

## CITIES' URBAN RESILIENCE IN THE FACE OF URBAN SPRAWL CHALLENGES

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### ABSTRACT

**Motives:** The research deals with the issue of urban sprawl on agricultural lands. It is an urban problem caused by rapid urbanization and poor planning. It is considered one problem that threatens cities with environmental and health disasters. It also threatens agricultural life and the green belt surrounding cities. Changes in urban sprawl on agricultural land are associated with complex processes that lead to multiple social, economic, political, and environmental risks and thus pose a threat and an obstacle to the sustainability of cities.

**Aim:** The research aims to study and evaluate the reality of the city of Baghdad and the extent of its ability and flexibility to withstand the disaster of urban sprawl on agricultural lands. The research also the aim of this research to identify the gaps and the reasons that led to this disaster and reach solutions that may reduce this phenomenon that burdens the economy and the Iraqi people who suffer from difficult economic conditions. In addition to raising awareness about the effects of urban sprawl on agricultural lands and the environment, clarifying the role of participation and the limits of responsibility that can be entrusted to government and academic agencies at all levels, individually or collectively, to participate and find solutions to the risk of extensive urban sprawl.

**Results:** In assessing the reality of the study area, the research relied on the city resilience scorecard, which the United Nations Office for Disaster Risk Reduction (UNDRR) and with the support of United States Agency for International Development (USAID) and the European Commission. Field surveys and the opinions of specialists were relied upon to study the reality of the city of Baghdad to determine the extent to which it was affected by the disaster of encroachment on agricultural lands.

There are gaps between planning and contemporary challenges among the most important research findings. Planning is increasingly decoupled from the contemporary urban challenges associated with rapid urbanization. The results of the practical study showed that the division of land uses in the city of Baghdad is not deep and incomplete. Also, it is not regularly reviewed according to the map of the expected risks, including the state of urban sprawl on agricultural lands in the city. Consequently, the city's inability to withstand the disaster resulting from urban sprawl and the problems that result

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from it in the environmental, health, or social aspects. Based on the results, the research reached a set of recommendations, including the need for continuous updating to detect urban sprawl on agricultural lands. This is done using the latest remote sensing data and taking quick precautions against these expansions, in addition to the importance of updating building controls and standards regularly (or periodically) to take the changing data and evidence about risks to enhance the city of Baghdad's ability to withstand the disaster of the decline of agricultural lands.

**Keywords:** flexibility, disaster, risk, agriculture land use, urban sprawl

## INTRODUCTION

Agricultural land is an essential resource for the sustainability and security of human food systems, environments, agro-industries, and livelihoods. Sustainably managed agricultural land provides invaluable ecosystem services, such as wildlife habitat, carbon sequestration, water regulation, and amenity value (Power, 2010). Moreover, although the technology in the world is getting more and more complex every day, no technology has been able to replace the unique qualities of the major agricultural lands that have developed over time.

The issue of agricultural land as an indispensable natural resource is witnessing great interest on several levels, represented by organizations and conferences and books and research. The American Farmland Trust (AFT) is a national group that aim to stop the loss of farmland and promote farming practices that lead to farmland conservation due to its economic, environmental, and social role. As well as the cultural significance and landscapes that connect individuals to the natural world (Vinge, 2018).

The United Nations Global Goals for Sustainable Development 2030 included several goals related to the importance of agricultural land with direct and implicit goals. Goal 2 referred to “eradicating hunger, achieving food security, improving nutrition, and promoting sustainable agriculture”. Goal 12 referred to “ensure sustainable consumption and production patterns”. Agriculture is a sector where these objectives can synergize (Plastun et al., 2021). For this reason, preserving agricultural lands and developing investment tools have become important for countries to achieve sustainable development goals related to the agricultural sector (Havemann et al.,

2020). According to studies conducted by the Food and Agriculture Organization (FAO), the International Fund for Agricultural Development (IFAD), and the World Food Program (WFP), the amount required to achieve these goals is estimated at 265 USD billion annually by 2030.

With urbanization and economic growth, the urban areas increased, and the cities expanded dangerously. This expansion changed land use and, in most cases, reduced the area of productive agricultural land around these cities. Agricultural land is increasingly under threat from social, physical, and climatic factors (Vinge, 2018). The issue of preserving agricultural lands for current and future generations has become a global issue that must be urgently addressed as it constitutes an urban disaster that most countries are unaware of. It is rapidly reaching its peak in conjunction with the urban disasters of recent years represented by natural hazards, equipment accidents, public health events, and terrorist attacks. All of them lead to an escalation of economic and human losses and threaten sustainable urban development (Lizarralde et al., 2015).

The main gist of this paper emerges from the recognition that land is a valuable natural resource that must be protected for the benefit of current and future populations. The encroachment on agricultural land is an urban disaster that cities must address so that they can continue and recover quickly. The research problem is represented by: the absence of a clear perception of the gaps and the reasons that led to the decrease of agricultural lands in a country where agriculture is the main livelihood resource for many of its residents. Society is accustomed to taking land for granted, and until recently, no attempts have been made

to generate public interest in “monitoring” land use. The research aim to study and evaluate the reality of the city of Baghdad and its ability to withstand the disaster of urban sprawl on agricultural lands, identify the gaps and reasons that led to this disaster, and reach solutions that may contribute to limiting this phenomenon that burdens the economy and the Iraqi people who suffer from difficult economic conditions. As well as raising awareness about the effects of urban sprawl on agricultural lands and the environment and clarifying the role of participation and the limits of responsibility that can be entrusted to government and academic agencies, individually or collectively, to find solutions to the risk of extensive urban sprawl.

This paper suggested relying on the City's Resilience Scorecard, established by the United Nations Office for Disaster Risk Reduction (UNDRR) and supported by (USAID) and the European Commission. Field surveys and the opinions of specialists were relied upon to study the reality of the city of Baghdad to determine the extent to which it was affected by the disaster of encroachment on agricultural lands.

## Methodology

To achieve the goal of the research, the study methodology consisted of two sides, the theoretical side and the practical side.

### The theoretical side

The theoretical side of the research relied on the qualitative approach in collecting multiple sources and data from the literature related to the urban sprawl disaster on agricultural lands to understand and analyze this phenomenon by classifying these sources and data on four main axes. The first axis included studying the concept of risks and disasters in the urban environment and its most important characteristics and classifying them into several types, such as environmental and economic risks, social and cultural risks, capital risks, and institutional political risks. The second axis included a study of the concept

of urban sprawl and its risks on agricultural lands and the most important effects resulting from this disaster, such as the economic, environmental, and social effects. The most important reasons that led to the urban sprawl disaster on agricultural lands and their relationship to the ability of cities to combat these risks were identified. The third axis touched on the ability of cities to find ways to combat disaster risks and the classification of international frameworks and conferences that dealt with this aspect. The fourth axis dealt with the resilience of cities. Within this axis, the resources related to urban resilience frameworks were classified into cross-sectoral and sector-specific frameworks. The cities resilience scorecard developed by the United Nations Office for Disaster Reduction, part of the cross-sectoral framework, was selected. This card was analyzed, and the necessary sources and data were collected for understanding and then applied to the functional study area.

### The practical side

The practical side relied on the quantitative analytical approach for the study area, represented by the city of Baghdad, to determine the extent of the city's ability to withstand the catastrophe of urban sprawl on agricultural land. Methods of collecting data about the study area included three main methods:

1. Using the remote sensing system (aerial images and satellites) with examinations and field surveys and a comparison between the map of the city of Baghdad for agricultural use within the basic design maps and the change that occurred in the city of Baghdad due to the phenomenon of urban sprawl on its agricultural lands.

2. Choosing the fourth basic (the application of urban designs capable of being resilient) from among the ten basics proposed in the card for measuring the resilience of cities prepared by the United Nations.

3. Making a questionnaire to measure the main indicators branching from the fourth basic of the city's resilience card and then distributing the questionnaire to a sample of specialists in the relevant departments and institutions (Ministry of Planning, Ministry

of Housing, Municipality of Baghdad, municipalities that make up the city of Baghdad). The selected sample consists of 20 specialists from the fields mentioned above.

The answers were calculated using the Likert scale, and then the results were analyzed and presented in the form of tables and graphs to discuss these results and reach conclusions.

## **THEORETICAL FRAMEWORK**

### **Hazards and disasters**

Many studies have indicated that there is no such thing as a disaster, but disasters often follow dangers. Thus, it can be said that the danger becomes a disaster when human settlements are exposed to it and development is affected by it as disasters are sometimes considered external shocks (Bansal et al., 2013). Disaster risk is defined as a combination of the intensity and frequency of danger, the number of people and assets at risk, and their exposure to harm. Intensive risks are the disaster risks associated with low-probability and high-impact events, while broad risks are associated with high-probability and low-impact events (UNDRR, 2015). Thus, it can be said that disasters result from the interaction of hazards and weak conditions and thus are a product of social, political, and economic environments. When disaster risks affect cities or urban areas, they are referred to as urban disaster risks, and thus the research will address the concept of disaster risks and their characteristics, focus on urban disaster risks, and the relationship of cities to those risks.

### **The concept of disaster risk**

Disaster risk is widely recognized as the interaction between hazards and the characteristics that make people and places vulnerable. Schipper et al. originally defined disaster risk as to the probability of a natural event multiplied by its outcomes (Schipper & Pelling, 2006). The disaster risk is a process of accumulation and that its effects have led to significant imbalances in different countries (O'Keefe et al., 1976), "urban

vulnerability to hazard is a function of human behavior, and describes how urban social and economic systems and physical assets are either vulnerable or resilient to natural hazards" (Rashed & Weeks, 2003).

### **Characteristics of disaster risk**

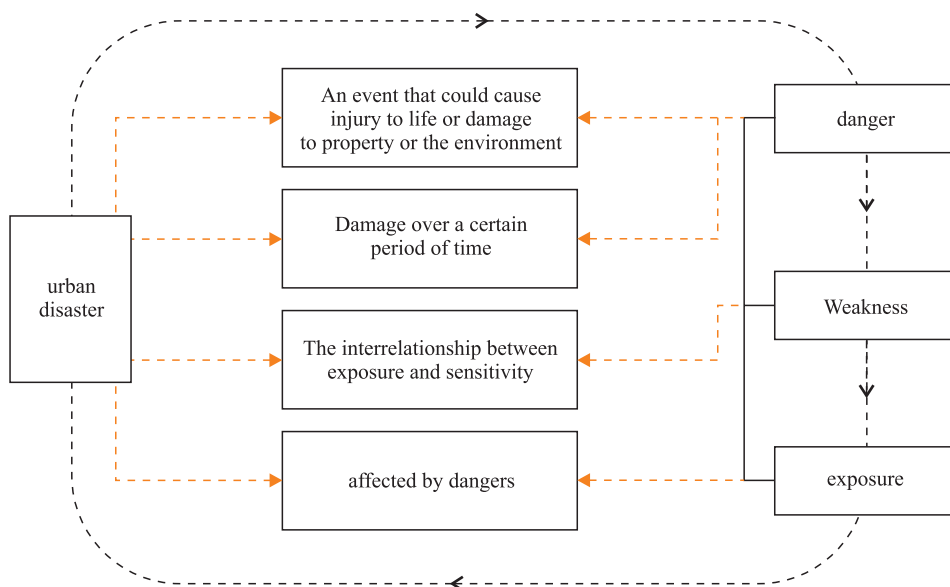
Disaster risks have many characteristics that can be summarized as follows (Bansal et al., 2013):

1. Forward-looking: at the probability of loss of life, destruction, and damage in a given time.
2. Dynamic: can increase or decrease according to our ability to reduce vulnerability.
3. Invisible: consists of not only the threat of high-impact events but also low-impact recurring events that are often hidden.
4. Unevenly distributed around the earth: Hazards affect different regions, but the pattern of disaster risk reflects the social construction of exposure and vulnerability in different countries.
5. Emergent and complex: Many processes, including climate change and globalized economic development, create new and interrelated risks.

It is clear from the above that the characteristics of disaster risks overlap between several dimensions represented by the spatial and social dimensions, which are directly or indirectly reflected in the city. Therefore, the research had address the risks of urban disasters and their relationship to the city since it represents the political and economic center.

### **Urban disaster risk**

Research has traditionally expressed disaster risk as the probability of future loss due to three factors, risk (the probability of a potentially harmful physical event such as a hurricane, earthquake, or drought), exposure (the population or assets – including human settlements, infrastructure, crops, and livestock – at risk) and vulnerability. (Exposure to loss, associated with a combination of physical, social, economic, and other characteristics of the exposed items). The risks are defined as follows Figure 1:



**Fig. 1.** Urban disaster  
 Source: researchers based on Serje & Team (2011) and Taubenböck et al. (2008).

1. Hazard is a phenomenon or event that can cause injury to life or damage to property or the environment (e.g., flood, hurricane, volcanic eruption, earthquake, landslide, or man-made hazard). The magnitude of the phenomenon, the probability of its occurrence, and the extent and severity of its impact may vary. In many cases, these impacts can be anticipated or estimated, and thus people and the environment are vulnerable to disaster because of the risks (Serje & Team, 2011).

2. Risk is the probability of damage occurring during a certain period. They include the potential effects of interrelated (socio-economic impacts on employment, production, etc.) or induced effects (effects of hazardous industries, dam collapses, fires and explosions, etc.) and a human or social dimension (demographic, socio-organizational, political, educational and cultural) (Taubenböck et al., 2008).

3. Vulnerability is the interrelationship between exposure, sensitivity (system stress), and adaptive capacity (system potential) to reduce the impact of danger (Taubenböck et al., 2008).

4. Exposure is another component of disaster risk and refers to the vulnerability to hazards such as people and property.

### City and disaster risk

Since the twentieth century, disaster risks, economic losses, and people affected have increased dramatically in cities worldwide. Cities as centers of politics, economy, and culture have provided many job opportunities and other characteristics such as population concentration, a large number of buildings, and different types of infrastructure. These characteristics allow cities to function normally and become livable. However, it also revealed the emergence of new and ever-changing disaster risks. The characteristics of new disaster risks differ from traditional disaster risks in that they are extreme, unknown, and often high in destructive power, which may cause serious human losses, property damage, and social unrest in the country or regions (Mercer et al., 2010a). Moreover, these characteristics make it difficult to predict new disaster risks. Thus, it can be said that the development of cities, to a large extent, transformed risks into disaster risks and increased the possibility of these cities being exposed to the risk of new disasters (Jie et al., 2017).

Cities face enormous disaster risks exacerbated by uncontrolled population growth, deterioration



of the physical living environment, and human actions being a responsible phenomenon. Thus, the meaning of “natural disasters” has constantly changed from a historical point of view (Norris et al., 2008). From the “forces of nature” to the “actions of men”. Scientific researchers realized that disasters are no longer the product of purely natural phenomena but rather the result of a combination of natural and human environmental systems (Liu & Wang, 2015). There has been a significant increase in low frequency and high consequences disasters such as climate change, global warming, etc., which have caused unpredictable, unbalanced, and deadly disasters. Thus, human actions cause many problems and increase risks in cities. Various social and environmental trends, from local to global, contribute to increased disaster risk and vulnerability for cities (Ismail-Zadeh et al., 2017). The most important are unplanned expansion, rapid urbanization, inappropriate land use planning, and poor application of building regulations (FH-Köln et al., 2010). Rapid urbanization, combined with urban poverty and widening income and wealth gaps between and within urban areas, often increases the exposure of people and economic assets to the risk and creates new patterns of disaster risk. This makes disaster risk management in urban areas particularly complex (Cutter, 2021). Disaster risks in urban areas are classified into five categories (Bansal et al., 2013):

1. Capital risks: include damage to government buildings and basic facilities. Damage to buildings and services and machinery, equipment, and furniture.

2. Environmental risks: include water and air pollution, biodiversity loss, and noise and light pollution.

3. Social/cultural risks: loss of life, injury, disease, disability, demographic change, loss of cultural and historical resources, and change in the character of residential neighborhoods, which in turn affects the population and exposes them to danger.

4. Institutional and policy risks: include governmental responsibility, eroding society's vision, and undermining other policies.

5. Economic risks: They include the financial loss of the government, the financial loss of business, the

decrease in tax and commercial income, the increase in government expenditures, the lack of affordable housing, and the loss of work, which in turn directly affects the increasing phenomenon of urban sprawl as it is a major problem that many cities suffer from. Especially cities that suffer from the absence of planning laws.

It can be said that there is a consensus from many studies since the late nineties on the idea that cities that suffer from urban sprawl are less sustainable economically and socially (Rubiera-Morollón & Garrido-Yserte, 2020). The research will focus on the risks of an urban disaster that cities should consider to achieve resilience in the coming paragraphs.

## Urban sprawl

Since the second half of the last century, there has been a dynamic development of cities which have played an increasingly important social and economic role. Changes in the work of urban areas caused a loss of control within some development processes, which led to a disturbance in the functional and spatial structure of each of the cities and their neighborhoods. Therefore, urban sprawl has become an important research problem regarding the conceptual dimension (Lityński, 2021).

Urban sprawl is defined as scattered and inefficient urban growth (Hasse & Lathrop, 2003). Slavati and Morelli reviewed the distinct definition of urban sprawl. Among the definitions, it can be noted that urban sprawl is greedy, selfish, and inefficient in the use of land, which leads to monotonous development without interruption. It is not continuous spatially (Salvati & Gargiulo Morelli, 2014). In the second decade of the twenty-first century, there is consistency in defining urban sprawl as a chaotic change in spatial structure with a low degree of control through spatial politics (Lityński & Hołuj, 2020). Thus, it can be noted that the essence of the term urban sprawl is to understand what is the chaotic change in the spatial structure, which is a question related to morphological features, as urban sprawl is usually described as a loose form of housing, whether on the outskirts of cities or in suburban areas (Galster et al., 2001).

Urban sprawl takes many different forms, including residential buildings, industrial facilities, infrastructure, etc. It takes many types in terms of encroachment on agricultural lands, highways, archaeological sites, water sources, and sources of biodiversity. Thus, urban sprawl refers to the growth of urban areas resulting from uncontrolled, uncoordinated, and unplanned growth and its continuation leads to a phenomenon, and the phenomenon turns into a problem and then into a disaster. As a result of the increase in the urban sprawl of all kinds globally, the research will focus on encroachment on agricultural lands as a man-made disaster. Being a problem facing the world's agricultural resources is a warning to advocates of fair housing, environmental scientists, land-use planners, and many employers (O'Keefe et al., 1976) trying to resist its effects and recover from them quickly and efficiently.

Since the topic of the research deals with urban disasters and their relationship to the city, the research will address the dangers of urban sprawl on agricultural land and its effects.

### Risks of the urban sprawl disaster on agricultural lands

The problem of urban sprawl at the expense of agricultural land is one of the problems that all countries of the world suffer from, especially those characterized by rapid population increases. Human activities, especially urbanization, have led to a great loss of agricultural land (Shi et al., 2016). This phenomenon has become a challenge to most countries of the world. Since the Neolithic period, the transformation of the land by human action has mainly included effects on soil and vital resources. The land transformation has not receded but rather accelerated and diversified. With the onset of the Industrial Revolution, the globalization of the world economy, the expansion of population and technological capacity, forests were cleared, grasslands were plowed, and wetlands were dried up. The global demand for land products will likely continue to grow for the foreseeable future, and thus maintaining the

ability of the land to meet this demand will remain of fundamental importance. The level of interest generated by current trends reflects the potential for land conversion to pose a degradation and danger in the near future (Fazal, 2000).

Land converted from agricultural to urban uses can significantly affect broader environmental sustainability and ecosystem functioning and affect the areas of economic and social well-being. The main drivers of land-use change are numerous, including social and economic forces, urbanization, technological developments, and land use policies (Ustaoglu & Williams, 2017). Thus, it can be said that the causes of urban sprawl on agricultural lands are many and varied, and the research will address the most important of those reasons to show the dimensions and the associated and causative bodies of sprawl to determine the risks and to develop solutions that contribute to preserving agricultural lands.

1. Lack of laws and regulations to plan for solutions to reduce encroachment on agricultural lands, as most of the decisions taken by competitors in the private and government sectors are based on expectations that do not meet the requirements or needs of future development.

2. Sometimes urban sprawl occurs due to improper financial costs (such as rough terrain, wetlands, mineral lands, water bodies, etc.), resulting in high financial costs incurred on providing infrastructure services and, in turn, the ease of infrastructure services in a land agricultural (Brueckner, 2000).

3. Farmers are often tempted by the prospect of selling rather than continuing with the farming business. Because the value of the revenue of the built facilities is much better than the value of the land's agricultural production, urban use is often preferred over agricultural use, which leads to the growth of the city and thus urban sprawl (Schipper & Pelling, 2006).

4. Industrialization led to social transformations and changed the traditional view of agriculture. The region's residents tend to work in government jobs and leave work in agriculture, which leads to neglecting agricultural land, and preferring buildings

instead of farming because building shops and renting provides them with a better income than their income in agriculture (Schipper & Pelling, 2006).

5. The lack of affordable housing for low-income people. Due to the high land prices and the consequent inability of these groups to buy land and build on it (Asif, 2014).

### The effects of urban sprawl on agricultural lands

Changes in urban sprawl on agricultural lands are linked to complex processes that lead to multiple social, economic, political, and environmental risks (Rashed & Weeks, 2003). Once agricultural land is paved and built for urban use, it is lost forever to non-agricultural uses. It is an irreversible category. The risks of this disaster are not just about urban sprawl but should be measured concerning the effects and dimensions of this phenomenon, represented by:

### Economic effects

Urban sprawl leads to the depletion of major natural resources such as agricultural land, one of the economy's most important components. Consequently, the lower per-capita productive agricultural land in the world and the fact that living in larger and more widespread areas makes public services more expensive in general with the higher cost of providing infrastructure. Reduced food production is a direct consequence of agricultural land conversion, affecting national food security.

### Environmental effects

The urban sprawl on agricultural lands has several effects on the ecosystem within the city, as follows, see Figure 2:

1. The United Nations Environment Program defines desertification as the spread and increase

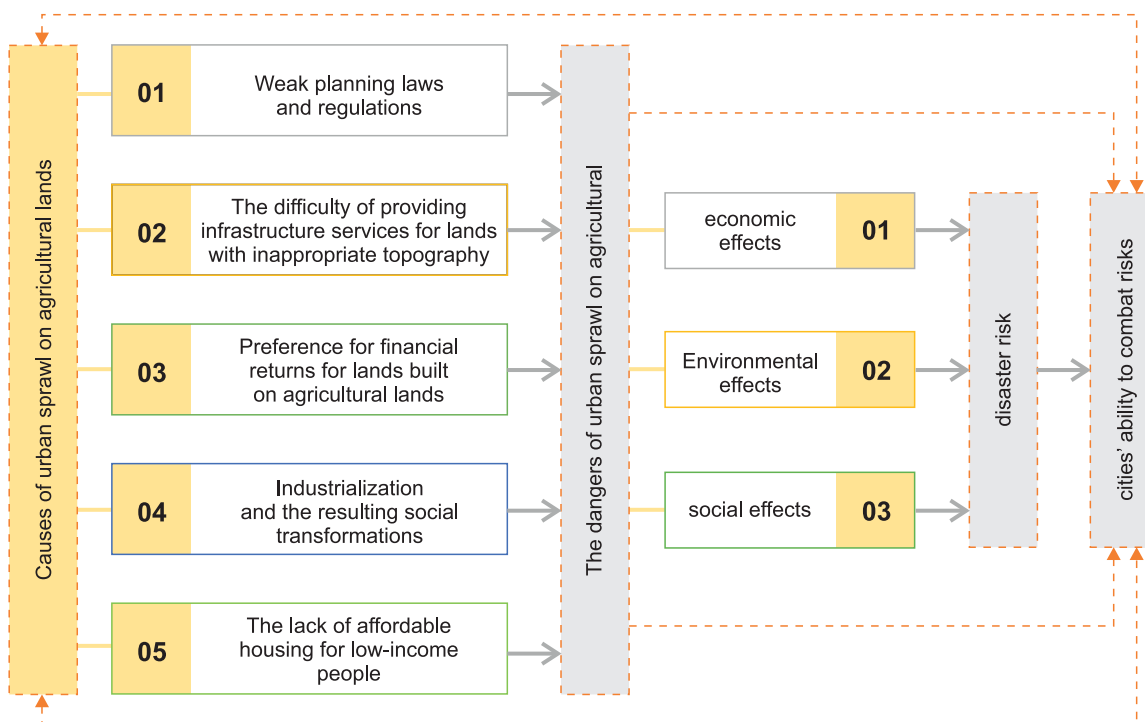


Fig. 2. Causes of urban sprawl on agricultural lands  
Source: researchers based on Stone et al. (2010) and Bhatta (2010).



of desert conditions that decrease the productivity of living matter. Urban sprawl on agricultural lands leads to desertification. This reduces the production of crops, and consequently, the loss of fertile soil and the loss of organic elements needed by the land for plant growth makes it unsuitable for agriculture.

2. In cities with high levels of urban sprawl, rising temperatures have more than twice the number of days with extreme temperatures than in cities with more compact growth patterns (Stone et al., 2010).

3. Increased consumption of fossil fuels and greenhouse gas emissions. Urban sprawl leads to poor air quality through increased housing and dependence on cars, which increases dependence on fossil fuels (Bhatta, 2010).

4. Impacts on wildlife and the ecosystem. In areas where encroachment is not controlled, ecosystem patterns change. Urban sprawl has serious impacts on water quality and quantity. Since a large area of land is covered with impermeable materials such as concrete, there is less leaching of rainwater to reach the aquifers, thus exposing the area to increased flood risks (Bhatta, 2010).

### Social effects

Spatial diversity is based on social classes, the disparity in wealth between cities and agricultural areas, and social issues related to the deterioration of urban communities and the quality of life, including the disintegration of society and the lack of social interaction (Taubenböck et al., 2008).

From the preceding, it is clear that the risks of urban sprawl on agricultural lands are a real urban disaster due to the effects resulting from this disaster in its economic, social, and environmental dimensions. It is necessary to shed light on this disaster and indicate the extent of the cities' ability to address it and recover from it. Therefore, the research will address cities' capacity concerning disaster risks.

### CITIES' CAPACITY TO COMBAT DISASTER RISKS

The concept of disaster resilience is key to resolving the complex and uncertain interactions between natural and human ecosystem systems (Mercer et al., 2010a). The increasing contradictions in population, resources, and the environment have led to the concept of resilience to disaster risk becoming a basic concept of research in sustainable urban development and a common concern in many disciplines. Aldrich et al. noted that disaster resilience is the ability to respond effectively to disaster disturbances. He defined the concept as "the ability of communities or cities to be resilient to the disruptions of disasters and with a high capacity to combat disaster risks can continue to operate or recover quickly during or after disasters" (Aldrich & Meyer, 2015).

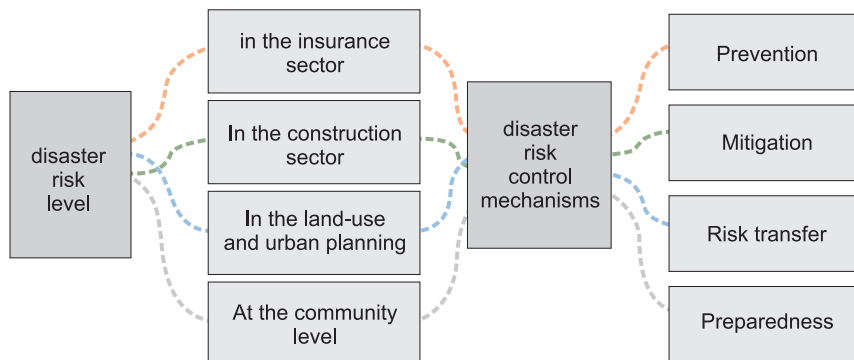
There are both political and economic imperatives for disaster risk reduction. Disaster risks are a common risk. Businesses, the public sector, and civil society participation in its construction and thus, combating disaster risks must be considered a shared value. This, therefore, requires an approach that initially relies on providing risk information as a critical foundation for the ability to combat and manage disaster risk across a wide range of sectors (Norris et al., 2008):

1. In the insurance sector, disaster risk assessment is essential. The capital of most insurance companies other than life insurance is severely affected by their exposure to the risks of natural disasters.

2. In the construction sector, identifying potential risks expected in the life of a building, bridge, or critical facility leads to the creation and modification of building codes.

3. In the land-use and urban planning sectors, robust flood risk analysis similarly drives investment in flood protection and potentially the effects of changes in insurance.

4. At the community level, understanding hazardous events – whether from living memory or oral and written history – can guide and influence



**Fig. 3.** Disaster risk levels  
 Source: researchers based on Cutter et al. (2008).

preparedness decisions, including life-saving evacuation procedures and the location of important facilities.

The ability to combat disaster risks contributes to building the capacity of cities and society to anticipate, deal with, resist and recover from disasters through activities related to the following (Liu & Wang, 2015):

1. Prevention: the complete avoidance of the negative effects of related hazards and disasters (often less costly than disaster relief and response).

2. Mitigation from the negative effects of a hazardous event. For example, nature-based flood mitigation can help Mississippi River farmers.

3. Risk transfer is the formal or informal transfer of the financial consequences of certain risks from one party to another. Where the family, community, institution, or state authority will obtain resources from the other party after a disaster has occurred. This is in exchange for current or compensatory social or financial benefits provided to that other party.

4. Preparedness The ability of governments, communities, individuals, and disaster recovery organizations to effectively predict, respond to, and recover from potential, imminent, or current disasters. Cities' understanding of systems and strong governance structures, and political and social participation by stakeholders all influence the ability to reduce disaster risk either negatively or positively (Cutter et al., 2008).

From the preceding, it is clear that the capacity to reduce disaster risks is a participatory building

process between several sectors, each with a goal (companies, the public sector, and civil society). Therefore, the research will address the international and global frameworks and conferences that took into account and shed light on the importance of disaster risk reduction in order to extract the most important global common points that contribute to controlling urban disasters Figure 3:

### INTERNATIONAL FRAMEWORKS AND CONFERENCES FOR DISASTER RISK REDUCTION

Cities are complex and are made up of several overlapping physical systems, and human societies are prone to disasters to varying degrees (Mercer et al., 2010b). As cities grow larger, they will become more economically productive. In doing so, it acts as a magnet for rural-urban migration. As urbanization continues, more and more people are settling in cities, which leads to urban sprawl and increased density. Urbanization has the potential to make cities more prosperous and countries more developed. However, many cities worldwide are completely unprepared for the multidimensional challenges associated with urbanization. As a result of rapid urbanization, cities are highly vulnerable to threats posed by hazards, often lacking the capacity and resources to deal with the sheer scale of risks. Despite various local coping strategies, urban communities cannot mitigate, reduce or manage the disasters that result from an urban

development process outside their control (Aldrich & Meyer, 2015). Many international frameworks and conferences have emerged to reduce disaster risks and make cities disaster-proof.

### Hyogo framework for action

The 10-year Hyogo Framework for Action emerged from the World Conference held in Kobe, Japan, from January 18–22, 2005. The Hyogo Framework for Action (HFA) is the first blueprint to explain, describe and detail the work required of all sectors and different actors to reduce disaster losses. The Hyogo Framework for Action identifies five priorities for action:

1. Make disaster risk reduction (DRR) a priority.
2. Know the risks and take action.
3. Build understanding and awareness.
4. Reduce risk.
5. Be prepared and ready to act.

The framework provides guidelines and practical means for achieving resilience in the face of disasters. Its goal is to significantly reduce disaster losses by 2015 by building the resilience of nations and societies to disasters (Norris et al., 2008).

### Sendai framework

Outlines the Sendai Framework for Disaster Risk Reduction: 2015–2030 adopted at the Third United Nations World Conference on Disaster Risk Reduction. The priorities for action at the national and local levels are to reduce the deaths and direct economic losses of disasters (including damage to critical infrastructure) by increasing the number of national and local disaster risk reduction strategies by 2020. These strategies should be Available across different time scales, with targets, indicators, and timeframes all aimed at preventing the emergence of risks, minimizing existing risks, and enhancing economic, social, health, and environmental resilience (UNDRR, 2015).

With the adoption of the Hyoko and Sendai Framework for Action and SDG 11 to “make cities inclusive, safe, resilient and sustainable”, many efforts

are being made to build resilience. Thus, the concept of resilience appeared in urban studies and disciplines related to cities facing disaster risks and emphasizing the concept of resilience for cities and societies in the face of disasters.

### RESILIENCE OF CITIES

An effective way to estimate urban disaster risk is to determine how resilient a city is to urban disasters. This will help understand the city's vulnerability and, thus, indirectly discover the risks that urban disasters pose to the city. Definitions and approaches to resilience vary from social systems to engineering to environmental to public health. Despite the subtle differences, there is consistency between views regarding promoting positive social change leading to long-term sustainability. i.e., moving forward to what could have been, not regressing to what was (Mercer et al., 2010a). Leichenko defines resilience in its simplest form as “the ability of a city or urban system to withstand a wide range of shocks and stresses” (Aldrich & Meyer, 2015). Boshier defined it in theoretical research as “the ability of the city and society to use all forces and resources to reduce the risks and effects of disasters, as the internal weakness of urban systems” resilience is an essential ability to predict the effects of disasters and to resist or recover from them (UNDRR, 2015). The National Academy of Sciences (NAS) defines resilience as “the ability to plan, prepare for, absorb, recover from, and adapt to adverse events” (UNDRR, 2015). Teoh and Zadeh provide a different definition. They focus on resilience more as “a measure of the persistence of systems, and their ability to accommodate change and disruption and still maintain the same relationship between population and state variables”. Therefore, “essential”, as they rely on this definition for resilience. It is “a function of public awareness of the organization's situation, underlying vulnerability and adaptability in a complex, dynamic and interconnected system” (Cutter et al., 2008).

They are often seen as highly complex and adaptive systems as cities continue to grow and address risks

and challenges. Thus, it can be argued that resilience has emerged as an attractive perspective on cities. It is becoming an increasingly preferred concept for disaster risk reduction.

### Flexibility frameworks

A wide range of efforts has been made to develop frameworks and tools for measuring and reporting resilience in recent years. These areas generally fall into two broad areas:

1. Cross-sectoral frameworks: These frameworks can generally be described as high-level frameworks that capture and report resilience in broad areas/sectors (e.g., planning, infrastructure, emergency response, economics, governance, etc.). In many cases, these broad sectors are broken down into more specific indicators that can be used to develop measurement tools. Lisa, Schipper, & Langston have reviewed and compared a wide range of frameworks. This included (Mercer et al., 2010b):

- a. ARCAB – Action Research for Community Based Adaptation;
- b. CRF – City Resilience Framework from the Rockefeller 100 Resilient Cities Programme;
- c. CoBRA – UNDP Community-Based Resilience Analysis Framework;

d. UNDRR Disaster Resilience Scorecard for Cities (based on the “10 essentials”);

e. USAID Measurement for Community Resilience.

Their analysis found a variety of resilience measures and that the comparisons were different as each was developed for a different purpose. They also found that many frameworks attempted to apply quantitative or semi-quantitative indicators to resilience criteria. They conclude that indicators should be used with caution, and in some cases, their use may be incompatible with the desire to measure resilience.

2. Sector-specific resilience frameworks: These are generally more detailed assessments that focus on one specific sector, such as infrastructure, ecosystems, economies, or organizations.

Hughes & Healy defined and reviewed infrastructure resilience frameworks in detail. A distinction is made between conceptual (qualitative) and indicator-based frameworks and the frameworks that attempt to scale before or after the event (Aldrich & Meyer, 2015).

They continued to develop a transport resilience framework based on technical (infrastructure) and organizational flexibility. The organizational resilience indicators developed from Resorgs include three main

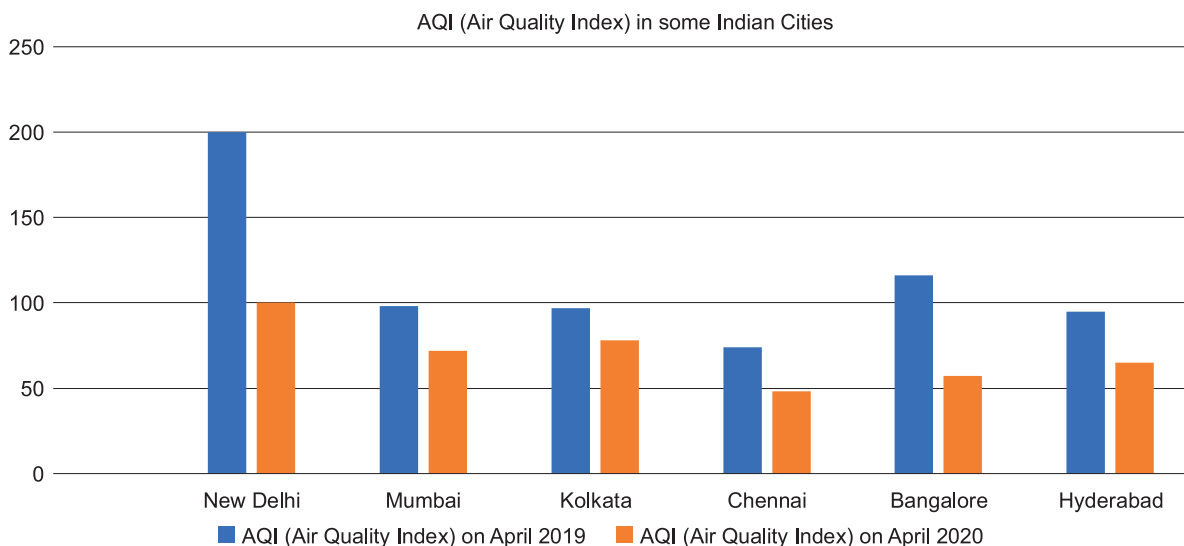


Fig. 4. Flexibility frameworks  
Source: own preparation based on UNDRR (2015).

focus areas: Change readiness, leadership and culture, and networks/relationships (UNDRR, 2015).

In this context, the research focuses on the “Ten Essentials” included within the cross-sectoral frameworks developed by the United Nations Office for Disaster Reduction to promote a greater understanding of local governments and their commitment to disaster risk reduction and making cities resilient disaster risks (Fig. 4).

### **UNISDR 10 essentials and scorecard**

The United Nations Office for Disaster Risk Reduction (UNISDR) launched the Make Cities Resilient campaign in 2010 because of the increased risks associated with global urbanization. This campaign highlights resilience and disaster risk reduction among local governments and urban communities worldwide. To enhance the role of local governments in reducing these risks, the campaign is based on self-motivation and partnership. So does a focus on resilience – the city’s ability to plan, mitigate, respond, recover, adapt and grow after disasters in light of its unique physical, economic, environmental, and social conditions (Mercer et al., 2010a).

Although all levels of government are generally expected to be involved in disaster risk reduction, the role and actions of local governments in making cities resilient are critical. Local governments can play a key role in making cities resilient in many ways because they are rooted at the local level where disasters occur. Since its launch, the campaign has collected pledges from more than 3,000 cities. By subscribing to the campaign, local governments are committing to implementing the “10 Essentials” to make cities resilient, a checklist of 10 essentials that guide disaster risk management and good disaster reduction practices.

Given the implementation of the 2030 global agendas, the increasing risks, and future projections of uncontrolled urbanization, there is a need to design the “Ten Essentials” to be more feasible and encourage

cities to move towards their implementation. Member States and stakeholders have called for revisions to local indicators, informed by the basics, and the reporting process. These revisions are required in the new framework, including the goals of the Sustainable Development Goals (Aldrich & Meyer, 2015).

The Make Cities Resilient Steering Committee met in September 2014 and developed guidance for the United Nations Strategy for Disaster Reduction to review the Ten Fundamentals. The recommendations included:

1. Create a group consisting of technical agencies, experts, and partners working at the local level to lead the modification and harmonization of the Ten Fundamentals.

2. Involve national and local governments in the process to ensure that relevant linkages are built-in measurement and monitoring; ensure that empirical studies are conducted to take into account the facts on the ground.

3. Focus on action-oriented actions; participation in intergovernmental processes to obtain validation of new fundamentals and indicators.

Then these basics were finalized after further consultations and experiments. These new fundamentals are aligned with guidance provided by the Sendai Framework for Monitoring Disaster Risk Reduction at the local level. Pilot tests of the New Essentials and their indicators and generation of guidance notes were conducted in 20 cities starting in January 2016. The resulting feedback was used in the pilot studies to review the 10 New Essentials and develop final indicators and guidelines. These revisions were then incorporated into the new indicators of the Joint Monitoring and Action Planning Tool for Disaster Risk Reduction at the local level. The main objective of the New Essentials is to be implementable as these 10 New Essentials build on the previous ones, just as outlined in the Post-2015 Framework for Disaster Risk Reduction on the Hyogo Framework for Action (2005–2015), which marks the transition to implementation.



### Implementation of the “ten essentials” and the scorecard

The Ten Essentials define the elements or characteristics of a city to absorb shocks and stresses or recover quickly from them. Indicators that support the fundamentals measure whether or not these characteristics exist and to what degree they are present so that decision-makers can indicate “how a city would perform in the face of shocks and stress”.

In some cases, this may require a qualitative approach in evaluating the degree of presence or absence of a characteristic and each basic covering one characteristic. However, to understand to what degree it exists, several sub-indicators are used to reflect the composition of the main characteristic. The sub-indicators must be evaluated, and a qualitative score should be determined with the reasons given. This will provide more detail and substance for each of the main indicators.

This process establishes a “baseline” at multiple levels. Strategically, it provides cities with clear guidelines for prioritizing action while, at the sub-indicator level, it enables the identification of gaps or weaknesses. Thus, remedial actions can build resilience coherently and systematically.

The “Ten Essentials” Figure 5 form the basis of the approach and the structure of the Disaster Resilience Scorecard. The scorecard provides an assessment process that allows for the review and monitoring of cities’ resilience in the face of disasters. The Ten Fundamentals cover three main aspects of the Council’s disaster risk reduction strategies/plans.

- a. Increasing governance and financial capacity;
- b. Integrated planning and disaster preparation and, Post-disaster response and recovery.

### PRACTICAL FRAMEWORK

1. The research will deal in its practical framework with the following work mechanism.
2. The city of Baghdad as an elected case study and a statement of the reality of urban sprawl on agricultural lands within it using remote sensing (aerial and satellite images). Along with field inspections and surveys to measure the loss of agricultural land due to urban expansion in the city of Baghdad.
3. The fourth basis of the card measures the ability of the city of Baghdad to withstand the danger of urban sprawl on agricultural lands.
4. Apply the scorecard to the elected case.

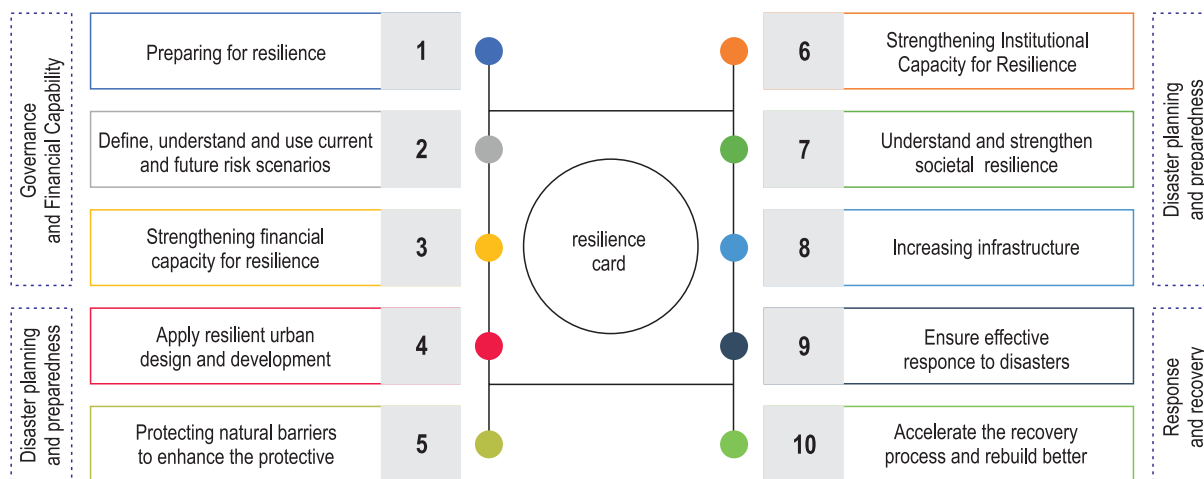


Fig. 5. Resilience scorecard  
 Source: own preparation based on UNDRR (2015) and Mercer et al. (2010a).

### Choosing the study area and the reasons for choosing it

The boundaries of the spatial study area include the city of Baghdad, the capital of the Republic of Iraq, the administrative center of Baghdad Governorate, the largest city in Iraq (with an area of 4.6 square kilometers), the second-largest city in the Arab world after Cairo, and the second-largest city in West Asia after Tehran, the capital of Iran. The city of Baghdad acts as an economic, administrative, and educational center in the country (Santos-Reyes, 2010). As a result of its geographical location, it is prevented from having many agricultural lands classified within agricultural

use in Baghdad. The study area was chosen for the following reasons:

The state issued laws in successive periods of distributing lands for agricultural use, dividing them for residential use or other uses, and giving building approvals within these lands without paying attention to the basic design and nature of the land uses.

1. Expand the building area of the city of Baghdad tremendously at the expense of the area of agricultural land surrounding it.

2. The entry of slums into the city of Baghdad and the irregular encroachment on the surrounding agricultural lands. This is due to several reasons: the increasing immigration resulting from the

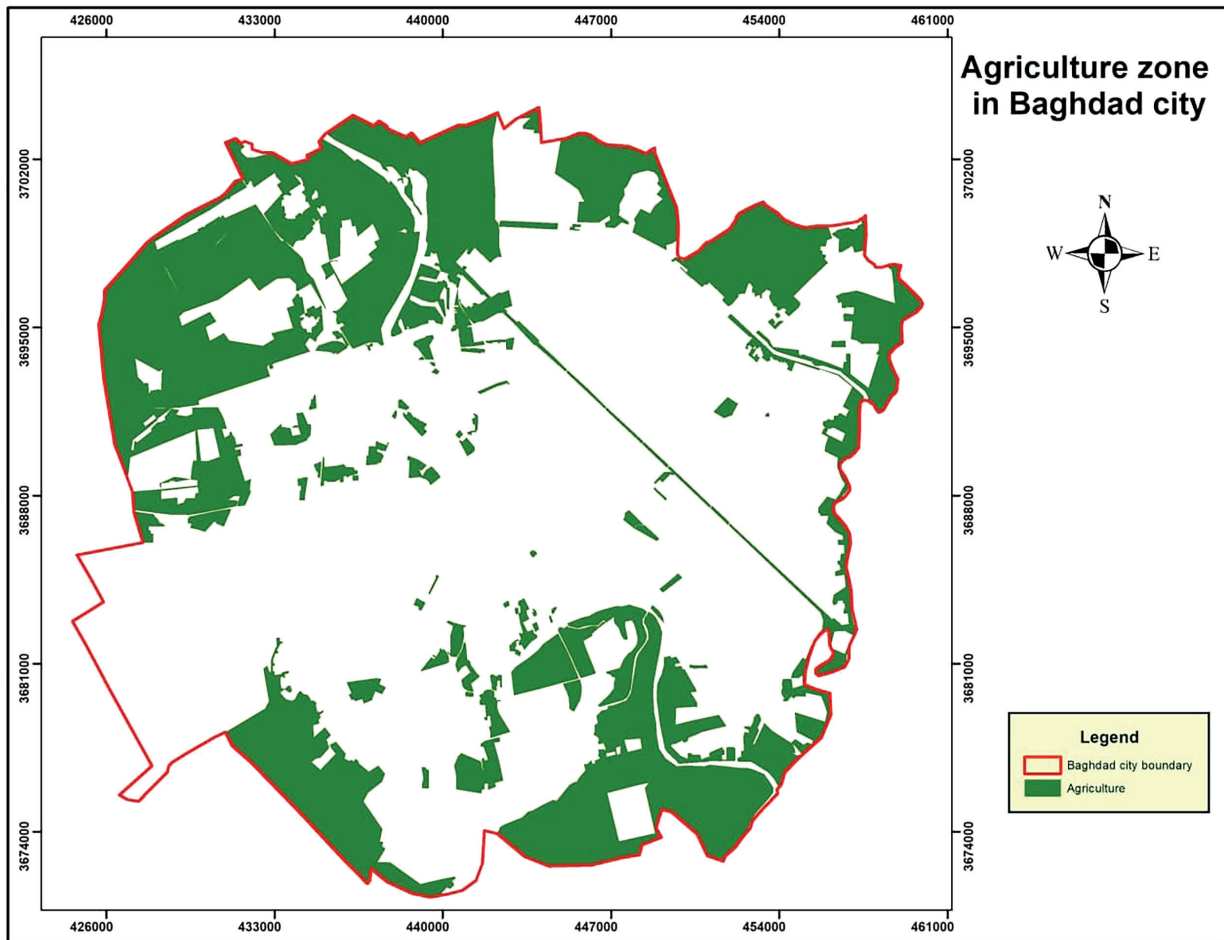


Fig. 6. The urban sprawl on agricultural lands in the Baghdad governorate  
Source: own preparation based on Authors (2022).

security conditions of Iraq in general, the economic situation and the search for work, and other reasons that allowed the encroachment on agricultural lands.

3. The dredging of thousands of orchards in Baghdad, which contains many palm trees and citrus, threatens a serious decline in the environmental reality and the desertification of the surrounding environment (Santos-Reyes, 2010).

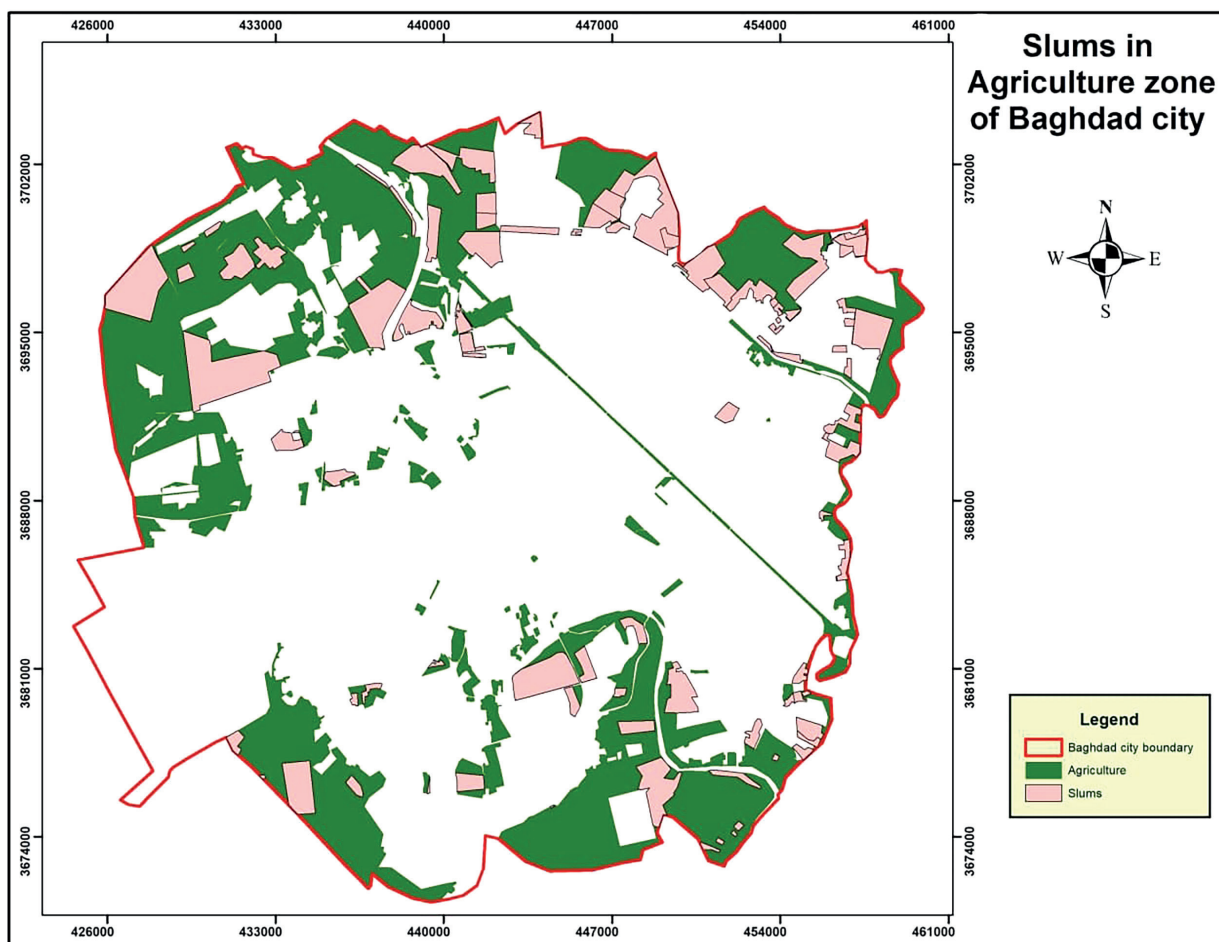
### The reality of the causes of urban sprawl in the city of Baghdad

Several reasons contributed to the urban sprawl towards agricultural lands within Baghdad, where the area of agricultural use within the city reached

27,453 hectares, as shown in Figure 6. The area overrun by random residential use and other uses amounted to approximately 6987.3 hectares, as shown in Figure 7. The most important reasons that led to this encroachment and transgression can be stated as follows:

### Population growth in the city of Baghdad

The ratio of the population of Baghdad to the total population of the whole of Iraq has jumped very significantly in the course of a few decades. This large increase in the population was reflected in stifling overcrowding in many of Baghdad's residential areas, especially in the center of Baghdad. This rapid



**Fig. 7.** The area of agricultural land in the Baghdad governorate  
 Source: own preparation based on Authors (2022).

urban phenomenon has coincided with a period of unprecedented turmoil in the modern history of Iraq. A severe housing crisis erupted in Baghdad, traffic jams, and the emergence of a widespread deficit in services, as its population reached 7,055,000 people in 2021. Some to low-level or irregular dwellings (slums) and sprawl towards agricultural lands because of their vastness and mean value compared to residential lands Table 1.

**Table 1.** Change in the population of the city of Baghdad

| Year | Population |
|------|------------|
| 2021 | 8,780,422  |
| 2020 | 8,558,625  |
| 2019 | 8,340,711  |
| 2018 | 8,126,755  |
| 2017 | 7,926,847  |
| 2016 | 7,720,001  |
| 2015 | 7,506,105  |

Source: Ministry of Planning – Central Bureau of Statistics (2021).

### Weakness of laws and legislation

Many laws affected the future of the urban plan size of the city of Baghdad and the expansion of the city. And at the expense of the area of agricultural land. Resolution No. 117 of 2000 provides for the ownership of agricultural lands owned purely as a property, or endowed with a valid endowment, or properly endowed, or owned by the state burdened with dispositional rights, or belonging to the Ministry of Finance and at the disposal of agrarian reform destined for non-agricultural uses in accordance with the basic designs of cities and towns and their future expansions, intended to Allocate it to the military and police officers to the Municipality of Baghdad or the concerned municipality (UNDRR, 2015). As for the Supreme Committee for Basic Design decisions during the years 2004–2007, the Supreme Committee for Basic Design exercises its powers in accordance with the Basic Design Law No. 156 of 1971.

The Council of Ministers was approached to activate the committee's work, obtaining approval.

Since its formation, the committee has received many requests for changing land uses, especially agricultural and green lands, from their original uses to residential use under the pressure of the need for housing, especially with the efforts of state ministries to provide housing plots for their employees.

### Poor urban planning and non-compliance with structural plans

The spatial distribution of land uses almost the main engine for distributing the population and determining the general population densities in the city. Since the spatial trends of cities in Iraq are purely horizontal trends based on urban sprawl at the expense of agricultural lands, which led to the Iraqi cities, including the city of Baghdad, suffer from the problem of urban sprawl on the uses of the land allocated within the basic designs of the city and the lack of commitment to these uses contributed to the large size of the city, It expanded in different directions. An imbalance emerged between the city and its services.

### The fourth core of the Baghdad city resilience measurement card

The scorecard is based on ten principles to enable cities to withstand disaster risks, as clarified in the theoretical framework and through a study of the reality of the situation. It turns out that urban sprawl on agricultural lands has become a threat to future disasters as it is linked to several levels (social, economic, environmental, etc.). Therefore, it is necessary to plan and prepare for those disasters. Based on this, the second phase of planning and preparing for disasters was approved. Which includes five basics. The focus will be on the fourth since its indicators are directly related to the risks of the elected disaster, represented by urban sprawl in terms of land use, zoning, and building standards and codes. As well as a questionnaire for planning specialists from the concerned departments about the availability and preparation of policies to reduce the risks of this

disaster. Within the planning stage and disaster preparedness, the fourth basic (the application of resilient urban designs and development) was chosen, which includes a set of points that will be focused on, as it includes a set of indicators through which the measurement is made, as shown in the Table 2.

**Table 2.** Likert scale

| Likert scale | Range        |
|--------------|--------------|
| Severe       | 3.25 to 4    |
| Moderate     | 2.50 to 3.24 |
| Mild         | 1.75 to 2.49 |
| None         | 1 to 1.74    |

Source: own preparation based on Authors (2022).

### The mechanism of applying the fourth essential to the elected case

To measure the main indicators branching from the fourth basic (the application of resilient urban designs and development), a questionnaire was distributed through the Google Form to a sample of specialists in the relevant departments and institutions: (Ministry of Planning, Ministry of Housing, Municipality of Baghdad, municipalities constituting the city of Baghdad), to indicate and identify the special gaps that can be based on the. All this is made to provide recommendations that should be taken into account to prepare and mitigate the risks of the urban sprawl disaster on agricultural lands. A response was made by 20 people from the various government departments referred to, and the results were calculated. The answers were calculated by a Likert scale and will be relied on. The following values are used to interpret the questionnaire results.

### General background about the sample

Through the questionnaire form, the sample was distributed according to the entities in which it works, as follows in Table 3.

As for the specialization of the questionnaire sample, it was distributed in the following Table 4.

**Table 3.** Distribution of the sample by employer

| Sample employer  | Repetition | Percentage |
|--|------------|------------|
| Baghdad Municipality   | 9          | 45         |
| Ministry of Construction, Housing, and Public Municipalities | 7          | 35         |
| The Ministry of Planning                                     | 4          | 20         |
| Total  | 20         | 100        |

Source: own preparation based on Authors (2022).

**Table 4.** Sample Specialization

| Sample Specialization     | Repetition | Percentage |
|---------------------------|------------|------------|
| Project Management        | 1          | 5          |
| city planning             | 1          | 5          |
| Civil Engineering         | 4          | 20         |
| geometry space            | 5          | 25         |
| Architectural Engineering | 6          | 30         |
| other                     | 3          | 15         |
| Total                     |            | 100        |

Source: own preparation based on Authors (2022).

## RESULTS AND DISCUSSION

After the sample was surveyed about the questions related to the fourth basic indicator, this paragraph will analyze and discuss the sample results to reach results that show the city's ability to confront the disaster of encroachment on agricultural lands.

### The first indicator: zoning according to land use

Where the sample was asked: Is the city appropriately divided as it takes into account the risks that affect economic activity, agricultural and population centers? The results indicated Table 5, Figure 8: 25% of the sample indicated that there is no clear division of areas, and 45% indicated that this division is not deep or complete and is not regularly reviewed according to the dangers/disasters.

The sample indicated by 25% that the city of Baghdad is divided and interconnected to some extent, with the danger maps and plans to modernize the division not well understood. It is fully



**Table 5.** Zoning according to land use

| Zoning according to land use   | Repetition | Percentage | Mediator |
|--|------------|------------|----------|
| There is no clear division of regions  | 5          | 25         |          |
| The breakdown is not in-depth or complete and is not regularly reviewed according to risks/risks   | 9          | 45         |          |
| The city is divided by land use, which is interconnected,) to some extent with maps of hazards and risks) and divisional modernization plans are not well understood | 5          | 25         | 2.1      |
| The city is divided by land use, which is interconnected, (Fully with the hazards and risks maps) and the division is updated at agreed intervals                    | 1          | 5          |          |

Source: own preparation based on Authors (2022).

interconnected with the hazard and risk maps, and the division is updated at agreed intervals. The lowest percentage of the sample answers was 5%, indicating that the city is divided according to land use.

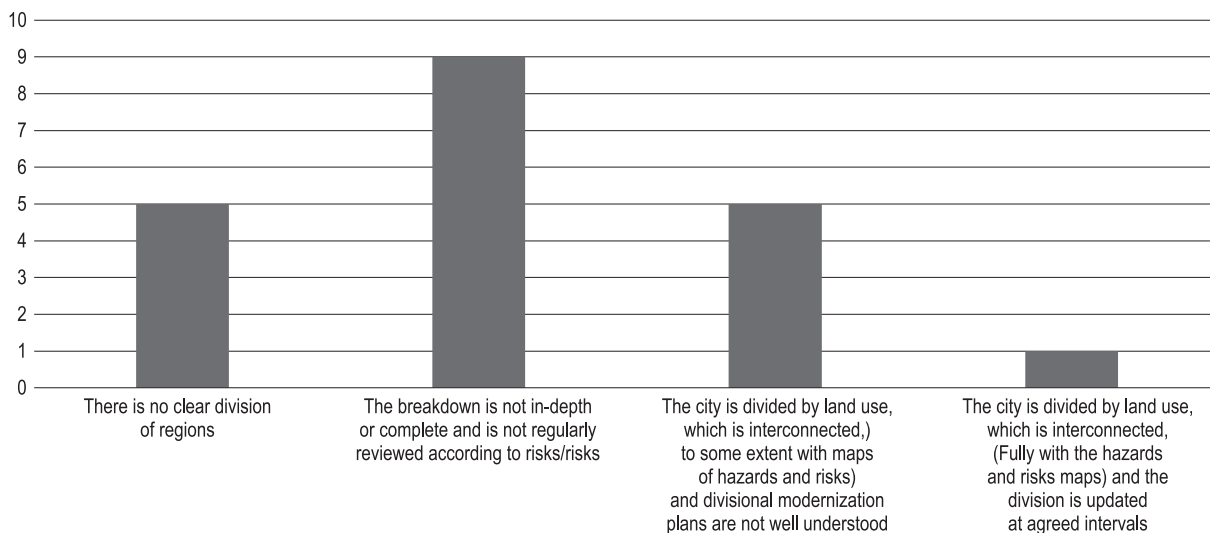
By analyzing the sample results, it is clear that the largest percentage of the sample (95%) indicates the

existence of gaps that have led to the inability of the city of Baghdad to absorb the danger of urban expansion that causing the disaster of losing agricultural lands. These gaps are represented by the lack of a clear and explicit division of agricultural and residential land uses. In the case of the division of agricultural lands, it is not integrated and is not reviewed with the urban expansion that occurs. As well as updating it according to the decline of agricultural land and its environmental and economic danger; in other cases, the gap lies in the lack of a clear understanding of modernization plans, their mechanisms, and details.

### The second indicator: new urban development

Sample question: Are methodologies promoted through the design and development of new urban development to enhance resilience? The results showed Table 6, Figure 9:

One answer out of 20, with a rate of 5%, indicated the availability of a clear policy at the level of the city of Baghdad. The guiding principles are prepared, and the sample agreed by 40% that if the policy exists, the problem lies in the guiding principles supporting it, as they are not appropriate.



**Fig. 8.** Division of areas according to land use

Source: own preparation based on Authors (2022).

**Table 6.** New Urban Development

| New urban development  | Repetition | Percentage | Mediator |
|--|------------|------------|----------|
| There is little or no strengthening of resilience in new urban development   | 5          | 25         |          |
| Resilience methodologies are enhanced but not consistently and are not based on city policy  | 6          | 30         |          |
| The policy is in place, but the guiding principles behind it are not appropriate   | 8          | 40         | 2.25     |
| There is a clear citywide policy. The guiding principles have been prepared for a range of practitioners, such as architects, landscape designers, engineers... etc. | 1          | 5          |          |

Source: own preparation based on Authors (2022).

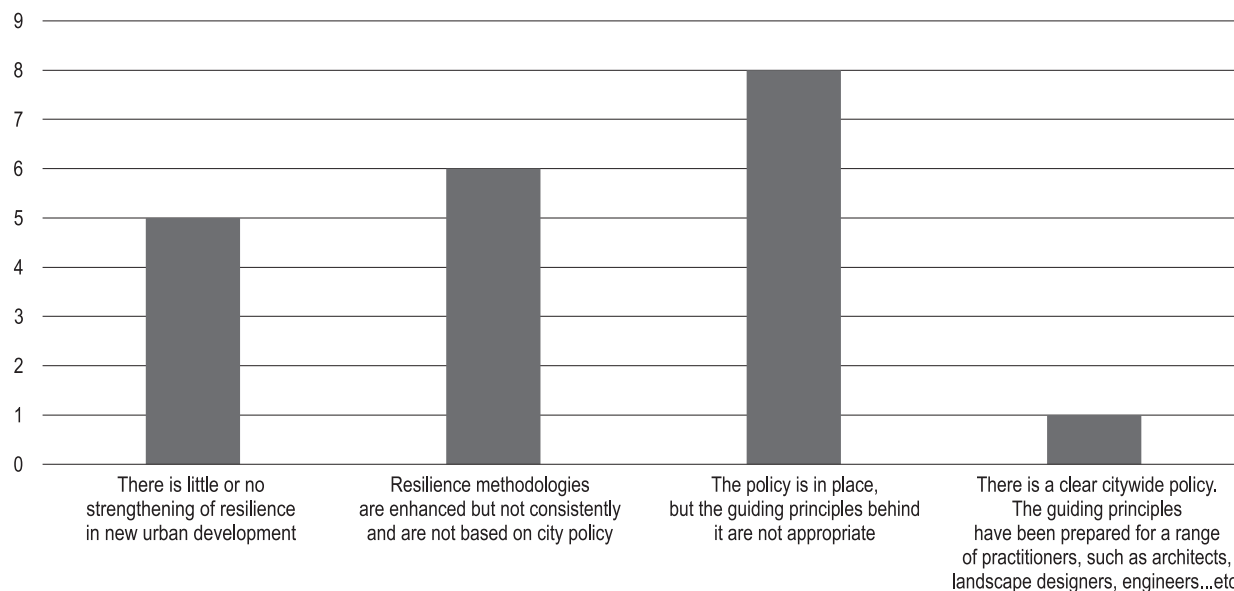
As for enhancing resilience, 30% of the sample indicated that resilience methodologies are being strengthened, but not consistently and not based on city policy. Moreover, 25% have little or no resilience in new urban development.

Analyzing the sample results makes it clear that gaps lead to the city's inability to withstand the disaster of losing agricultural land. The gaps are represented in the lack of clear policies to deal with population increases that lead to urban sprawl on agricultural lands and agricultural land policies. In the case of policies, the gap lies in the lack of proportionality and integration between the policy and the guiding principles. The analysis indicates the existence of a major gap represented in integrating the concept of resilience with its methodologies and mechanisms and its importance towards the city and the preservation of its agricultural lands now and in the future to achieve the concepts of environmental, economic, and social sustainability.

### The third indicator: building code and standards

Where the sample was asked: Are building codes or standards available for the city of Baghdad? Are these standards regularly updated? Are you dealing with specific risks known to the city? The results indicated Table 7, Figure 10:

The indicator results "Availability of local building codes and standards" showed that the city of Baghdad



**Fig. 9.** New urban development

Source: own preparation based on Authors (2022).

**Table 7.** Building codes and standards

| Building codes and standards   | Repetition | Percentage | Mediator |
|--|------------|------------|----------|
| There is no real use of relevant building codes and standards  | 6          | 30         |          |
| Some codes cover some risks, and there is no clear plan to update the codes                                      | 9          | 45         |          |
| Local building codes and standards are in place that deals with major city hazards and are updated regularly     | 5          | 25         | 1.95     |
| Local building codes and standards are available that deal with all known city hazards and are updated regularly | 0          | 0          |          |

Source: own preparation based on Authors (2022).

does not deal with the known dangers of the city by providing local building codes and standards, and they are updated regularly where no response from the sample was recorded for this case. At the same time, 25% of the sample indicated the availability of local building codes and standards that deal with the main dangers of the city and are updated regularly. On the other hand, 45% of the sample indicated the

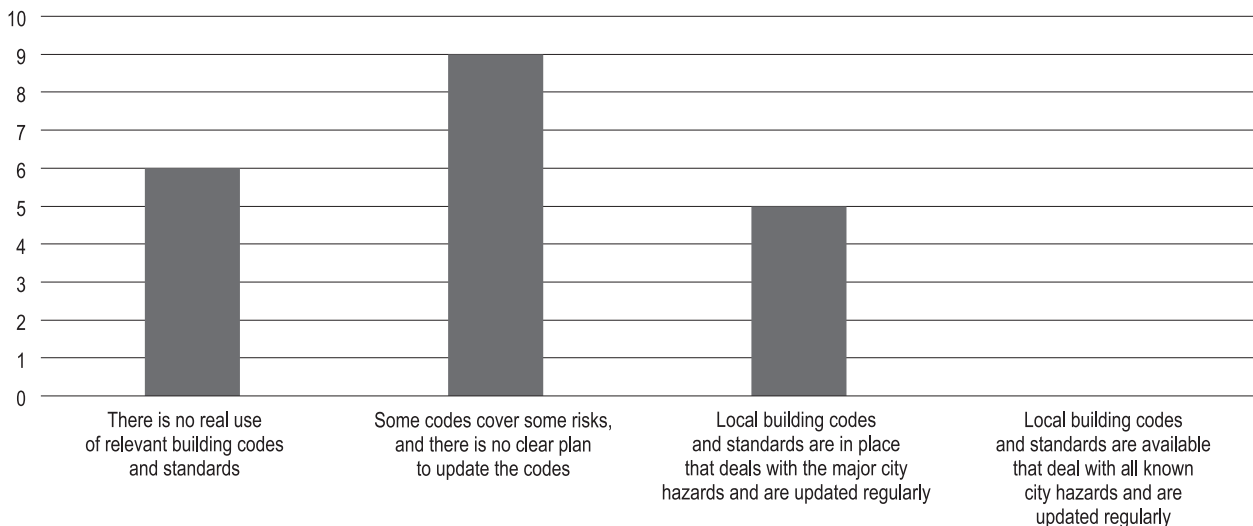
availability of some codes that cover some risks. There is no clear plan to update the codes. As for 30% of the sample, there is no real use of relevant building codes and standards.

Analyzing the sample results clarifies that there are gaps related to the “building codes and standards” indicator, represented by the absence of codes and standards for the risk of urban sprawl and loss of agricultural lands. The codes indicate how they are interconnected with the known and main dangers and their use in a manner appropriate to population and housing changes.

### The fourth indicator: the application of zoning and building codes and standards

Where the sample was asked: Are zoning rules, building codes, and standards widely and appropriately applied? And verified? The results indicated Table 8.

The results showed that no percentage of the sample was recorded for the case of the city of Baghdad, that it follows zoning and building codes, and it is 100% applied, enforced, and verified. A small percentage of the sample (10%) indicated that zoning and building codes are applied, enforced, and verified in more than 50% of cases.



**Fig. 10.** Building codes and standards

Source: own preparation based on Authors (2022).

**Table 8.** Application, zoning, and building codes

| Application, zoning, and building codes   | Repetition | Percentage | Mediator |
|---|------------|------------|----------|
| There is no real focus on enforcing zoning and building codes                           | 8          | 40         | 1.17     |
| Existing zoning applications and building codes are partial and/or not fixed            | 10         | 50         |          |
| Zoning and building codes are applied, enforced, and verified in more than 50% of cases | 2          | 10         |          |
| Zoning and building codes are 100% enforced, enforced, and verified                     | 0          | 0          |          |

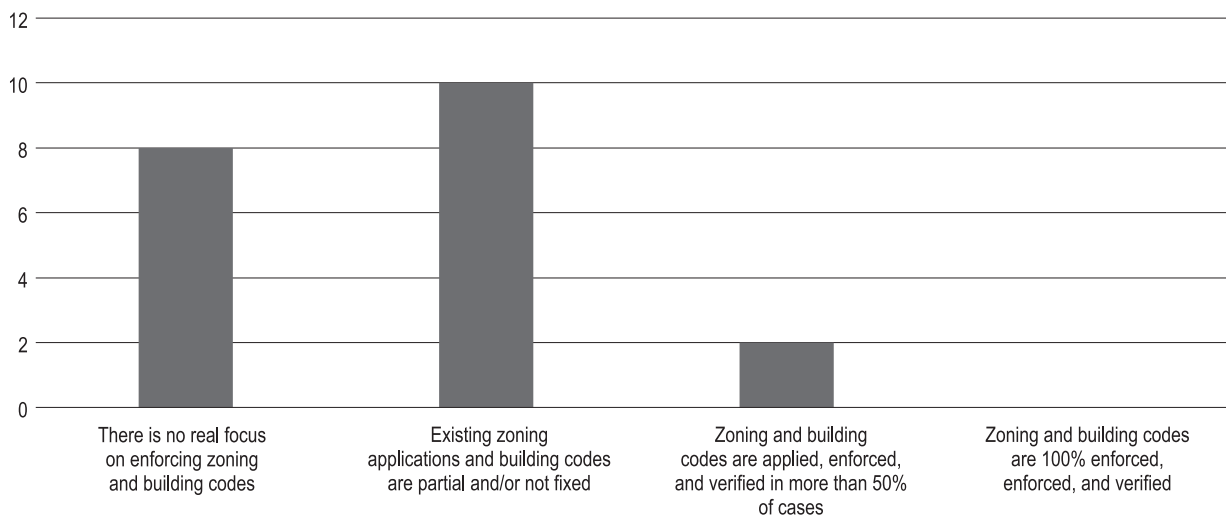
Source: own preparation based on Authors (2022).

The largest percentage of the sample, 50%, indicated that the current zoning and building codes are partial and/or not fixed. 40% of the sample agree with no real focus on zoning and building code enforcement.

Analyzing the sample results makes it clear that there are gaps related to the indicator “application

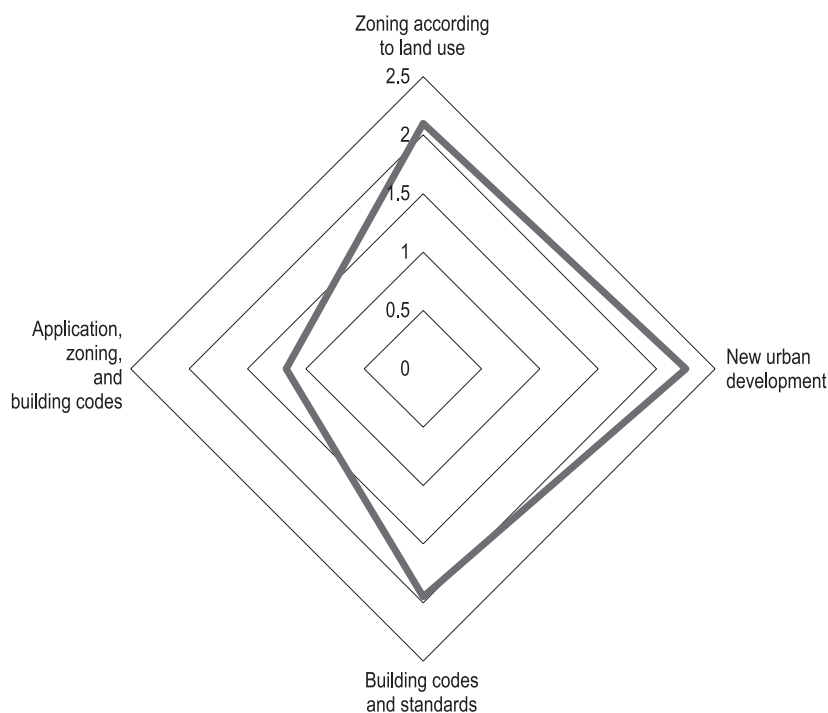
of zoning and building codes and standards”. The gaps are that zoning applications and building codes are patchy and incomplete. There is no real focus on this topic, and its importance in regulating land uses and integration and interconnection between uses to ensure no expansion and overreach.

Finally, by analyzing the results of the four indicators resulting from the fourth basic, it becomes clear that the city of Baghdad is unable to withstand the disaster of encroachment on agricultural lands caused by urban sprawl. This is due to the main gaps in each indicator represented in the lack of a clear plan to update the partition codes and not focusing on imposing zoning and building rules and other gaps mentioned in the analysis. Based on these gaps, many difficulties appear that the city of Baghdad must face in order to be able to absorb pressure and danger at multiple levels, such as the environment, the economy, as well as the social elements. Figure (12) shows the final model according to the sample results related to the four indicators about the city’s ability to withstand the disaster of encroachment on agricultural lands concerning the basic “application of urban designs and development that can withstand”.



**Fig. 11.** Application, zoning, and building codes

Source: own preparation based on Authors (2022).



**Fig. 12.** Apply resilient urban design and development  
*Source* own preparation based on Authors (2022).

## CONCLUSIONS AND RECOMMENDATIONS

Although urbanization fuels the economy and contributes to the growth of countries, it can lead to dire consequences if it is not properly managed and controlled. Cities are by their nature complex and consist of several overlapping systems. Cities face enormous disaster risks of varying degrees, exacerbated by uncontrolled population growth, deterioration of the physical living environment, and human actions.

1. Urban sprawl is a serious problem that threatens agricultural life and the green belt surrounding cities. Changes in urban sprawl on agricultural lands are linked to complex processes that lead to multiple social, economic, political, and environmental risks.

2. The concept of resilience is the ability of cities to plan, mitigate, respond, recover, adapt and grow after disasters in light of different circumstances. The urban planning and development process to make cities resilient requires the involvement of multiple

stakeholders, including municipalities, local leaders, the private sector, academic or research institutions, and interested institutions, in order to meet the needs and priorities of the various stakeholders involved, to allow for a better quality of decision-making.

3. There are gaps between planning and contemporary challenges as planning in many parts is becoming increasingly separate from contemporary urban challenges associated with rapid urbanization.

4. Cities resilience is not a concept separate from planning concepts and is related to addressing daily events, small and large, through low impact recurrent hazards to extreme events. This will require new approaches to reducing risks.

**Recommendation:**

1. Zoning and urban growth management to avoid exacerbating risk issues – Identify suitable land for future development.

2. The latest remote sensing data is continuously updated to monitor urban encroachment on agricultural lands. Moreover, take quick precautions against this infringement.



3. Use of new, existing, or traditional techniques in risk-informed planning.

4. Develop and implement appropriate building codes and use them to assess existing structures for their resilience to potential hazards, and incorporate appropriate safeguards modifications.

5. Regularly (or periodically) updating building controls and standards to take in the changing data and evidence about risks.

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**Note:** the results of this study were not presented in another form, such as a poster/abstract at a conference.

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