub |
| Baghdad Secretariat | 2,421.808.0 | 58,240.0 | 0.0 | 97.7 | 2.3 | 0.0 |
| Baghdad Parties    | 443.56 | 109,536.0 | 11,600.0 | 78.5 | 19.4 | 2.1 |

Note: Removed wastes include (regular waste + rubble and include demolition and construction residue + scrub)

Table (23) Total electricity produced, imported and for sale and per capita electricity prepared for sale for years (2012 - 2017) (19)

| Years | Total electricity produced (M.W.h) | The amount of electricity imported + the barge (M.W.h) | The amount of electricity prepared for sale (M.W.h) | Population* | Per capita electricity for sale (M.W.h/year) | Per capita electricity for sale (M.W.h) |
|-------|-----------------------------------|------------------------------------------------------|--------------------------------------------------|-------------|---------------------------------------------|----------------------------------------|
| 12    | 63,891,914                        | 10,170,23                                            | 49,122,5                                         | 34,207,2    | 1.44                                        | 0.00                                   |
| 13    | 58,422,041                        | 12,201,62                                            | 62,705,1                                         | 30,219,8    | 2.08                                        | 0.00                                   |
| 14    | 67,767,995                        | 12,250,55                                            | 71,299,8                                         | 30,994,4    | 2.30                                        | 0.00                                   |
| 15    | 68,688,325                        | 13,104,20                                            | 74,215,1                                         | 30,308,5    | 2.45                                        | 0.00                                   |
| 16    | 80,803,253                        | 11,964,87                                            | 81,247,2                                         | 31,131,8    | 2.61                                        | 0.00                                   |
| 17    | 85,513,644                        | 13,644,40                                            | 89,223,3                                         | 31,967,0    | 2.79                                        | 0.00                                   |
Population for years (2015, 2016, 2017), according to estimates by the Central Bureau of Statistics, based on Iraq's campaign of murder and genocide by ISIS and terrorist forces against Iraqis, the country has been devastated by the security situation. The instability that the country has experienced, new population projections have been prepared based on population hypotheses that fit the reality of the country in terms of fertility reduction and the expectation of birth age.

**Including energy purchased from Kurdistan region

***Represents energy imported from neighbouring countries and energy added from investment, including barangays.

****Represents energy purchased from Kurdistan region, energy imported from neighbouring countries and energy added from investment, knowing that there was no power from the barangays for 2017 Because of the financial crisis and the termination of the company's contract

**Table (24) Per capita electricity sold by governorate for 2017(20)

| Departmen | Governorate | Total | Populatio | Per capita | Per capita |
|-----------|-------------|-------|-----------|------------|------------|
| Baghdad  | Baghdad     | 11,863,24 | 7,916,847 | 1.50       | 0.00017    |

* Population estimated by the Central Bureau of Statistics, based on Iraq's campaign of murder and genocide by ISIS and terrorist forces against Iraqis and the destruction caused to the country by the precarious security conditions in the country, new population projections have been prepared based on population assumptions that are appropriate to the country's reality in terms of reducing fertility and predicting the age of birth.

10. Conclusions

From the above tables we note no change in the years from (2017-2018) According to data obtained from the Central Bureau of Statistics in all municipal sectors from the lifting and generation of waste, recycling plants, treatment plants for drinking water, sewage and electricity produced and consumed, as well as various problems in the governorates and for all sectors.

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