



Original scientific paper

# Revitalization Approaches to Maximize Heritage Urban DNA Characteristics in Declined Cities: Foah City as a Case Study

\*<sup>1</sup> Assoc. Prof. Dr. **Mohamed M. Youssef** , <sup>2</sup> Arch **Rowida Esaam**

<sup>1</sup> Department of Urban Planning, Faculty of Urban and Regional Planning, Cairo University, Giza, Cairo, Egypt

<sup>2</sup> Department of Architecture, Faculty of Engineering, Tanta University, Tanta, Egypt

<sup>1</sup>E-mail: [drmmyoussef@cu.edu.eg](mailto:drmmyoussef@cu.edu.eg), <sup>2</sup>E-mail: [rowidaessam4@gmail.com](mailto:rowidaessam4@gmail.com)

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## ABSTRACT



*Revitalization is an important process in action area planning, especially in the heritage sites located within urban area contexts. Varied techniques and tools of revitalization are applied at various spatial levels, some are suitable for the urban scope, and others suit the architectural building scope. Urban DNA is a term used academically to reflect social, economic, and urban characteristics but has a different interpretation that depends on the spatial scale and context. In action areas, urban DNA refers to the essential visual, social, economic, and physical characteristics that preserve the vital structure of an urban area. Heritage areas are vital in a city structure, in the journey of maximizing the urban DNA characteristics of heritage sites, sometimes the urban DNA is lost in the process. This paper identifies and encapsulates the importance of Urban DNA in heritage site considerations in the revitalization process within heritage urban context to maximize the socio-economic and visual impacts, especially in declined cities such as Foah City the case study in the Nile Delta region in Egypt. The results pinpoint the most effective urban DNA structure for the declined Foah Heritage Center, despite the city's importance as a ranked third of heritage cities in the country.*

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### Highlights:

- Revitalization is crucial in urban planning for heritage sites, employing different techniques tailored to urban and architectural scales.
- Urban DNA, comprising visual, social, economic, and physical aspects, is key to maintaining the integrity of heritage areas, though it may be compromised during revitalization.
- This study underscores the significance of Urban DNA in the revitalization of heritage sites to enhance socio-economic and visual outcomes, illustrated by Foah City in Egypt's Nile Delta.

### Contribution to the field statement:

This article contributes to academia by emphasizing the importance of revitalizing heritage sites in urban planning and highlighting the concept of "Urban DNA" for preserving heritage areas during revitalization. It offers insights on tailoring techniques to different urban and architectural scales, enhancing socio-economic and visual outcomes. The article also introduces a biological approach for analyzing heritage areas' physical and visual profiles, providing valuable insights for urban planners and scholars in heritage preservation and urban revitalization.

### \*Corresponding Author:

Department of Urban Planning, Faculty of Urban and Regional Planning, Cairo University, Cairo, Egypt

Email address: [drmmyoussef@cu.edu.eg](mailto:drmmyoussef@cu.edu.eg)

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## 1. Introduction

Vital human functions play an important role in maintaining the continuity of human performance of basic activities for survival, growth, and physical and mental development, and the basic unit for the preservation of these vital activities is the DNA present in a basic cell which is called the genetic DNA or Human DNA Kaya and Bölen (2017) defined biological DNA as "the genetic material or information and guidance for the development, growth, and reproduction of genes where genetic information is transmitted from parents to children" (Kaya & Bolen, 2017), that distinguishes each human physical and mental characteristics from another. The urban characteristics stand as the urban DNA in this research, which is responsible for maintaining the uniqueness of its own physical and visual qualities that distinguish an urban area from another.

## 2. literature Review Urban DNA

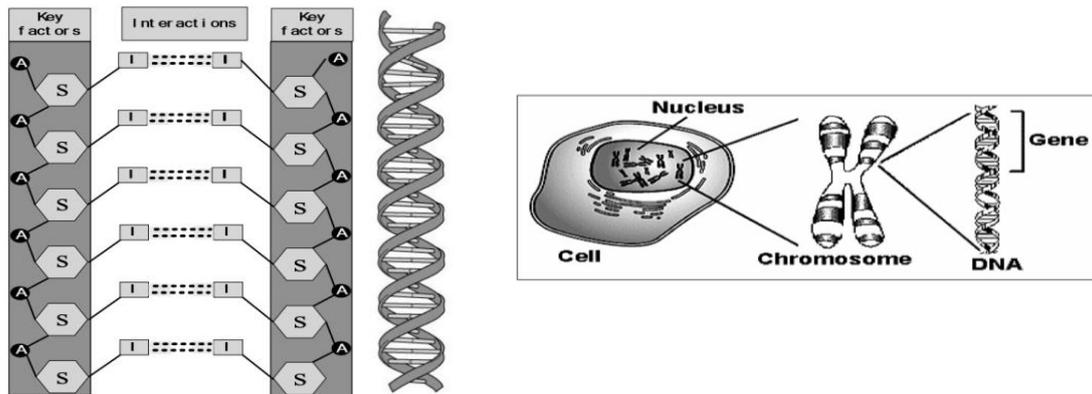
### 2.1 rationale and concept of urban DNA

Like the human body's biological structure and evolution, urban evolution can be described as the long-term aggregate effect of urban components such as urban fabric, buildings, activities, and land uses (Silva, 2004). It can be argued that a certain urban area has an element or set of elements responsible for its function such as the performance of a human's genetic DNA, beyond economic, demographic, or other forces that shape the urban area, cities are not just the result of rational planning, in the same way living organisms are not simply what is in their genetic codes, but even unplanned cities evolve by following several simple universal mechanisms regardless of cultural and historical differences. In addition, urban DNA is a view deduced from mechanisms in biological research such as mutation, and hybrid of genes, and these concepts can be applied to urban studies, In that case, the (Element/Elements) responsible for urban character, and activities that distinguish urban areas and confer a unique personality and identity on each area to the extent that the areas are distinct from each other, both functionally and visually (Youssef, 2021). Previous literature has addressed the issue of urban DNA in several research aspects, including addressing the issue of urban DNA as features or qualities that distinguish urban areas from each other, especially when discussing urban patterns and land uses at the level of urban planning of the city (Youssef, 2023), while others addressed the concept of DNA at the larger level in planning through the regional scale of urban regions to study those features and their impact on urban growth and how to characterize patterns of that growth depicted in Figure 1 (Silva & Wu, 2017). The urban planning and design literature dealt with many components of the areas that make them distinct from each other such as street networks, economic activities, elements of movement, and the urban and architectural character of building formations, so those elements can be called in this research, the genetic DNA because of their roles and functions.

Genetic material carries genetic information, guidance, and qualities specific to human genes. Human DNA is one of the most popular biomolecular compounds. Every cell in the body contains DNA, which is located inside the cell's nuclei, and which distinguishes it from other living organisms, by carrying the ingredients, compounds, and elements needed for the components that distinguish each human from the other and cannot be repeated and containing each person's unique genetic code, which carries the instructions for building proteins essential to the human body (Gifford , 2000). Gene, an organism that carries DNA and carries every class of DNA is associated with specific behaviour. It is the smallest basic unit responsible for genetics. metaphorically, in the urban realm, it can be assumed that urban character carries the ingredients, compounds, and elements needed to distinguish each urban area from the other in an urban context (Gifford , 2000). Urban DNA term is used in this research as a representation of the Urban character of heritage areas to understand what makes heritage areas unique in terms of urban character elements that are responsible for creating that unique urban DNA see Figure 1.

The research focuses on addressing urban revitalization strategies in heritage areas, the subject of the urban DNA represented in the features of urban character, the research is focused on identifying the major and minor elements of that urban DNA. The research presents a more focused and

detailed view of the topic of character by identifying the components of the urban DNA of the heritage the essential elements responsible for preserving that character and how it can enhance the strategies and methods of revitalization in the heritage area.



**Figure 1.** Structure of Human DNA versus Urban DNA (Silva and Wu, 2017).

## 2.2 Urban Character Context vs. Biological DNA

Previous researchers discuss the similarities between Urban characters including the physical and non-physical and genetic DNA, Urban DNA is a borrowed view of biological research mechanisms such as natural selection, mutation, and hybrid of genes. Researchers have also pointed out that these concepts can be applied to urban studies. Admittedly, it is difficult to identify a general genetic urban DNA for all physical analyses, not only because urbanization is a complex system, but because there are a lot of variables that can affect the forming process and urban fabric forming a different genetic urban DNA group and may be derived from different applications or perspective. Urban DNA was initially discussed in urban growth contexts and quantitative urban modelling, Silva 2004 and 2017, but the idea recently also found resonance in modular spatial design. Batty and Longley (2014) discuss that urban growth processes symbolize rules that dictate how to achieve the organization and replication of primary spatial social entities for certain urban forms and urban functions across metrics (Batty & Longley, 2014). Wu and Silva (2017) discuss that virtual urban DNA should include both spatial and non-spatial genes and that it should reflect both the drivers of urban growth and the institutional responses to it. Regarding the latter, unlike the way biological DNA plays out in natural selection, biological variation, and evolution, urban DNA will have a clear feature of deliberate intervention. In Addition, a different approach focuses not on how to build growth engines and institutional behaviour for urban DNA, but on how spatial planners synthesize a genetic pattern equal to disparities in the spatial distribution of benefits and negative exogenous factors of urban clusters (Silva & Wu, 2017). Despite this, it is possible to define a general structure for the physical genetic DNA, as shown in Figure 1. In general, the physical genetic DNA integrates both spatial and non-spatial genes of the urban character of the city. In that perspective in the spatial scale of urban areas urban DNA of specific functions such as industrial, Historical, and Commercial areas can be deduced in the sense of what urban character elements are responsible for creating that specific Urban DNA for this area. The research is focused on the Heritage area's urban DNA and the various elements that reform that urban DNA.

## 2.3 Urban Character Philosophy

Researchers discussed the relationship between public and historical character and its impact on urban and human settlements to explore the basic principles of nature's perceptions and historical dimensions. Lynch, 1981 discussed the visual elements of good city form and how designing the city can impact the overall visual image. Cullen discusses how urban form elements and features can weave a certain unique character of cities (Cullen, 1995). Brenner discusses the aspect of scale



that impacts the perception of urban character (Brenner, 2019). Furthermore, it is also important to highlight the idea of the effectiveness of urban fabric as a framework for identifying and describing material characteristics that contribute to the formation of the general and historical urban character of cities (Calthorpe, 1993). Karl Kropf (1996), one of the most important researchers discussed this idea of the urban fabric and its relationship to personality and urban character. Kropf says that the character arises as a reaction to a city, a particular area, or a street with an urban and visual distinction in the character of the place. Kropf discussed the idea of character and philosophy that urban character is what determines the shape, features, and features of the place. (Kropf, 1996) argues that the distinctive personality of the age depends on the observation and the element of observation in the visual features and elements of urbanization, so the character can only be identified by knowing the measurement tools of the character and cannot be determined if it does not identify specific and reasonable attributes. Urban DNA concept in the scale of the district can be built on, the philosophy of urban character and its relationship to the formation of urban personality on the 3 basic hypotheses discussed by Kropf as follows:

First hypothesis: Personality is attributed only to the city, The common idea of character is that it is always attributed to cities in general, but Kropf sees that character cannot be reduced to physical objects buildings, or users, but the character is the harmonious of users with physical objects that create a distinctive urban character.

The second hypothesis: Character is a set of differences, features that give the city its character are things that make it different from others. Kropf also regarded the character as a set of differences that characterize civilization as things that make it different from others. In old cities such as Venice and Los Angeles, desert settlements such as Saudi Arabia heritage communities (Alzamil, Al-Qahtani, & Al-Takhifi, 2023), or even in new cities in England such as the city of Milton Keynes, they are distinct and unique cities, each of which has the advantage of giving civilization its identity (Yeang, 2000). So, the character reflects the form of urbanization both in historical areas such as existing cities but can also be applied in new cities (The Urban Task Force, 1999), simple characteristics such as building materials and construction details are not enough to create an entire character but are just part of the character.

The third hypothesis: There are other more important and larger components such as the entire building, plots, blocks, gardens, streets, and areas because there are patterns of materials and the composition of components with each other constitutes a pattern (Abusaada & Elshater, 2023), these components greatly contribute to the composition of the character of the city if we look at the idea of the pattern more broadly or more comprehensively, (Kropf, 1996).

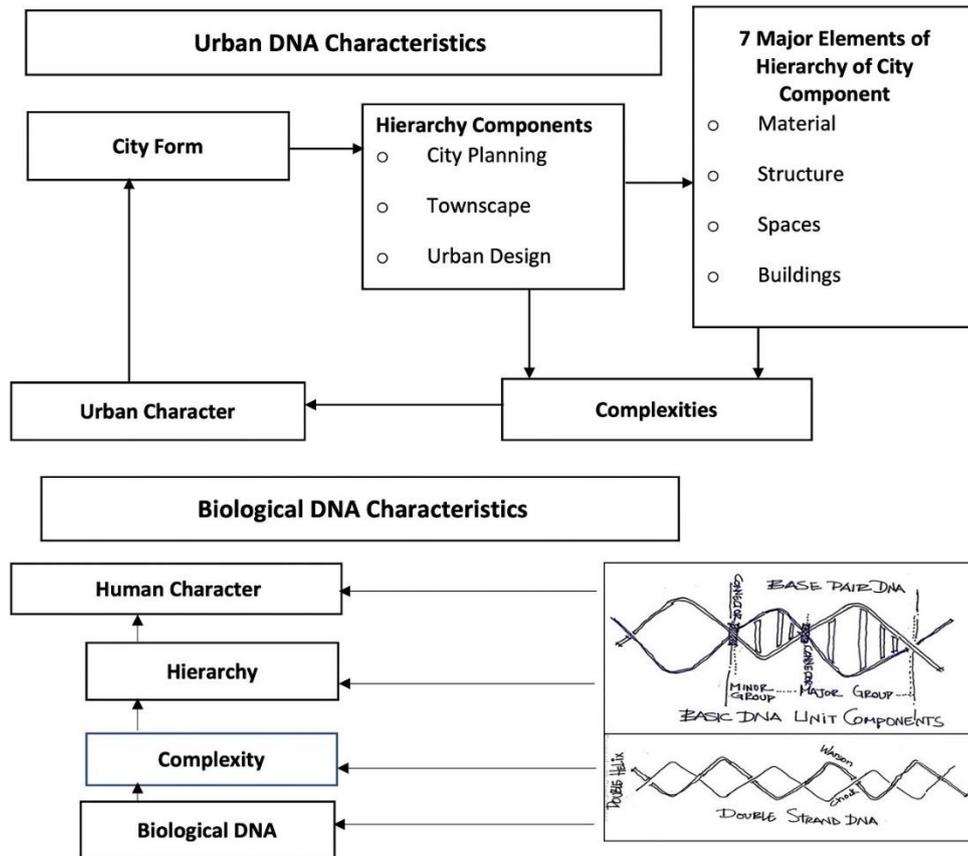
The previous discussion leads to the basic conclusion that dealing with the pattern in the city must understand the interlinkages in Urban Complexity between all those elements, The concept of entanglements is the theoretical basis for perceptions of the shape of the city.

The city is complicated by that concept because it is made up of several systems and composite elements with each other. Analysis of urban context components based on (Kropf, 1996) previous insights of character argument and the similarity in features and characteristics between the biological genetic DNA and the physical genetic DNA is shown in Figure 2 where complexity and hierarchy are the major influences in both biological and urban character.

In addition, similarities extend within the concept of the major unit and the minor unit, in one biological DNA there is a unit called double-strand DNA, which contains a major and minor unit, and through the replication of this unit, a complete biological DNA formation can function perfectly in a human body.

In an urban context, the city spatial formation is almost the same as biological DNA through zones and sub-zones that are replicated with different functions for each zone to create a fully functional urban DNA. It can be assumed philosophically that the assumption of similarities between biological DNA and urban DNA are plausible, and can form a platform to study the elements that

form each urban area's unique character that can be labelled as urban DNA to describe various areas in the city, such as residential, industrial, historical, commercial, etc.



**Figure 2.** Similarities between Human DNA and Urban Characteristics Complexity DNA.

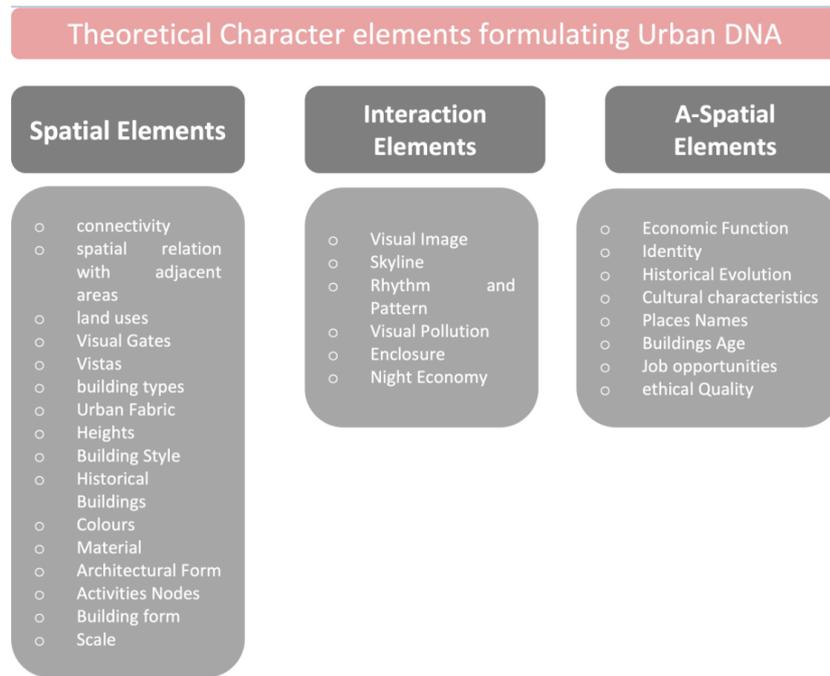
### 3 Urban DNA Analysis

#### 3.1 Urban character analysis to form the theoretical base of urban DNA

Many authors discussed the structure and elements of urban character, (Lynch, 1964), (Lynch, 1984), (Cullen, 1995), (Kropf, 1996), and many others, furthermore, the British Urban Design Compendium Report released in 2000 by Yeang, structured the components of urban character concisely, providing an integrated view of what urban character represents within the urban design methodology. In addition, Yeang (2000) provides a systematic method to deal with urban character elements in reshaping and redesigning action areas. That point of view is essential in the revitalization process especially when managing historical and heritage areas, this research adopts the classification of Yeang (Yeang, 2000).

In this research, we reclassified the elements of urban character based on the literature discussion of how Silva, 2004 classified urban data to form urban DNA classification, which is based on dividing elements into three main categories;

1. Spatial Level that indicates the physical characteristics of the urban context,
2. A-spatial level which indicates the non-physical characteristics such as the social, and economic aspects of urbanism, and finally,
3. Interaction factors stand for the elements that are a result of combining physical and non-physical factors such as visual image, skyline, Activities, etc. We can argue that using this classification is an attempt to integrate the concept of complexity and hierarchy of biological DNA into the urbanism point of view to understand what urban DNA should look like. A further step by the research in Figure 3, is an attempt to classify urban character into these main three categories, which contribute towards understanding urbanism from the biological point of view.



**Figure 3.** Classification of Urban Character elements into Basic Urban DNA Model of Spatial, A-spatial, and Interaction elements.

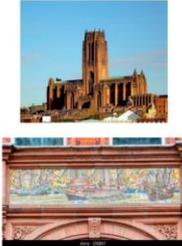
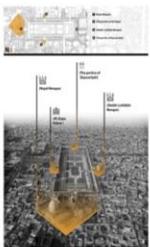
#### 4. Material and Methods

Materials used for this research are two international best practice cases of UNESCO Heritage areas Isfahan, Iran, and Liverpool, UK, (SITES, 2008), in addition to the materials for the city of Foah in Delta, Egypt to apply results of what Heritage area urban DNA might look like. The comparative study addresses the components of the urban DNA test and the character elements of these areas in the form of international examples that applied conservation methods by UNESCO in heritage areas, to extract the components of the urban DNA by analyzing two international best practice heritage areas (Isfahan, Iran- Liverpool, UK) examples and building the specialized questionnaire. Methods used in this research are 1. comparative analytical study of international best practice cases, 2. Expert Questionnaire to pinpoint certain elements that dictate urban DNA in heritage areas, 3., physical and visual analysis of Foah City Heritage Center to recommend how to preserve the unique heritage urban DNA of the old center.

##### 4.1 Best Practice International UNESCO Heritage Revitalization Projects

The study and analysis of the Urban DNA components in these two projects, to understand how revitalization policies influence the heritage urban DNA for the case of Liverpool and Isfahan. The results identified the most influential architectural and urban elements forming the unique urban DNA vocabulary heritage areas. the previous results will be applied in Foah City one of Egypt's heritage areas to reflect the most influential elements that affect Urban DNA in the Heritage area.

Foah City, which, is the third most important heritage area in Egypt after Cairo and Rashid, to draw the general framework of the shape of the urban DNA of the heritage areas that must be systematically taken care of, in the urban revitalization projects of the heritage areas in Egypt. figure 4, depicts the example of the comparative study between Isfahan and Liverpool conducted to interpret the Urban DNA of heritage areas, it discusses how urban character and visual image have important role to play in the urban genetic characteristic of heritage areas.

Comparison Urban DNA Element	Isfahan	Liverpool	Comparison Urban DNA Element	Isfahan	Liverpool
Colours Impact on Visual Image and Urban DNA			Visual Perception Impacts on Urban Image and DNA		
Building Materials and Treatments impact on Visual Image Urban DNA			Land Uses and Activities Impacts on Image Urban DNA		
Visual Edges Impact on Urban DNA			Building Heights Impacts on Skyline of Heritage Urban DNA		

**Figure 4.** Comparative study (Isfahan, Liverpool) interpretation of Urban Genetic DNA of Heritage Areas.

#### 4.2 Urban DNA of Isfahan and Liverpool

The comparative study of the heritage area of Isfahan City and the waterfront heritage area of Liverpool City, it can be argued that the characteristics of either area cannot be neglected, and despite the many physical, cultural, social, and economic differences between them, one factor remains worth studying, analyzing, and scrutinizing for its preservation, this factor is the urban character of each area. logically, Isfahan's with its long history and distinct various cultures in history, specifically, the Persian civilization created a unique composition of architectural vocabulary that formed its uniqueness. On the other side of the world, Liverpool the heart of the city was distinguished by its important function of the British Empire in the 10th century its heritage value comes from the unique buildings of docks and the surrounding activities of Albert Docks (Zancheti & Hidaka, 2011). Each of them had a set of elements that had a clear impact on the urban and architectural character, which helped to create their genetic DNA describing the city's history, nature, and culture.

#### 4.3 Isfahan Urban DNA Character Elements

##### *Land uses and area function:*

The distribution of religious uses and activity has had the greatest weight in setting the features of the heritage area through the proliferation of many mosques in the city of Isfahan, paying attention to the finest details, and rich material through buildings of the heritage area, the commercial activities and land uses accelerate the natural development helped to create urban spaces in the area that meet the individual's initial needs.

##### *Historical development and archaeological buildings:*

One of the most important reasons for historical development was religious development. The city of Isfahan witnessed a great religious development beginning with the Persian Empire with other

variations such as the Muguli, Saljouqi, and Safavi. Each of those periods had a pattern of urban formation in which people recorded their history and culture, and that variety created the value of the heritage area in Isfahan (Tahmasebi, 2020).

***Style and Identity:***

The evolution of the Islamic model element influenced by the mixture of Islamic basic units mixed with far Eastern colours and materials culture formed the basis of Iran's architectural character and identity in the city of Isfahan. It evolved the Islamic style of architectural vocabulary through local colours and materials that earned the area and the whole region a different and non-recurrent character (Rojas, 2023).

***Visual image and cultural characteristics:***

The cultural characteristics of the population in the city of Isfahan are part of the components of the visual image of the city. Its effective role in acquiring the visual image of Isfahan is undeniable through their thoughts, daily activities, needs, requirements, style, and lifestyle, which are translated into the image of mosques, museums, palaces, markets, workshops, churches, and schools with architectural components that achieve their satisfaction (Jing Xie & Tim, 2017). Political situation: As Isfahan was the capital of Iran at the time of the Safavid caliphate, most of the attention was paid to Isfahan as the great and dominant political region at the time to express the power of the government and the ruler (Cameron & Rössler, 2013).

**4.4 Liverpool Urban DNA character elements:**

***Land Uses and Area Function:***

Liverpool Heritage area function of maritime commerce has significantly affected the land uses of the city, especially the waterfront, reflected in the proliferation of marine insurers, jetties, and post offices as the most important and greatest seaport in the United Kingdom (D'Agostino, 2021).

***Style and Identity:***

Victorian style prevailed in the 18th century, giving Liverpool its architectural identity.

***Historical development and archaeological buildings:***

At each stage of Liverpool's historical development unique architectural style buildings were built such as Edwardian Baroque, Georgian, and Victorian style. there was a collection of heritage buildings described and demonstrated each provision, thus becoming part of the general part of character of the area (Hmood, 2019).

***Visual image and cultural characteristics:***

The cultural characteristics of Liverpool City's demographics were a large part of the visual image composition.

***Economic situation:***

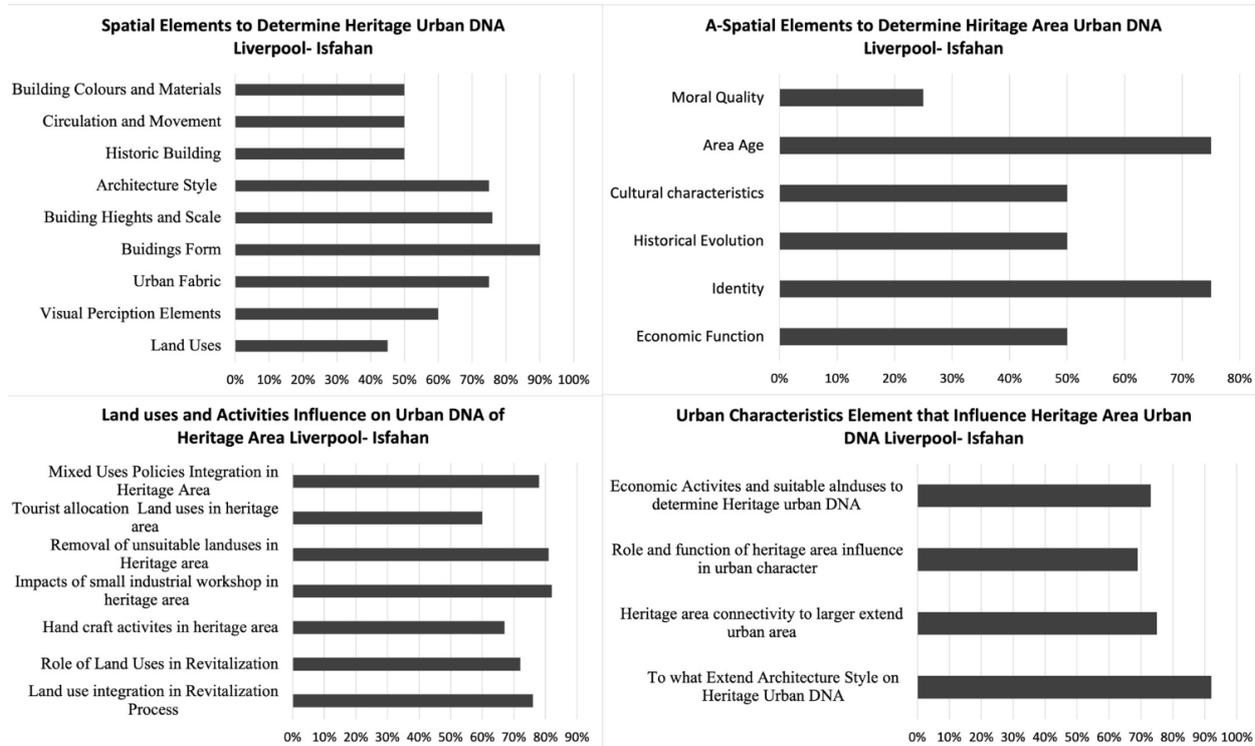
The economic situation has been one of the most influential factors the stable economic situation of the city has played a role in investing and positioning the most important and largest businesses in the heritage area that encouraged commercial and administration activities in the Docks area (SITES, 2008).

**4.5 Expert-Based Questionnaire of Isfahan and Liverpool Urban DNA Analysis Rationale**

The theoretical discussion of urban DNA previously, and the comparison study of Liverpool and Isfahan, were the basis of building the Expert-Based Questionnaire to seek the answers of the most influential elements that affect the heritage area's urban DNA. In previous figure 4, discussed the philosophical cornerstone of urban DNA in general, but the research argued that within these elements a particular group of spatial and Aspatial elements constitute, formulate, and distinguish urban areas from another, what are these elements in Heritage areas, that the ultimate question of this research.

The researcher through the theoretical framework and comparative study prepared a set of elements that can be tested over the questionnaire to validate whether these elements have been preserved and to what extent through an expert questionnaire. The questionnaire sample is selected carefully between

urban planning and design, and architect practitioners and academics to increase the certainty of the answers, to measure a set of major and minor elements that reflect urban DNA in heritage areas. The next step is to apply the results of selected elements of urban DNA in the heritage area of Foah City in Egypt to validate and recommend certain urban components that can be pointed out when undertaking a revitalization study of a heritage area and answer the question of what elements need to be considered carefully to restore the area's heritage urban DNA.

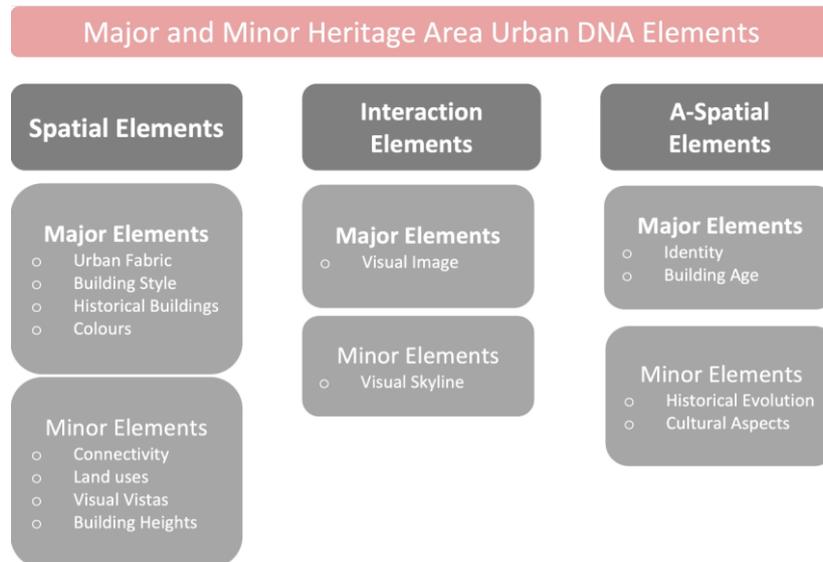


**Figure 5:** Results of the Expert-Based questionnaire of Elements that influence the Urban DNA of Heritage Areas.

#### 4.6 Isfahan and Liverpool Expert-Based Questionnaire Results

Figure 5, indicates the results of the expert-based questionnaire to articulate the major elements that influence the heritage area's urban DNA, based on the comparative analysis of Liverpool and Isfahan heritage areas, the questionnaire topics are divided into three main sections. Section A tests the spatial elements in in each heritage area, Section B tests the A-spatial elements such as social and cultural issues and Section C tests the interaction elements that combine spatial and aspatial elements such as visual perception and activities and land uses. from the results it can be concluded that;

1. On the spatial elements level, major elements that identify Urban DNA in heritage areas are historical building style, Urban Fabric, and movement circulation, urban form, the number of historical buildings, and visual perception of the heritage urban context.
2. On the A-spatial Level, building identity and age, activities and economic characteristics are major influences in identifying the urban DNA of the heritage context
3. On the interaction level, Visual perception, skyline, urban pattern, and night activities control the identity of the urban DNA of the Heritage Context.



**Figure 6.** Results of the Expert-Based questionnaire- Final Major and Minor Elements Formulating Urban DNA of Heritage Areas (Researchers, 2023).

Figure 6 depicts the final major and minor elements that influence the Heritage area urban DNA, it can be argued and concluded from the results the following:

A. The dominating elements whether major or minor lies in the spatial aspect, logically because most heritage area character are derived from the value of historical built environment such as urban fabric, historical buildings, and colours, in addition, to connectivity, and land-uses as minor elements are necessary for any urban area urban dynamics, especially in Heritage area where the proper access and suitable land uses can increase heritage area revitalization policies (Couch, 1990).

B. The influences of A-Spatial elements such as social, economic, and cultural elements are focused on a few yet important elements such as building age and identity, historical evolution of the area, and cultural characteristics because the age of the area and identity is a sum of evolving influence of Historical ages the area has experienced in term of social, cultural, and economic changes.

C. The Interaction elements are the combination of physical and non-physical elements depicted in the form of a visual image and skyline, these two elements are the sum of interconnectivity between the area function and built-up area that impacts the form, visual image and the type of activities exist in the area.

Taking into consideration the previous results of what heritage area urban DNA major and minor elements are, the next section of the research is devoted to applying the questionnaire results of urban DNA to Foah City, the results of the questionnaire can ensure the proper revitalization of the Heritage Center in Foah to have the ingredients of Heritage area DNA in future revitalization proposals.

## 5. Foah City, Egypt a case study application of preserving heritage urban DNA

### 5.1 Foah City, an important heritage site in Egypt

The city of Foah is the oldest in the region, and its history confirms the relative location as Foah was likely the capital of the Seventh Province in the maritime face of Pharaonic Egypt and was known as "Faithful Conscious" or "Nefer Amente" in the sense of "First Western Region". In the Fatimid era, the city of Foah became a Great Kur Kabbah, while in the Ayubian era, it was influenced by the Islamic war crusade. Foah continued in the Ottoman era as an administrative center in 1826 and established the Rice Country West Section and made Foah its headquarters because it is the largest and oldest of its villages (GOPP, 2020).

### 5.2 Physical, Social, and Economic aspect of the Foah Old Center

The city's inhabitants depend on agriculture, fishing, and handicrafts, and the city is known for producing different types of fruits, vegetables, and fish. It also features handicrafts and small industries, especially textiles, wood, and copper. The city's economic strength is characterized by diversification in major economic activities and includes agriculture, livestock, fisheries, industry, crafts, and commerce. The city is characterized by neglected numerous and diverse tourist and archaeological resources (GOPP, 2020).

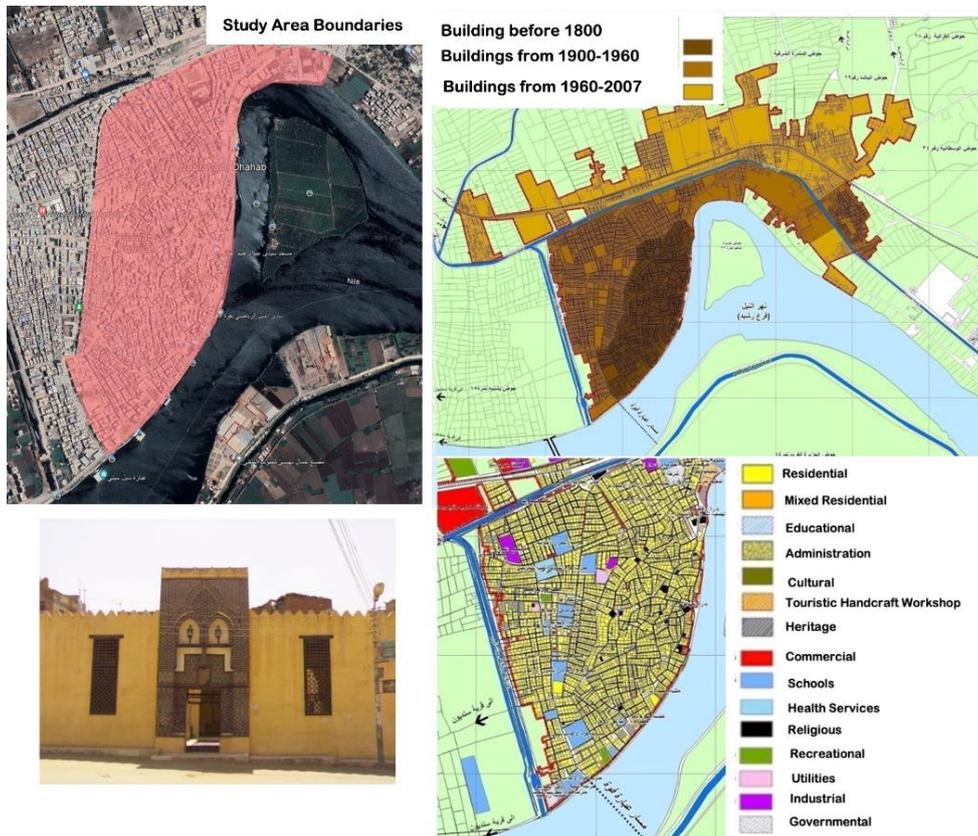


Figure 7. Foah Historical Area Land Uses and Historical Evolution (GOPP, 2020).

### 5.3 Proposal for urban revitalization of urban DNA of Foah City Heritage Area

Based on the results of the first section of the research concerning identifying the major and minor elements of heritage area urban DNA, a proposal for preserving the heritage center of Foah City is based on (Roberts & Sykes, 1999), (Rodwell, 2008), a discussion of regeneration and revitalization in both urban and historic context, in addition, they took into considerations, the socio-economic and spatial aspects of regeneration. the following elements are proposed to revitalize Foah Heritage Center.

#### Analyzing Heritage Urban Character:

The first step to conserve the urban DNA of Foah Heritage Old Center is to analyze the component of the urban character of the area based on the diagram in Figure 3, to systematically identify the spatial, A-spatial, and Interaction elements that form the basic ingredients of heritage area including, connectivity with adjacent areas, urban fabric, visual perception, historical buildings context Etc (Vehbi & Hoşkara, 2009).

#### Identifying Major and Minor urban DNA elements in Foah:

By applying the research results of urban DNA in heritage areas, see Figure 6, and paying more attention to these elements, the research found these elements formulate the essential elements that can conserve the urban DNA of the area, creating an analysis matrix, see Figure 8, it enabled the research to

pinpoint the essential improvements and consideration in the proposal of revitalization process of Foah heritage area.

*Recommendations Vital changes on urban DNA elements in Foah:*

1. On the Spatial level, elements such as urban fabric, building types, Historical buildings, and colours are major changes to conserve urban DNA in revitalization. Connectivity, Activities, Land Uses, and urban form shaping the minor elements recommended in the old center, to be improved, improve pedestrian movement circulation and controlling vehicle movement in the waterfront and inner city.
2. On the A-spatial level, Heritage identity, Building Age, Historical evolution of the heritage area, and cultural characteristics form the major and minor elements that should be treated very carefully, to maintain a sustainable urban DNA of the area and conserve the urban and architectural identity.
3. On the Interaction level, Visual image is the most important element that defines the Heritage area's uniqueness, combined with the physical and visual skyline as a minor element that controls the heritage's physical and visual perception as a unique area. Through revitalizing these two important elements the Urban DNA of any heritage area remains the keystone of identifying the physical and visual distinction of heritage areas in the city.
4. It can be argued that the nature of urbanism and its complications make the interaction level elements essential in the process as it combines in its nature the overall interaction between social, and economic characteristics with the physical characteristics that define urbanism which can incorporate into the level of interaction between the physical and non-physical elements in urban realm (Roberts & Sykes, 1999).

Foah Heritage Urban DNA Recommendations	Spatial Elements
Major Urban DNA Elements	 <p><b>Urban Fabric</b> Preserving urban fabric including public realm, land uses, encourage, local handcraft as an asset for Foah heritage urban DNA</p>
	 <p><b>Building Style</b> all urban and architectural characteristics should be maintained as an Islamic vocabulary and colours for the Heritage context urban DNA</p>
	 <p><b>Historical Buildings</b> Historical buildings are one of the factors that identify Foah heritage urban DNA</p>
	 <p><b>Colours</b> Colours motives selection must be dominant in Revitalization process to provide uniqueness for Foah heritage urban DNA</p>
Minor Urban DNA Elements	 <p><b>Connectivity</b> Strengthen connectivity with rest of the city will enhance the economic and social prosperity of overall Urban assets</p>
	 <p><b>Land Uses and Activities</b> Suitable local activities and land-uses should be encouraged to maximize the economic and social function of heritage urban DNA</p>
	 <p><b>Architectural Form</b> Islamic architectural regulations for materials, colours requirements in the revitalization process will conserve the visual image of Foah</p>

**Figure 8.** Foah Urban Characteristics DNA.

## 6. Results

In the study at hand, an in-depth exploration of the theoretical framework of urban DNA and the analysis of character elements within the city has yielded several critical findings:

Firstly, the shared characteristics of complexity and hierarchy found in both biological and urban DNA have been instrumental in this research. These similarities facilitated a nuanced analysis and identification of the heritage urban DNA, providing a unique perspective on urban planning.

The foundational aspects of physical character stood at the forefront of recognizing urban DNA, acting as a primary reference point throughout the investigation. These physical components have proved to be pivotal in understanding the inherent urban DNA of a heritage city. Employing comparative analysis with two international case studies, the research conducted an empirical validation of theoretical discussions. The Expert-Based Questionnaire method was pivotal in distinguishing between major and minor elements of urban DNA within heritage areas. Spatial-level elements, such as historical building style, urban fabric, movement circulation, urban form, the prevalence of historical structures, and the visual perception of the heritage context, emerged as significant factors in identifying Urban DNA. In contrast, on the A-spatial Level, it was found that aspects such as the identity and age of buildings, local activities, and economic traits exert substantial influence on defining the heritage context's urban DNA.

At the interaction level, the research highlighted that visual perception, the skyline, urban pattern, and night-time activities are determinants in sculpting the urban DNA identity of a heritage context.

Lastly, the application of these findings to the local case study of Foah City has led to actionable recommendations for the city's revitalization process, with an emphasis on preserving its distinctive heritage Urban DNA. The study advises prioritizing the visual enhancement of waterfronts, maintaining a visual connection with historical buildings, and carefully designing the skyline to align with the heritage area's colour scheme. Restricting building heights to preserve the skyline and promoting night-time economic activities, particularly those related to tourism and recreation, are suggested to beneficially impact Foah City's heritage context and urban DNA. These measures are poised to not only uphold but also enhance the unique heritage identity of Foah City.

## 7. Discussion

### 7.1 research objectives

The research's main objective is to seek what might be the Urban DNA elements in Heritage area, first the similarities between biological and urban DNA was established in the theoretical part, where both have the complexity and hierarchy characteristics that make sense to use the term urban DNA on the action area level. Urban character rationale as a representative of urban areas DNA was discussed, and classified into spatial, aspatial, and interaction elements following the literature of regional DNA and how urban features can be classified and structured, which enabled the research to classify urban character features into the same classification method. Heritage areas as a unique structure of the city, were the focus of the following section, to answer the question of what major and minor elements of urban DNA can be labelled as heritage urban DNA. A comparison study of international best practice of UNESCO cases were Isfahan and Liverpool to understand the revitalization process have succeeded in depicting the unique characteristics, so we can identify the group of elements that are responsible for a heritage urban DNA by using expert-- Based questionnaire to pinpoint these elements, the last section of the research were applying the results of the heritage area urban DNA on the third heritage city in Egypt, Foah, which can be described as a declined economic city in the northern part of Egypt and lacks attention of revitalization in the old center that became deteriorated in terms of physical (Spatial) and non-physical (Aspatial) characteristics.

### 7.2 Analytical Urban DNA in Heritage Areas

A set of recommendations based on the analysis results have been structured in the form of a matrix, discussing the urban DNA elements that can assure the uniqueness of the heritage area and return the urban dynamics to the old, neglected center. From the analysis conducted in this research we think



urban DNA is a useful analytical approach and contributes towards defining a new perspective of urban context analysis, also defines the factors of drivers that can create urban DNA of a certain urban area. The research considers a detailed step from discussing Urban DNA on the regional level, where treatments of urban data can be measured objectively with mathematical modelling, into the more subjective level of dealing with action areas where urban DNA is rationally discussed from the point of view of physical and visual elements that makes heritage areas reserve its uniqueness by assuring that revitalization process takes careful consideration when dealing with elements that are responsible for heritage area Urban DNA. The importance of heritage areas comes from being a part of any society's cultural traditions. If properly dealt with, heritage will be a catalyst for social and economic development through tourism, commercial use, and raising land and property values, thereby providing revenues from which maintenance, restoration, and repair costs are paid.

### **7.3 Urban DNA Future Research on Action Area Spatial Level**

Furthermore, Using the method of analysis by biological approach was credited with conceptualizing the physical and visual profile of heritage areas. Investing in the city's historic fabric, buildings and space helps in physical, cultural, and economic renewal, contributes to its developments for the benefit of residents and visitors, and preserves the culture and character of the city. Additional urban controls must be placed within the whole heritage area boundaries and context for urban and architectural development, by the prevailing urban character in heritage areas.

### **8. Conclusion**

The research mainly focused on formulating the link between Biological DNA and how useful for urbanists to use it as a new definition of urban areas' unique characteristics to recognize heritage areas Urban DNA, previous attempts to link biology with urbanism were mainly focused on the national and regional level of urbanism, this research attempt to identify the urban DNA on the action areas level, the research apply the method on heritage area for its importance on the city's social, economic and visual function that creates vibrant and dynamic activities within the city. Research outcomes can be built on for further research on various types of urban action areas to understand what makes an area unique and what elements of revitalization and regeneration process should carefully increase focus on studying, analyzing, and finally taking serious actions to conserve these elements to create a unique urban DNA which will impact and enhance the overall physical and visual characteristics of urbanism. From the study of Foah city and urban government regulations in Egypt, many criticisms arise to conclude its most important notes.

1. Making certain decisions about identifying the urban context DNA and the character of heritage areas must be done by specialists.
2. A dedicated team (planners, architects, artists, two characters) must be available to supervise and implement the revitalization of heritage buildings.
3. The broader scope (buffer zone) must be defined to control and determine changes and planning and design requirements of heritage areas.
4. Preservation and rehabilitation processes are not inconsistent with the revitalization process but must be in an appropriate and compatible framework that respects heritage areas' planning and design requirements.

A comparative Study of Isfahan and Liverpool revealed that the attempt to revitalize Urban DNA in Liverpool by proposing the placement of modern buildings with height and contemporary architectural style beyond the wider area was a failure and found incompatible from the UNESCO side of view and policy. Maybe it was more appropriate with the new buildings proposal, using architectural vocabulary reproduced from the general character of the heritage area creates a continuity of the visual image. On the contrary in the case of Isfahan, the authorities make few positive changes to preserve the urban DNA but with a focus on the historical buildings, not the urban extent of the heritage area. In the case of Foah City to preserve the urban DNA of the heritage old centre, revitalization authorities should activate and redesign vertical pedestrian axes on the waterfront to connect tourism to the heritage area



and increase the efficiency of utilizing the economic and heritage value of the heritage centre. Linking the old centre area (heritage) with the rest of the city, especially the river facade in terms of right-of-way adjustments and increasing economic Tourist-Based activities to emphasize the role of the heritage centre to increase the efficiency of the economic base. In addition, inappropriate activities should be relocated out of the central heritage area, and increase efforts to improve the urban surroundings of archaeological buildings.

### Conflicts of Interest

The authors declare no conflicts of interest.

### Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

### Ethics statements

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