

Exploring the potential resiliencies of traditional urban fabric.. Bazaar area in Sulaimani as a case study

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Abstract:

The city is characterized by structure, urban space organization, and specific configurations of the urban fabric. These factors act on distinguishing the city and give it a specific identity with specific features. The urban fabric is different, according to its morphology, planning, and design characteristics.

Thus, if we know that the city, affecting and affected by rapid changes in its structure, configuration and space organization, these changes and transformations, according to its topological relations, places and its structure are different in between the city. At the same time, the severity and degree of these impacts also vary from one another location. More areas that resist and hold up against these changes and maintain their structure are the traditional urban areas, usually located in city centers, which retain their identity, authenticity, and urban and physical specificities.

The study attempt to find out and diagnose the factors affecting, and then clarify the features, which lead to making the fabric retain its originality, stand up against winds of ongoing changes and transformations that occur in traditional urban fabrics when comparing with other areas in the city.

The formation of the urban fabric appears as a result of a balance between internal and external forces, or in other words between more complex relationships, between parts with each other and parts with the whole, acting on its explicit and implicit structure. Implicit structure (genetic system) represents the potentiality, which our study aims to explore its configuration as an objective of the study as well.

The research adopted space syntax methodology and its applications to arrive at the traditional know-how, which had weaved the rules of its nature, and also to verify the research hypothesis and achieve its objectives, too. Finally, the study found that the system of relationships that exists between (parts – parts) and (parts – whole), and the nature of these relationships had granted the area its uniqueness to persist against any deformation or rapid transformation over time.

Keywords:

Traditional Urban Fabric, urban transformation, urban resilience, genetic system

1. Introduction:

The city and its urban architecture trends represent its unique characteristics of urban, social, economic, and cultural developments, and are significant in determining the period and era of their construction. They are the reflection of human thought and philosophy throughout its evolution over different stages through time¹. The city is affecting and has been affected by the rapid changes occurring in its structure, composition, and space organization. However, these changes and transformations are varied, their degrees of intensity also vary from one location to another. This

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does not mean that any kind of change doesn't occur in these areas, but that shifts become more compatible and preserve historic continuity and temporal correlation.

Study and literature reviews show that a city is an organism with both physical and spiritual aspects². It has both subjective and objective concepts. Cities are dynamic and full of life, so a desire to know the structure of a city and what unifies its various parts are the most significant to reveal its potentiality.

2. City as a System:

The notion of a system is equally applicable to living beings, physical reality, and abstract thinking. In fact, systems-oriented thinking blurs the separation between these realms, between the natural and the artificial, and between the physical and the abstract³.

A system is always dynamic because it's a conceptualization of the interactions between the parts that make the whole, and in turn between these and the environment.

An organization of parts within a whole is usually understood as a structure. A system, on the other hand, is a structure with a functional purpose. A structure is a stable organization, while a system is a dynamic set of interactions.

A city, as a complex system comprising a multitude of elements, is thus generated in the course of city development. The phenomenon of architecture and urban planning should reflect social diversity in providing living environment forms that are socially generated⁴.

Both man and a city play the roles of being a part and a whole simultaneously, and each is composed –as the concept of system told us- of two sides, the (material), and the (immaterial) side, or the (tangible) and the (intangible) .

A city is also composed of the duality of masses and spaces, where the mass is a part and material side, while spaces are the whole and the immaterial side. Mass and space (Part and the whole) play both active and passive roles in generating the total organization in urban areas⁵.

According to this relationship between part/whole on one side and man (society)/city on another side, when change occurs in one term it should reflect to change in another side of the equation...Any change in form in response to man (society), should be seen through the unifying elements of the city. From this point of view. It can be said that the smallest elements are capable of representing the structure of the urban whole.

Russell states that; the final shape of a city –at a certain time- is the whole or the total imposed demands represented as a system of collaborations and oppositions among the demands of all the design elements that are needed⁶.

2. Change and resilience in urban areas

Over time, every city faces multiple transformations and changes as part of its natural growth and development, due to both visible and non-visible aspects through internal and external forces. The internal forces include the way of life, social and physical structure, while the external aspects are those forces that influence and shape a building without the will of society.

Rossi believes that the city as architecture was established on two levels; one, as an urban artifact, where the city has its particular form and history; the second as the work of architects and engineers time through, which he refers to in his hypothesis as '*a gigantic man-made object*'. For him, some events take place and stay alive because of the physical traces at the site⁷.

Dealing with the idea of change permits us to understand a key term in a historic urban fabric, namely persistence/ permanence. This term has been experienced in different fields, one of them being the realm of architecture and urban design, through different scholars of architecture and urban design directly or implicitly. The theories indicate the important role of the permanent structure or

elements, which can help to define the individuality of an area or a city and create a strong connection with the past. Therefore, within all the changes that have happened to the urban structure of the city some distinctive urban elements and patterns, remain to carry the meaning from the past while offering the potential for the future since, as Cohen indicates, they are the creative and vital forces behind the construction of the city⁸.

The persistence of relationships within a system called “Resilience” is a measure of the ability of any system to absorb changes of state variables, driving variables, and parameters, In this definition, resilience is the property of the system and persistence or probability of extinction is the result. The main aim of resilience is to reduce the impacts resulting from a disturbance, a concept transversal to various research areas with very similar definitions¹.

However, the main differences found in the definitions of resilience lie in actions and perturbations, i.e. if the system can tolerate, to maintain, to neutralize, to support, to persist, to resist, to absorb, to survive, to reorganize, to adjust, to adapt, to recover, to respond, to transform, face a disturbance in the system (natural disasters, climatic conditions, calamities, crises or disruptive events), that create impacts (changes, stresses, destruction or uncertainties), may cause damage to the system.

Therefore, it can be concluded that resilience is the ability of a system to resist and/or adapt to a particular disturbance and recover its normal functioning or state of balance, which may set the initial baseline or a new situation.

Urban resilience can be physical, natural, economic, institutional, and social, Al-Ashwal identified four basic pillars of urban resilience, (resisting, recovering, adapting, and transforming)¹. In this context, the urban resilience emerges and evolves into a conceptual tool where a resilient urban system will always have to be evaluated for its ability to resist, maintain, recover, adapt or transform in the face of a series of disturbances, whose impacts tend to create instability in the system's equilibrium.

Urban resilience is the potential ability enhanced by the set of basic characteristics: redundancy, diversity, efficiency, robustness, interdependence, adaptability, resources, independence, ingenuity, inclusion, integration, allowing the construction of an operational and implementable evaluation tool as well¹.

3.1 Bazaar as the traditional urban fabric of old cities

Studies have proven that traditional commercial centers (bazaars) play a vital role in the social life and integral whole structure of a city.

The bazaar is a complex of multifunctional buildings and was a place for the exchange of goods and other socio-cultural activities; it was used by inhabitants of a city and by strangers⁹. Some historians would argue that the bazaar, with its associated facilities, singularly distinguishes the cities from any other cities.

Bazaar components were adopted historically but with some changes and manipulations. However, their aspects reflect the spirit of the place. Usually, Bazaar includes components or special sets of shops named (qaisary), - the linear or cluster organization of shops, covered or roofed paths -. These components were attached to other social institutions, such as the mosque, the human (public bath), khan or caravanserai⁹.

The urban structure of Bazaar forms the core of the old city and its components are considered as intrinsic elements and an important core that helped develop the nucleus of the city's urban life. Bazaar with its urban traditional fabric includes the authenticity of town plan composed by the system of masses, spaces, and pedestrian circulation with the following features¹⁰.

- The whole represents the part, so the complexity is potential in identifying and describing the part itself without identifying the whole.

- Urban space is composed of formed voids, linked together in formal and space hierarchy and continuation.

- The circulation system has been distributed due to this hierarchy ranked system, as seen in the space organization.
- In the structure of the urban fabric, the relation between part and whole is described through a conceptual system, which has the nature weaved due to the hierarchical system.

3.2 The Urban structure of bazaar

Bazaar is considered one of the most significant socio-spatial systems in the cities. The structure of traditional cities reveals that a bazaar, which usually takes an organic shape, acts as the spinal column of the city and continues toward the main gates of the town.

Bazaar as an integrated part of the city includes many specific zones or markets (goldsmith, clothes, grocers, butchers, dry foods, spices or flavor,), which are connected to each other since they are considered the main carrier to the whole parts of the city.

Most markets are covered and have narrow widths (2-3m), with small shops with a maximum 3 m elevation width. The public spaces inside the traditional urban fabric are a result of connecting those elements together.

The urban structure of Bazaar owned the renewable transformations with time and place and can be considered as the best tool of integration between different parts, because of its role of interaction among different users and its role of hierarchy.

So, Bazaar urban spaces define and explore the sociality, economic, and politic of different periods¹¹. In fact, a bazaar is one of the key elements of spatial organization in the old cities; the main body of the city cannot be identified without the existence of a bazaar.

4. Transformation and resiliency in traditional area

Traditional urban areas as the complex system with more integrated relationships between its parts or elements that constitute the system, confronted many faces of transformation, with mostly higher and sometimes lower resilience.

Romice returned the reason to the resilience trait that extends through time, the contribution of all parts must also extend through time at multiple scales. Resilience systems are those that absorbed changes or transformations, by adopting, justifying, or redefining themselves structurally and keeping all values and meaning, and relationships. There are indeed some essential building blocks of urban form, on which all the rest relies, that have allowed cities to be functional through time across very different contexts and conditions¹².

The existence of persistent elements as the permanent elements in the historical traditional area has a vital role. The theories indicate the important role of the permanent idea or elements, which can help to define the individuality of the community or city and create a strong connection with the past. Therefore, within all the changes that have happened to the urban structure of the city some distinctive urban elements and patterns remain to carry the meaning from the past while offering the potential for the future since, as Cohen indicates, they are the creative and vital forces behind the construction of the city⁸. They reveal clearly through analyzing and monitoring the change that happens to the old urban fabric diachronically, and they own some properties such as dominance, adaptation, and relationship of part to whole¹³.

4.1 The Genetic system of traditional bazaar area

Historical cities are characterized with their compact urban centers and traditional areas, which hold distinct moral values represented through inherent and prominent features that give each city its uniqueness and its historical and geographical belonging.

Salingaros see the similarities between organisms and cities. “When the small cells of a larger organ are damaged, it’s easy for that damaged tissue to grow back — rather like repairing the small bricks of a damaged wall”.

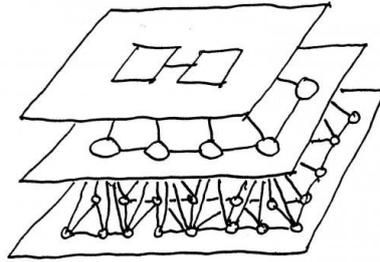


Figure (1) Distribution of inter-connected elements across several scales¹⁴

Self-organization and self-adaptation are central attributes of living systems, and their evolution. Indeed, this astonishing self-structuring capacity is one of the most important of biological processes, which requires networks, diversity, and distribution of structures across scales. (fig.1)

Salingaros, states that; urban fabric as the complex system in several layers and scales, requires the ability to retain and build upon existing patterns, so that those gradually build up into more complex patterns. Often this is done through the use of genetic memory. Structures that code earlier patterns are re-used and re-incorporated later. The most familiar example of this is, of course, DNA¹⁴.

The traditional urban fabric as the lived organism constitutes of a set of implicit (Geno types), which gone through some synthetic processes, leads to configure some explicit (Pheno types). Hillier, also emphasized the variety and complexity of this system. In his study, Hillier states that the Geno types is the basic generator which produces the various urban spaces, then (Pheno types) are those with visible properties for any urban settlement¹⁵.

Parts are the internal factors in the transformation process. Parts as Hillier described are the most linked or connected building through spaces and infrastructures. Functionally they supported the set of economical, social, environmental and cultural process. In his book ‘Space as the machine’ Hillier described the relationships due to the influences to;

- Casual; the configuration of urban structure produces as the result of nature of society as have been happened in the traditional cities.

- Symbolic; happened when the pre-design is put to the urban environment compulsorily (individual decision). This type causes to transform the social structure through regeneration¹⁴.

So focusing the urban context as the content of explicit (visual and formal properties) and implicit (synthetic –cultural, social, religious, and environmental- properties), system is crucial in understanding the urban fabric poses the formal and functional behavior chronological and synergic underpinned to the natural and compulsory transformation in the two or three dimension.

The implicit (deep) structure concerned to plural memories of society, aiming to create the inclusive integrated urban structure through parts linked locationally¹⁶.

Case Study

Sulaimani is one of the Iraqi Kurdish cities located in the northeast of Iraq. It has been constructed by Ibraheem pasha baban in 1784. The old city is a part of the central business district, has had an organic growth pattern, extending from the south (main entrance) towards the north. Constructing the other circulation axis (west-east) leads to the urban transformation towards the west gate, which linked the city to other main cities such as Erbil and Kirkuk. (Fig. 2, A) That was the main event in the history of the city’s structure transformation, which was the beginning of the inclusive change from the radial to linear pattern growth and form of the city.

The (Bazaar), as a part of the traditional commercial area, is located in the heart of the city, (Fig. 2, B) constructed since the emerging of the city. It has been the main vital core and surrounded by

various local focal points which have been the most common landmarks in the memories of the city's inhabitants, such as (the grand mosque, Saray building, Mawlawi street, Xanaqa mosque,)⁽¹⁾. (Fig. 2, C). For the purpose of the study, (bazaar) mentioned as the (locational level) among the larger area (central commercial area), which constitutes the (inclusive level). Also, the (Bazaar) identified by its compact form with the zig-zag network of circulation paths which connect all the parts, elements, and nodes in the most integrated pattern, kept its unity besides the social, economic, and functional coherence. (Fig. 2, C)

The study supposed that the structure and the synthetic properties of Bazaar acted as the armor for the most resilient part of the city, which persist against the radical changes and transformations faced the city during its history and granted its distinct urban privacy.

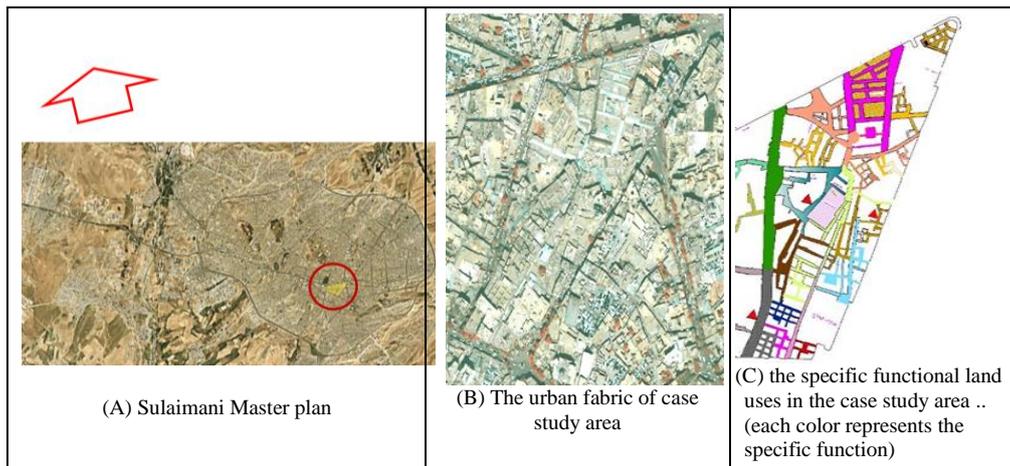


Figure 2, the case study area -Fabric & Land uses- .. (By researchers)

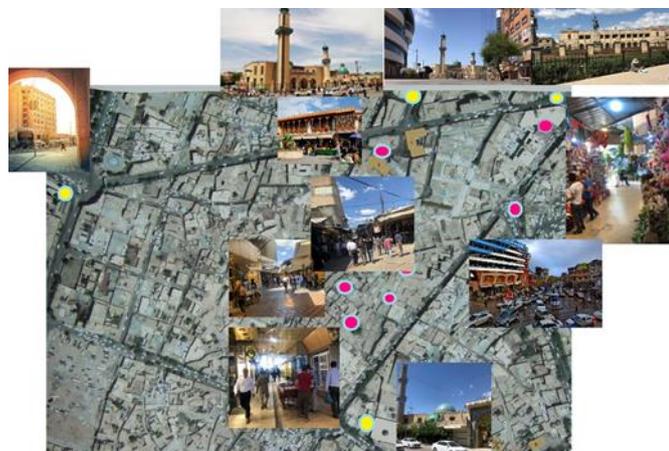


Figure 3 The most common landmarks in & outside of the case study area (by Researchers)

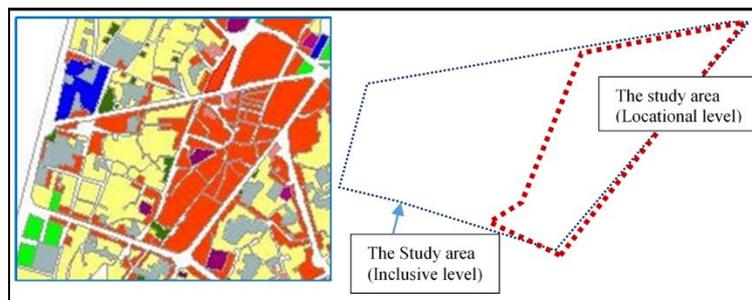


Figure 4 Local and inclusive level of the case study area (By Researchers)

⁽¹⁾Some local landmarks in Sulaimanyiah city

The study took the space syntax technique as the analytical description methodology, due to its capability in representing the urban fabric, types identification, formal analysis, structure or the place topology, and urban network (masses and spaces). All these, through the mathematical approach that links elements extended to the range of spatial configuration, considering the locational and inclusive relationships.

Space syntax is a method developed by Hillier and his colleagues in London College. The literature applied by researchers helps to understand the spatial system and its organization by measuring the Syntactical properties (Integration, Connectivity, Choice, Control) for each space that giving the impression of each space related to the other¹⁷. This approach is for describing and analyzing the architecture pattern of spaces on the urban level; also, it is a tool seek in the spatial configuration problems by measuring to which level that the social phoneme related to the characteristics of its spatial organization.

Moreover, the main variables measure will discuss in this paper:

- Integration of global integration according to Hillier could not be seen from the line global measure, describing the average depth of space to all other spaces in the system, the space of the system can be ranked from the most integrated (red axial lines) to the most segregated one (Blue axial lines). And for Hillier Integration used to understand the pattern of (to- movement potential) 'to- movement', and refers to how many other lines are up to (n) steps away from each line, and if count how deep or shallow each line is from all other lines.
- Integration core is the set of the most integrating (controlling) spaces of a system, For example, the (10%) most integrated spaces are normally referred to as the integration core. Meanwhile, Local integration for Hillier means counting how deep or shallow each line is from all lines up to three levels away is called radius-3 integration^{18, 19}.
- While, Connectivity, is a property of the line that can be seen from the line, and Klarqvist defined it as a "measures the number of immediate neighbors that are directly connected to a space. This is a static local measure"^{18, 19}.
- Choice, Global choice is a dynamic global measure of the "flow" through space and the space has a strong choice-value when many of the shortest paths, connecting all spaces to all spaces of a system, pass through it¹⁹.
- Control, is a dynamic local measure, it measures the degree to which space controls access to its immediate neighbors, considering the number of alternative connections that each of those neighbors has¹⁹.
- Another space syntax measure, Intelligibility calculate from the correlation between local and global variables (Global integration and connectivity), it is can describe what can be understood of the global relation of space from what can be observed within that space. (Table 2, H)

5.1 Depth-Map10 Software as technical tool

Depth-Map, a software program designed by Turner at University College London. Depth-Map concept developed behind the space syntax theory by Hillier and his colleagues, designed to be a tool for Space Syntax, the program deals with Visibility graph analysis for (Axial analysis, Convex analysis, Isovist analysis, and Segment analysis).

Axial analysis (a straight line- sightline possible to follow on foot) is running for this paper to analyze the spatial configuration of the urban system." For the program allows to import 2D layout in drawing (DXF) to make a graph, it can calculate topological distance, (how integrated a street is in relationship to all others in terms of the number of direction changes)^{19, 20}.

5.2 Results and Discussion

As for the axial lines analysis and syntactic properties that measured for the selected area, observed that:

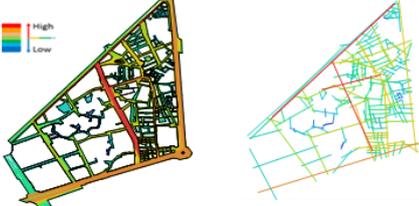
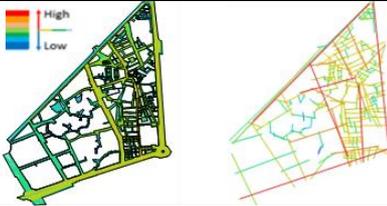
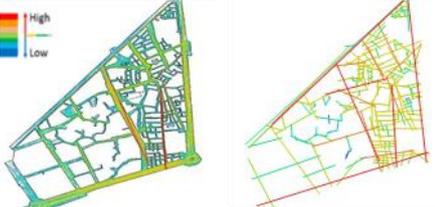
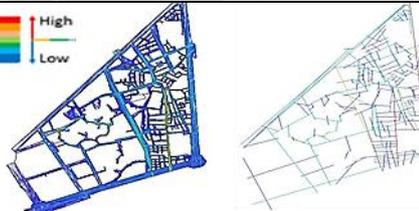
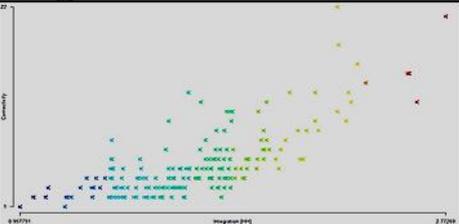
- From the analysis of the fewest number of the long and short axial lines that cover the urban spaces are 202 lines.
- The longest line (2596.7m) represents the main street, whereas the shortest axial line is (34.6 m), and the average length of about (296.8 m).
- According to the axial lines correlations in the Bazaar organization system; there are two types of intersections of the axial, the longest axial lines located in the layout of the system surrounded the selected area, with others located in the middle. While the shortest axial lines intersected between the longest ones cover the system overall. (Table 2, A)
- For Integration core; in any urban fabric is the set of axial lines, the most integrating spaces of a system, it assumes a shape of a spine or a wheel, whether it penetrates all parts or remains clustered in one area, also found that the integration core usually the highest of (5%,10%, or 20%) depending on the characteristics of the spatial system and the purpose of research in both global and local syntactic system¹⁹.
- For the system core of integration, the highest integration n (15% = 30 lines) with deciles (1 line). On the other hand 15% with the lowest integration lines (segregated lines). Integration core is clustered along the system diameter with clues of the spokes and rim portions of the deformed wheel, (penetrating core), the axial lines of low integration are spread in the integration core.
- Regarding the syntactic properties; the longest two surrounded axial lines with the longest lines in the center have the maximum global integration values respectively. (Table 2, B, C, D)
- The average of Bazaar Global Integration is 1.69 with min. = 0.95, and max. = 2.77
- For the local integration r =3, as the average local integration is = (2.18), with max. = (3.47) and min.= (0.33). (Table 2, B, C, D)
- The average of global choice (norm.) = (0.03), max.= (0.50), with a min. = (0), and the highest decile of choice, the only one axial line located in the center of the system, and this penetrates the center of the urban fabric on both sides. (Table 2, F, G) While the local choice r =3, shows that the high choice represents in two axial lines, one of the surrounded street and the other one in the middle intersected, while another line nearest to the main street, the average = (0.02), max. = (0.21) and min. = (0). (Table 2, F, G)

The total results are summarized in table (1).

Table 1 Syntactical properties

Syntactical property	Max.	Average	Min.
Connectivity	22	5.27	1
Integration(HH) r = n	2.77	1.69	0.95
Integration(HH) r = 3	3.47	2.18	0.33
Choice (Norm) r = n	0.50	0.03	0
Choice (Norm) r = 3	0.21	0.02	0
Control	4.78	0	0.21

Table 2 figures shows the syntactical properties of the case study area (researchers)

Figure No.,	Axial map analysis	Analysis illustrations
A	Connectivity	
B	Integration HH	
C	Integration H3	
D	(A); integration Core; (B); integration Core Values	
E	Control	
F	Choice (nom) HH	
G	Choice (nom) H3	
H	Intelligibility Scatgram (Integration to Connectivity)	

6. Conclusions

The study arrives at some most important points, which represents the syntactical properties of the case study and illustrate the potentiality, and know-how the challenges of persisting toward the radical changes or transformations during the city's history:

- The high centrality of the urban structure, although there was the high global integration adjacent to the main opened streets towards east-west and south-north.
- Some architectural elements outside the area (Landmarks) worked as a catalyst for the growth and change, and have the very high potentialities of persistence, play a vital role in constituting urban fabric through their propelling attributes; such as paths, nodes, urban artifacts, or the urban pattern and layout, i.e (the Grand mosque, Saray building and city center, Ashaba-spy intersection, Xanaqa mosque, and Sulaimani palace building...). These elements have allowed cities to be resilient and functional through time, across very different contexts and conditions. Also can help to define the individuality of the community or city and create a strong connection with the past.
- Arising some locational integration cores with short axial lines, around some of the specific zone, (Qaisary Naqeeb, Hawza Wshkaka, Bazaary Wasman Pasha, Farah hotel,)⁽¹⁾ which attract the most amount of movement.
- Unintelligibility of the urban structure –at the global level-, on the contrary of the locational Intelligibility relatively in the case study, especially in the center of the area and zones closed to the main streets, which had the short axial lines.
- The left part of the area suffers from the unidentified loose structure; conflicted land uses between residential, handcrafts, commercial, heritage, and modern buildings. All that leads to low-value integration, with a low level of connectivity and poor ranges of movement. A low level of choices with low control properties due to enharmonically relationships between locational and global syntactic properties caused radical changes in the urban structure of this part during the last 30 years.
- Bazaar is considered one of the most significant socio-spatial systems in the cities. Some syntactical properties reveal that increasing the correlation and local integration values in some nodes, (qaisaries), and paths with short axial lines, or long lines with high connectivity and high control, acts to link strongly with the public memories and mental images of the city's inhabitants, such as (Hawza wshkaka, qaisary Naqeeb, Mazadxanaka, Farah hotel, bazaar Dolaraka...)⁽²⁾.
- The coherence in some parts –with some global axial penetration-, resulted from the locational syntactic properties, reflects the correlation between (parts – parts) and (parts-whole), this trait represents the high coherence of the urban structure, which granted the area its resiliency and persistency.
- Some parts with low choice and low control values, although have high-value correlation, that is because includes of some heritage pollutant activities such as (carpentry, blacksmiths, saddlery, Poultry zone –under Mawalawi bridge- ...).
- Finally, Sulaimani Bazaar as the lived organism constitutes a set of implicit (Genotypes), (synthetic –cultural, social, religious, and environmental- properties), concerned with plural memories of society, aiming to create the inclusive integrated urban structure through parts linked locationally,

⁽¹⁾Some local and famous commercial complex and building in Sulaimanyiah city

⁽²⁾Some local and commercial landmarks inside the central traditional commercial zone in Sulaimanyiah city

identified by dominance, adaptation, and relationship of part to whole. These deep structures (Geno) acted as the creative generative engine, through mentioned synthetic processes, leads to configure explicit (Phenotypes), due to continuous adaptation gradually (natural self-organization). Such properties have been held the meaning from the past, the way that kept the Bazaar its identity, persistency, and resiliency.

Conflict of interests: The authors declare no conflict of interest.

Data availability: All data generated or analyzed during this study are included in this published article.

‘Authors Contribution’:

H. Q. R. and W. A. S. initiated, developed and performed the study; and drafted initial sections of the manuscript. W. A. S. performed the technical tool. Both of the authors analyzed the results, reviewed and approved the final manuscript.

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