Article

Sustainable continuity of cultural heritage: An approach for studying architectural identity using typo-morphology analysis and perception survey

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Architecture plays a crucial role in expressing identities. This study aims to create a model of sustainable continuity of cultural heritage as an approach to study architectural identity in Erbil City. The study combined visual analysis using graphical representation, analysis of previous studies, field surveys, and questionnaire surveys as methods of data collection. The rationale behind selecting Erbil City is related to its unique sustainable developments related to its cultural heritage through the ages, as the oldest continiously inhabited city in the world.

The proposed model revealed a strong correlation between independent variables that represent cultural heritage frameworks of (typo-morphology of house layouts and façade, sociocultural factors, sustainable development factors) and the (continuity of architectural identity in houses situated in Erbil city) as a dependent factors. The regression analysis demonstrated that the most effective factor contributing to the continuity of the architectural identity of houses in Erbil city is the physical characteristics related to the typo morphology of the house's plan layout. The study revealed a comprehensive model that includes the relation between inherited and created sustainable elelments related to cultural heritage that effects on the continuity of architectural identity.

Keywords: Sustainability, continuity, cultural heritage, architectural identity, typomorphology, perception survey

1. Introduction

The term "identity" is vague and elusive, with various applications in different situations. Recently, it has been utilized extensively for various intentions [1].

Hague and Jenkins [2], noted that there are certain assumptions regarding the concept of identity, as the term itself is derived from the Latin word "idem", which signifies "the same".

The concept of identity refers to the uniqueness, oneness, and recognition of an individual. People express their identity through both tangible and intangible means. The former involves physical aspects, while the latter pertains to moral and non-physical aspects.

Architecture, as a representation of civilization, holds significant significance in shaping cultural, social, and individual identities [3]. Architecture plays a crucial role in representing identity as it provides a medium for conveying human identity through physical components and spaces. Additionally, architecture as a physical product contributes to giving identity to its users and occupants.

Returning to the literature on the subject of architectural identity reveals that there are two contrasting viewpoints. The first asserts that architectural identity is a static

concept, passed down from previous generations to future ones. The second perspective contends that architectural identity is a process and can be formed anew. The two approaches have a tense relationship, where the response to each approach is influenced by a range of factors and forces. The nature of this relationship between the opposing views of inheritance and the creation of architectural identity can vary depending on the time and location of the geographical context.

Cultural heritage, both tangible and intangible, influences the continuity of architectural identity. Buildings are tangible cultural heritage and represent physical components and spaces. Other tangible cultural heritage factors include the environment, economy, and other related aspects. Intangible cultural heritage, on the other hand, relates to socio-cultural factors that can also influence the continuity of architectural identity.

The central argument of this paper is that both tangible and intangible sustainable elements of cultural heritage play a crucial role in maintaining the continuity of architectural identity. The research focuses on houses in Erbil city, spanning from 1900 to 2020, and examines how the typo morphology of houses has changed over 120 years. The study aims to establish a framework for the physical cultural heritage related to the typo-morphology of the layout and facades of houses in Erbil city during this period, to identify the sustainability of tangible cultural heritage elements of houses that affect the continuity of architectural identity.

Furthermore, the study also explores previous research on the sustainable tangible and intangible factors related to cultural heritage that may impact the continuity of the architectural identity of houses in Erbil City. To accomplish this, a questionnaire was designed based on the two frameworks mentioned above, and it was administered to architecture experts. The questionnaire aimed to test the main hypothesis of the research, which is that there is a significant correlation between the sustainable elements of cultural heritage and the continuity of architectural identity as a global concept and in Erbil city.

The research found that there is a strong correlation between sustainable tangible and intangible elements that are associated with the cultural heritage of Erbil city and the process of continuity of architectural identity. Also, it found that the physical elements of cultural heritage related to the typo-morphologies of houses are mostly contributing to the process of continuity of identity in houses of Erbil city more than the sociocultural factors and the sustainable development factors. It means that physical elements are more representative of identity in houses of Erbil city.

This study contributes to the body of knowledge by introducing a simplified guideline for researchers to study the process of continuity through the sustainable tangible and intangible elements. It associated to the notion of cultural heritage in a given society, within certain cultural context and specific period. Here cultural heritage is a broad concept that encompasses numerous sustainable elements that relates to certain culture. It is considered as a sustainable process that is inherited and continuous to future. Keeping in mind that cultural heritage elements are changeable according to different cultures and times. Also architectural identity is considered as a process that is changeable and continuous. Correlating cultural heritage sustainable elements and process of continuity of architectural identity through a qualitative and quantitative researche is necessary to understand the process of continuity of architectural identity in various contexts and periods. Interconnecting different frameworks throughout the research was helpful to achieve the research goals.

2. Literature review and definition of concepts

2.1. Cultural heritage

2.1.1. Definition of cultural heritage

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Heritage refers to the cultural inheritance that has been passed down to us from previous generations, that we experience in the present, and that we will transmit to future generations [4]. Heritage is a comprehensive and inclusive concept that encompasses something that an individual or a group considers important enough to be cherished, protected, documented, displayed, renovated, and appreciated [5].

As per the International Council on Monuments and Sites (ICOMOS), cultural heritage refers to the customs, practices, objects, places, artistic expressions, and values that have been developed and transmitted across generations by a community as a reflection of their way of life.

Cultural heritage can be categorized as either tangible or intangible and is often differentiated into three categories: built environment, natural environment, and artifacts.

Cultural heritage creates physical manifestations of belief systems, traditions, and ways of life that are an integral aspect of human activity. It is a fundamental component of overall culture, comprising of visible and touchable remnants that date from ancient times to the present [6].

According to Stanford Encyclopedia of Philosophy, Cultural heritage is a broad and nebulous concept, and discussions often assume an understanding meant to capture its heterogeneity [7].

Heritage is a set of values connected to objects, phenomena and people, which express the sustainable continuity between the present, past and future. Heritage is characteristic of a specific cultural period and level of society [8].

2.1.2. Approaches to the concept of heritage

Approaches to heritage can be conceptually divided into three groups [8]:

- Heritage as a set of valuable objects, this approach emphasized on the tangible heritage, such as architecture, work of arts that belong to the past. At the 2000s emphasize is directed towards intangible aspects of heritage.
- Heritage as a part of the environment. This approach is focusing on the sustainable connection between heritage and environment. Depending on the specific heritage, the environment can mean places, territories, landscapes, other objects, as well as the entire living environment more generally, in either the physical or intangible sense.
- Heritage as a socio-cultural construct, this approach is related to the social and cultural aspects of heritage. Heritage no longer dealt as an object related to a certain environment. There are also socio-cultural aspects that relate to heritage. This new approach is called (new heritage) [9].

2.1.3. Heritage as a sustainable process

Today's individuals and societies are not merely passive preservers and conveyors of their cultural legacy, but rather they actively produce and influence their heritage. The creation of heritage is a result of human efforts, and hence it would be more appropriate to view it as an ongoing sustainable process rather than a static entity [10].

2.1.4. Heritage as identity

The connection between heritage and identity is widely acknowledged in heritage studies, with material culture being considered as a means to give a concrete form to the abstract and fluid concept of 'identity'. In a manner similar to history, heritage generates a sense of belonging and continuity [11], and its tangible nature reinforces these emotions with a sense of physical reality. According to Graham et al. [12], heritage endows human

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existence with significance by transmitting the notions of enduring values and uninterrupted lineages that form the basis of identity.

The analysis suggests that cultural heritage, whether tangible or intangible, represents the past that is continuously evolving and being passed on to future generations. This indicates that the concept of cultural heritage is not a static object, but rather a sustainable ongoing process of inheritance and transformation. This process is continually evolving and can be developed at any time and in any environment, even including the creation of new cultural heritage in the future. Architecture, as a form of tangible cultural heritage, embodies the characteristics of the built environment that reflect the cultural heritage of a specific time and place. It is noteworthy that both tangible and intangible cultural heritage reflect the identity of the cultural groups and societies that produce them. Several sustainable elements are associated with cultural heritage, and these are regarded as elements that reflect it (Figure 1).

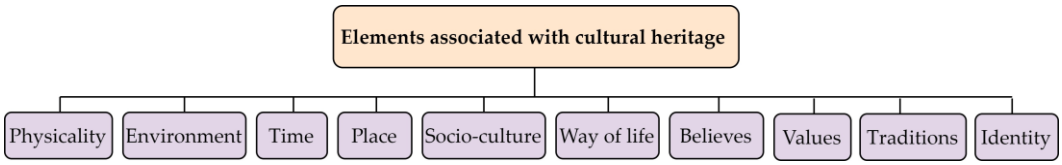

Figure 1. Elements associated with cultural heritage (by authors).

2.2. The concept of identity

According to research in social science and humanities, the exploration of the concept of "identity" raises the issue of personality. The concept of identity is commonly understood to refer to individuals' perceptions of "who they are" and their relationships with others [13, 14].

Maintaining a sense of identity is a means of ensuring that the self remains constant over time. This involves incorporating lifestyle or values that create a connection between the past and present [15].

For Graham [16], there are three principles of identity:

Distinctiveness: refers to how individuals use a location to set themselves apart from others.

Continuity: pertains to the idea of maintaining a sense of self throughout one's life utilizing places.

Self-esteem: involves utilizing a place to form a favorable assessment of oneself.

2.3. Architecture identity

2.3.1. Architecture identity as a concept

Expressing identity can be achieved through architecture [17]. A building can be differentiated based on its unique set of characteristics, which collectively represent its identity [18]. Identity refers to a set of meanings and mental images linked to a recognizable space that is formed in the mind through the process of perception [19]. Identity is composed of three fundamental aspects: time, location, and culture. The fourth aspect is prone to modification. Architecture primarily utilizes time and space as key elements for developing images that convey identity.

2.3.2. Identity and time (Architecture identity as a continuous process)

Identity can be described as a process of maintaining consistency over time [20]. As Hall [21] explains, identity is a production that is never complete, always in process, and always constituted within the representation. Societies continuously make new evaluations of the built environment and the meaning that it conveys, and this process is rapid.

According to Charles Correa, identity is viewed as a sequence of ongoing processes, rather than a fixed entity. It undergoes constant transformation over time, making it

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dynamic instead of being a concrete object [22]. Things that were visually acceptable in the past are now unacceptable, and what was unacceptable in the past has become valuable and received meaning over time. Identity goes beyond the visual appearance of the built environment and involves the meanings of those built environments to the people who created them and to the people who have occupied them [18].

2.3.3. Identity and place (Architecture identity and context)

There is a tensional relation between the idea of the intangibility of heritage – the idea that heritage is the cultural processes of meaning and memory making and remaking rather than a thing – and the critical reality that there are physical things or 'places' we call and define as heritage.

In exploring the idea of 'place', it is vital to consider the tension between the physicality of place, the conceptualization of identity or social place, and the inevitable interlinking of these ideas. As Escobar [23] argues, place is both 'a category of thought' and 'a constructed reality', and it suggested that this tension is a central aspect of the correlating place as heritage with identity.

Previous research highlights that the identity of architecture is an ongoing process that involves a delicate balance between upholding traditional influences and creating novel identities. This balance is impacted by various factors, such as time, place, and external influences, which will be examined in relevant studies (Figure 2).

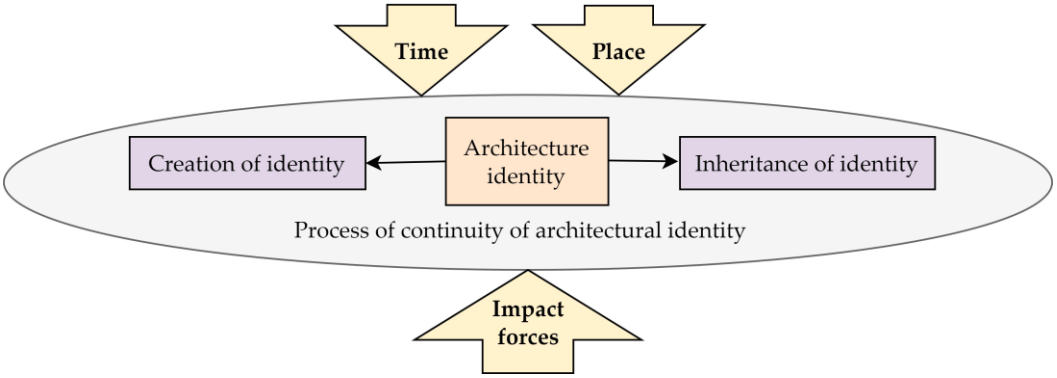

Figure 2. Conceptualizing the tensional relation of continuity of architecture identity (by authors).

Previous relevant studies about the concept of architectural identity reveal that there is a wide range of approaches to this topic, some studies have studied architectural identity as a concept through its meaning and essence [24], and others studied it as a process that is changeable with time and place. The study of architectural identity through time is conducted through the study of the concept in different periods chronologically or in a specific period [25, 26, 27, 28, 29, 30]. The study of architectural identity through its relationship with place includes two main approaches, the first is considering the place as a physical representation of certain geography [27], and the second considers place as a non-physical entity that influences architectural identity, such type of studies deal with specific cases comprises of different building typologies, for instance, houses, public buildings, commercial buildings [31]. Some studies are concentrating on multiple parallel identities that represent the identities of subcultures within a society, which is called hyper identity [32]. Other studies see that society has a role in changing identities to appropriate its physical and cultural needs [33]. Previous studies mostly investigate the physical representation of architectural identity, including visual features and functions of buildings [27, 34, 35, 36, 37, 38, 39, 40, 41]. Some studies discuss the influence of culture and morals on architectural identity [30, 31, 36, 37, 39, 41, 42, 43, 44, 45, 46, 47]; others are studying architectural identity through factors such as sustainability, politics, economy, design process, religion [43, 45, 48, 49, 50, 51]. Previous studies also

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investigated the power of modernity towards change in architectural identity even by adaptation of old identities with new cultural environments, or by transformation of past identities into new ones [37, 52]. In some studies, the creation of totally new identities is discussed for the inappropriateness of past identities for new ways of life and change in cultural values and beliefs [53, 54].

This research contributes to studying architectural identity as a continuous process via the influence of the tangible and intangible sustainable elements that are considered part of cultural heritage, taking Erbil as a case. This study investigates cultural heritage as a sustainable process that is changeable and it is a broad concept that reflects several aspects of society. It tries to discuss the broad concept of cultural heritage through a set of sustainable elements, then finds which of these elements is most effective on the continuity of the architectural identity of houses in Erbil city.

3. Materials and Methods

This study utilized mixed meyhodology comprising both qualitative and quantitative research methods including three systematic steps in order to obtain the research objectives. Data was collected from a range of sources including literature review, field survey, graphical analysis and questionnaire Figure (3).

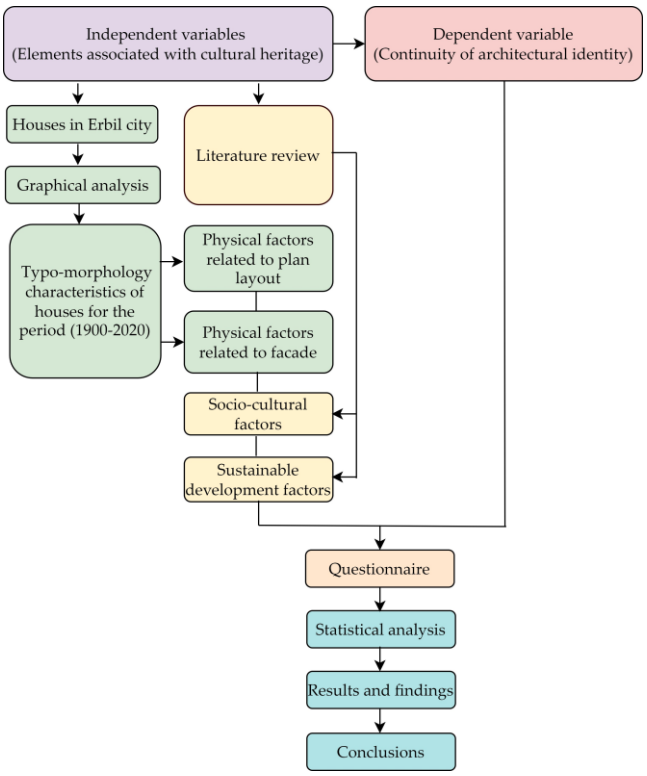

Figure 3. Flowchart of research methodology (by authors).

3.1. Objectives and research steps (implementation matrix)

The methodology in this paper comprises of three steps, in order to achieve the objectives of the research Table (1). Each step utilized a certain research tool to obtain research findings. Findings of step 1 and step 2 will be part of questionnaire survey in step 3

Table 1. Research steps and objectives.

Research	Research	Research	Type of	Objective

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steps	method	tool	sample	
Step 1	Qualitative	Typo-morphology analysis	Houses in Erbil city	The aim is to establish a framework that depicts the physical and typo-morphological characteristics of houses in Erbil city between 1900 and 2020
Step 2	Qualitative	Checklist analysis	Literature review	The objective is to develop a framework that portrays both tangible and intangible sustainable elements of cultural heritage that impact the process of continuity of architectural identity
Step 3	Quantitative	Questionnaire	Experts in the field of architecture	To identify the factors that influences on the continuity of architectural identity as a tensional relationship between inheritance and creation of identities. Also to find the most effective tangible and intangible factors that influences on the continuity of architectural identity in the houses in Erbil city for the period (1900-2020)

3.2. Step one: Developing a framework for typo-morphologies of houses in Erbil city for the period (1900-2020)

3.2.1. Typology in architecture

The primary focus of typology as a field of study is to examine the fundamental principles that determine how buildings are grouped and labeled according to their characteristics. According to Demiri [55], typology pertains to the formal and spatial features of buildings that are deeply rooted in history and culture. Here typology is considered as the "classification of models" [56]. Therefore, the process of typology is perceived in this discourse as a flexible process that evolves and advances in accordance with the evolutionary patterns of a specific society, and cannot be limited to a single formal framework.

It should be emphasized that discussions on typology highlight that its goal is not to identify architectural styles; rather, it comprises a collection of descriptive classifications that establish the spatial features of buildings across time [57].

Typology has been employed in two ways: as a foundation for evaluating buildings and cities (analytical typology) or as a foundation for creating designs of buildings (generative typology) [58].

Fundamentally, and in the substance of this study, the analysis of typology allows for the scrutiny, categorization, identification, and depiction of house features throughout various periods.

3.2.2. Morphology in architecture

The investigation and assessment of the physical and structural features of constructions is what building morphology pertains to. This encompasses an exploration of the design, shape, and spatial arrangement of buildings, as well as their interdependence with function and setting. Building morphology is an interdisciplinary area of study, incorporating principles and techniques from fields such as architecture, engineering, urban planning, and other relevant disciplines, with the objective of comprehending the formation of buildings and their influence on the built environment [59].

3.2.3. Typo-morphology in architecture

The creation of a type depends on the presence of a clear functional and formal similarity among a group of buildings [60]. This is known as a typo-morphological attitude of analyzing and categorizing the spatial and morphological aspect of buildings.

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3.2.4. Analysis of previous studies related to typo-morphology of houses

Previous studies concerning house typo-morphology analysis comprise various study methods and cases. They are conducted in different periods and contexts. Table (2) includes an analysis for studies concerning typo-morphology of houses. This is essential for extracting parameters utilized in these studies.

Table 2. Typo-morphology of houses in previous studies.

Typo-morphology of houses	**Reference**
Position of house and plot land	[61]
Shape of plan layout	
Construction system	
Features of the facade	
Accessibility	[62]
Ground floor plan typology	
Façade typology	
Structural system and materials	
Internal relationship of spaces	[63]
Spatial organization	
Plan typology	[64]
Space functions	
Plan form and layout	[65]
Roof configuration	
Construction techniques	
Relation of house area to land plot area	[66]
Roof type in plan	
Floor plans and vertical circulation	
Façade articulation	
Façade finishing	
Shape of entrance	
Shape of windows	
Indoor space arrangements	[67]
Indoor space functions	
Connection between indoor and outdoor spaces	[68]
Hierarchy of open spaces	
Connection and boundaries of functional zonings	
Relation of house with land plot	[69]
Orientation	
Plan layout shape	
Facade arrangement	
Construction technique	
Structural condition	
Building materials	
Façade elements	

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Spatial layout	[70]
Functional zones	
Construction	
Spatial composition	[71]
Relation between mass and void	
Construction	
Visibility from street	
Façade	
Street accessibility	
Number of floors	
Building materials	
Functions	
Spatial organization	[72]
Number of floor	
Plan form	
Spatial organization	[73]
Relation between house area and plot area	
Functional zones	
Number of floor	
House orientation regarding street	
House enclosure	
Type of houses in terms of space organization	[74]
Plan layout	
Functions	
Spatial patterns	[75]
Shape of house layout	[76]
Relation between house area and plot area	
Building parameter	
Spatial pattern	[77]
Function	
Shape of plan	
Material	
Form and space arrangement	[78]
Accessibility and entrance	
Shape of courtyard	[79]
Mass configuration	
Position of the courtyard	
Patterns of indoor and outdoor spaces	
Physical form	[80]
Spatial configuration	
Spatial arrangement	[81]
Structure	

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Housing typologies	[82]
Spatial organization	[83]
Building and façade typology	
Form typology	[84]
Mass configuration	

The research indicates that various parameters have been examined in previous studies in regards to analyzing the typo-morphology of houses. This suggests that the parameters for analyzing house design are subject to change depending on the specific time and context. The research was able to identify 31 parameters that are relevant to both the layout of a house and its façade. The most commonly used parameters in these studies were the shape of the plan layout, spatial organization, space functions, façade features, construction system, and configuration of indoor spaces (Figure 4).

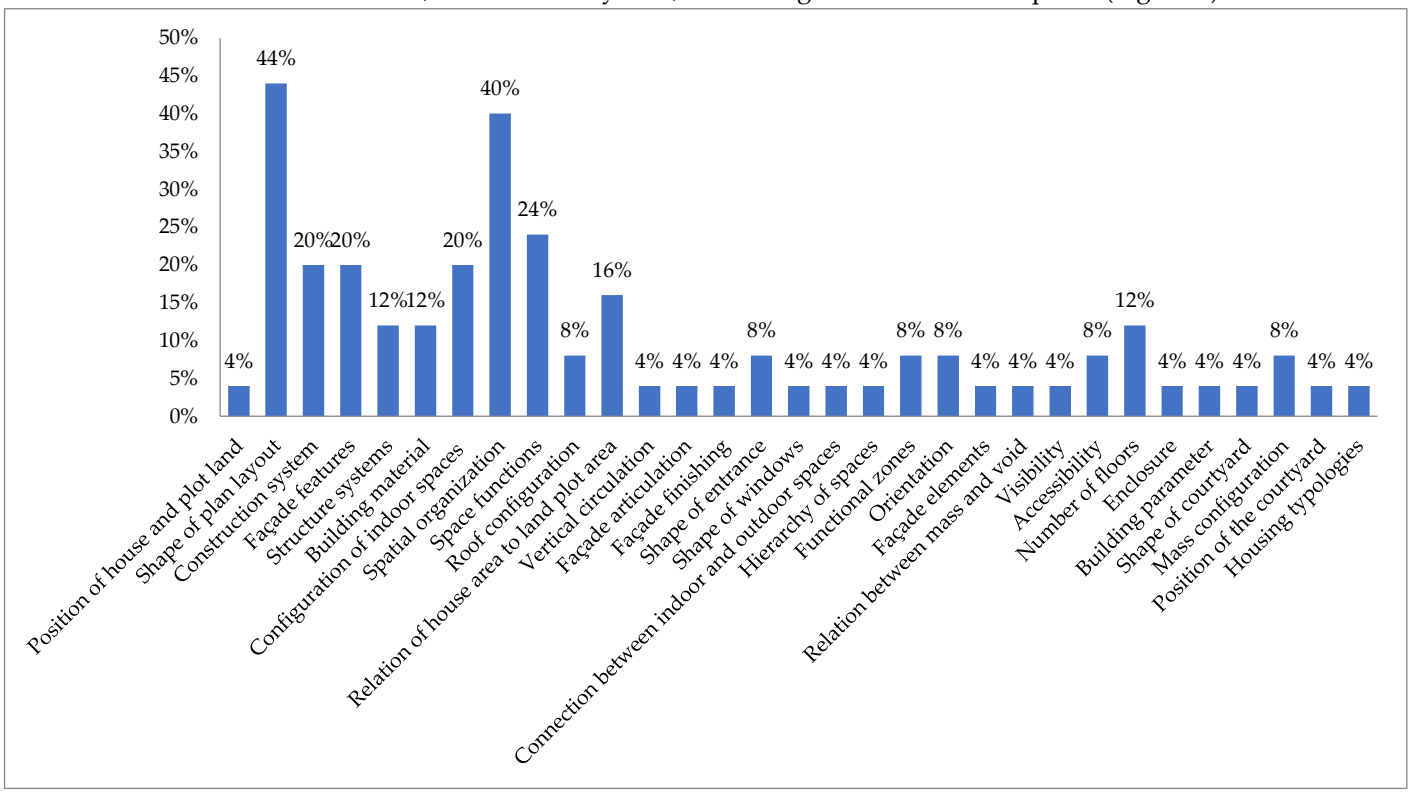

Figure 4. The ratio of parameters related to the typo-morphologies of houses that were mentioned in previous studies (by authors)

Based on the previous analysis, this paper will use the parameters extracted from the studies in two ways, firstly utilizing the variables that are matching with the selected samples of the research, secondly finding new parameters that represent the typo-morphology of the selected house samples and not mentioned in the previous studies.

3.2.5. Sampling and typo-morphology analysis for houses in Erbil city

Houses in Erbil city were selected as sample from the period 1900 to 2020. Erbil city is located in the north of Iraq. It is considered the oldest continuously inhabited city in the world, with a history dating back at least six millennia. The city is particularly renowned for its citadel, which remains intact to this day and serves as a cultural and spatial core of the city. The citadel sits atop a 32-meter-high mound [85], and the city's urban expansion and growth have continued to radiate outward from this central point, with concentric ring roads and crossroads. This growth pattern demonstrates how the city's architecture and urban fabric have maintained their continuity over time.

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Erbil's houses have a rich and long history, serving as physical and cultural representations of the city's patterns of living. The oldest houses still standing in the city date back to the Ottoman period at the end of the nineteenth century and the beginning of the twentieth century [85]. This is the rationale behind selecting houses from this period for the study, covering 120 years of architectural growth in the housing typo-morphology characteristics.

For this study, a total of 140 houses were analyzed for finding the typo-morphology characteristics of their plan layout and facade.

The samples have been stratified into four periods, to cover the entire period of study. The periods are:

- (1900-1929), this period represents the traditional houses; they are mainly located in Erbil citadel
- (1930-1959), this period represents the beginning of modern houses with keeping traditional house features; they are mainly located inside the first ring road that surrounds the citadel.
- (1960-1989), this period represents modernity in house features; they are located between the first ring road and the second ring road.
- (1990-2020), this period represents contemporary design features in houses; they are located between the second ring road and the third ring road (Figure 5).

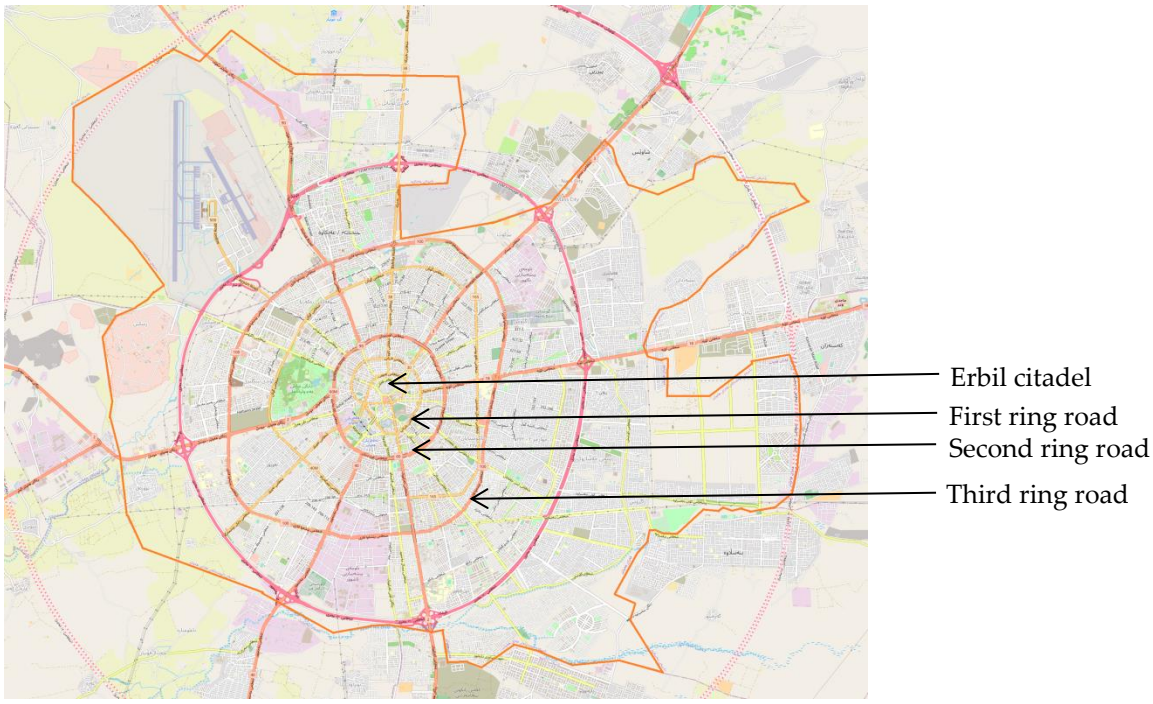

Figure 5. Erbil map showing the citadel and the ring roads. Source [86]

3.2.6. Criteria for sample selection

The samples must be in a satisfactory physical state and not be collapsed, even though traditional houses in Erbil city are currently in poor condition, with many of them partially or completely collapsed. The samples must maintain their originality and authenticity.

3.2.7. Sampling method

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In this step of the research, the goal is to identify diversities in typo-morphological features of houses built between 1900 and 2020. To accomplish this, samples were chosen using a probability random sampling method for each period of the research [87, 88]. Samples that are not matching the criteria for sample selection were neglected; as a result, a number of samples were selected for each period as shown in Table (3)

Table 3. Sample size for each strata period.

Period	Number of samples
1900-1929	20
1930-1959	20
1960-1989	50
1990-2020	50

Table (3) reveals that the number of samples in each stratum is not uniform. This is because the sampling area in the first and second periods was restricted compared to the third and fourth periods, owing to the rapid expansion of Erbil city's urban fabric since the 1960s Figure (4).

3.2.8. Data collection

- Conducting a site survey to gather information through measurements and photographs.
- Paying visits to official organizations in Erbil city, such as the municipality and the High Commission for Erbil Citadel Revitalization (HCECR), to obtain data, particularly the construction dates of sample structures and some original design sketches of house samples.
- During the survey, conducting brief interviews with homeowners to gather information on the construction dates of their houses and to check whether any alterations have been made to the original structure.

3.2.9. Typo-morphology analysis procedure

The analysis process begins with the use of the Autocad program to recreate the draft layouts of the houses and to organize the photos taken during the site survey stage. Subsequently, a checklist is prepared that includes typo-morphology parameters identified in previous studies. If a parameter is present in the samples, a tick sign (/) is placed in the corresponding cell of the checklist. Moreover, new parameters may be added to the checklist if any of the existing parameters derived from prior research are missing.

3.2.10. Findings of typo-morphology analysis

Following the analysis of the house samples, the paper identified and classified seven main items that represent a framework for the typo-morphological features of the houses' plan layouts as follows:

1- Setback and relationship between house mass and public domain
2- Relationship between house's ground level and street level
3- House layout patterns
4- Indoor spaces distribution patterns
5- Accesibility and circulation
6- Functions of spaces
7- Façade parameter

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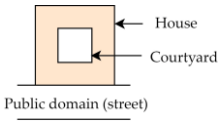
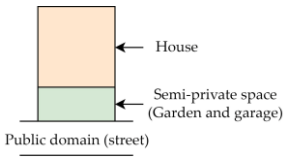
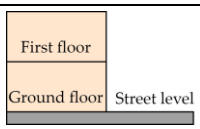
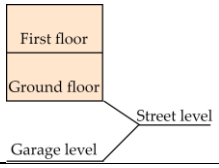
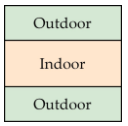
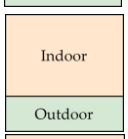
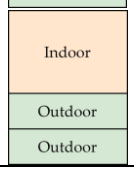
On the other hand, a group of seven main characteristics representing the typo-morphology of the houses' facades were identified and derived as follows:

1- Composition of mass
2- Composition of the façade
3- Ordering principles
4- Façade elements
5- Openings
6- Material
7- Color

Each of these main typo-morphologies includes other sub typo-morphologies observed in the selected house samples in Erbil city. The study concluded that the main typo-morphologies are broad categories that can be applied in various contexts, which is why they have been used in many previous studies. In contrast, sub typo-morphologies are more diverse and specific to particular contexts. (Tables 4) and (Table 5) display the total typo-morphologies and sub typo-morphologies of house plan layout and façade observed in the selected samples in Erbil city. Additionally, graphical representations of each typo-morphology and a brief description are included.

Table 4. The typo-morphologies that explored in the samples of houses plans in Erbil city from (1900-2020).

Main typo-morphology	Sub typo-morphology	Graphical representation	Description
Setback and relationship between house mass and public domain	Direct relationship between the house mass and public domain (street)		The house is located directly on the street
	Indirect relationship between the house mass and public domain (street)		There is a transitional semi-private space that seperates house from the public domain (street)
Relationship between house's ground level and street level	House level is the same as street level		House and public domain (street) are at the same level
	House level is half story above street level		The ground floor is raised above street level. A ramp is existing that leads to underground garage
House layout patterns	Relationship between indoor and outdoor spaces		There is an access from the main entrance to inside the house then there is a link to outside from another access
			There is an access from the main entrance to inside the house
			There is an access from the public realm (street) to the courtyard which is outdoor then stepping to inside spaces

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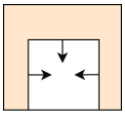
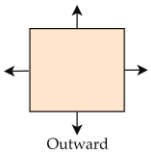
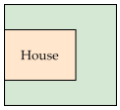
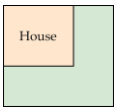
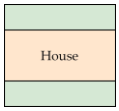
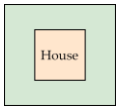
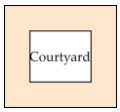
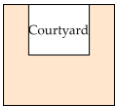
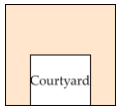
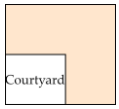
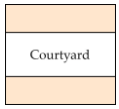
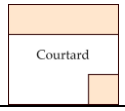
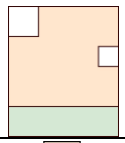
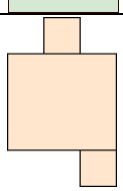
House layout patterns	Enclosure		The spaces are opened inward toward courtyard, and closed outward
			The spaces are opened outward
House layout patterns	Location of the house within the plot of land		The house is surrounded by U-shaped open space
			The house is located in a corner of the land surrounded by L-shaped open space
			The house is located at the middle of the land with front and backyard
			The house is located at the center of the land surrounded by open space
			Central courtyard surrounded by mass
			Courtyard located in the back surrounded by U-shaped mass
			Courtyard located in the front surrounded by U-shaped mass
			Courtyard located in the side surrounded by L-shaped mass
			Courtyard is located in the middle with two stripe of masses at the front and back
			Courtyard as a dominat space with scattered masses
			Scattered open spaces within the mass
House layout patterns	Shape of plan layout		Geometric regular

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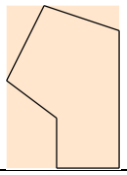
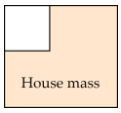
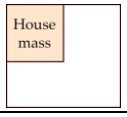
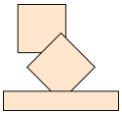
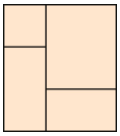
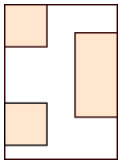
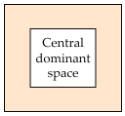
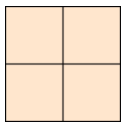
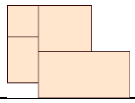
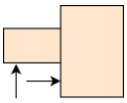
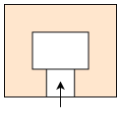
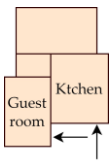
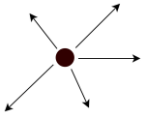
			Geometric irregular
House layout patterns	Ratio of house mass to open spaces area		The area of house is bigger than the area of open spaces
			The area of open space is bigger than the area of the house
Indoor spaces distribution patterns	Space configuration inside the house		Non-centralized organization. Spaces are clustered
			Spaces have different areas
			Spaces are scattered
			A central dominant space surrounded by a number of secondary spaces
			Spaces have congruent areas
			Spaces are densly organized
Accesibility and circulation	Number of entrances in the house		The house have multiple entries to indoor spaces
			The house have just one entrance that leads to the courtyard
	Direct access from outside to indoor spaces		There are direct entrances that connect outdoor space and indoor spaces including, kitchen, guest room, living room and courtyard
Accesibility and circulation	Type of circulation inside the house		A radial configuration has linear paths extending from or terminating at a central common point (space) [89]

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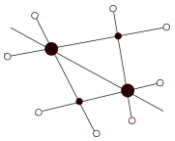
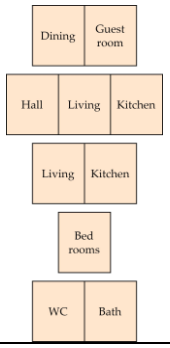
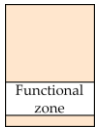
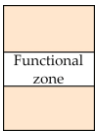
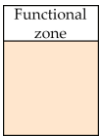
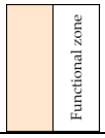
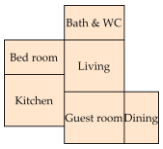
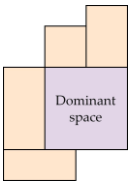
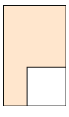
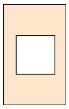
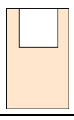
			A network configuration consisits of paths that connect established points in space [89]
Functions of spaces	Physically and spatially defined functional zones		Spaces are grouped together and they are spatially defined as a zone that includes spaces functionally related
Functions of spaces	Location of functional zones inside the house		The functional zone is located in front of the house
			The functional zone is located in the middle of the house
			The functional zone is located in the back of the house
			The functional zone is located in the side of the house
Functions of spaces	Functions of spaces inside the house		The availability of diverse functions in the house including, entrance, guest room, living room, kitchen, internal hall, bed room, bath, WC, courtyard
Functions of spaces	Hierarchy of spaces inside the house and the availability of dominant space		The dominant space in the house is the larger space that dominates on the other spaces. Courtyad, guest room and living room are observed as dominant spaces
Functions of spaces	Position of the dominant space		The dominant space is located in the front of the house
			The dominant space is located in the middle of the house
			The dominant space is located in the back of the house

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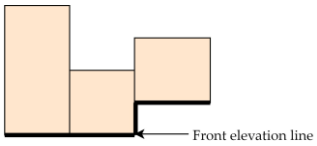
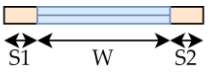
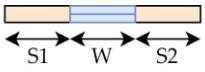
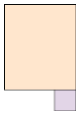
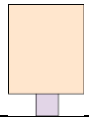
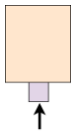
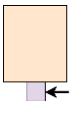
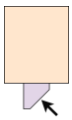
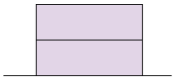
Façade parameter	Spaces adjacent to front facade parameter		Spaces are adjacent to the front elevation
Façade parameter	Shape of the window in the plan layout		The window have a linear straight shape
			The window have a right angle shape
			The window have a tapered shape
			The window have a semi-circular shape
Façade parameter	Ratio of Solid (wall) to void (window) in the plan layout of spaces		W > S1+S2
			W < S1+S2
Façade parameter	Location of the entrance regarding the elevation		The entrance is located at the side of the house facade
			The entrance is located at the center of the house facade
Façade parameter	Shape of the entrance in the plan layout		The entrance opening is parallel to house façade line
			The entrance opening is perpendicular to house façade line
			The entrance opening is 45 degree rotated to house façade line

Table (5) The typo-morphologies that explored in the samples of houses facades in Erbil city from (1900-2020)

Main typo-morphology	Sub typo-morphology	Graphical representation	Description
Composition of mass	Height of the house		The house is one floor high
			The house is two floors high

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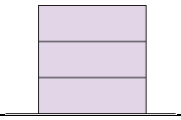
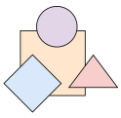
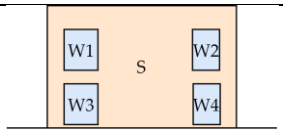
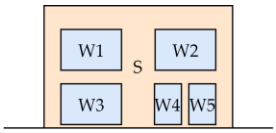
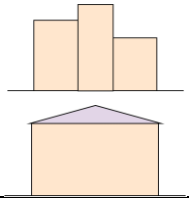
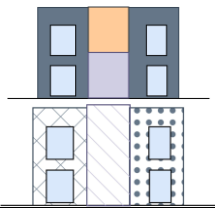
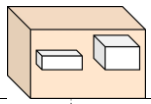
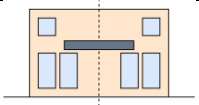
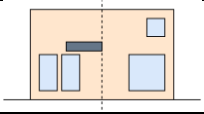
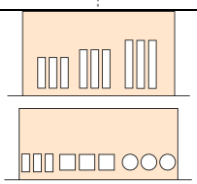
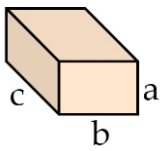
			The house is three floors high
Composition of mass	Regularity of mass	 	Square, circle, triangle are examples of regular forms. Usually they are symmetrical Irregular forms comprise dissimilar parts. Usually they are asymmetrical
Composition of the facade	Ratio of solid to void		Area of solid=S Area of void= W1+W2+W3+W4 Area of solid > area of void
			Area of solid=S Area of void= W1+W2+W3+W4+W5 Area of void > area of solid
Composition of the facade	Mass articulation		Using different height of masses Using pitched roof
Composition of the facade	Façade articulation		Articulation by using different colors in one façade plane Articulation by using different textures in one façade plane
Composition of the facade	Multi-layering of facade		Masses are used in different layers within one façade
Ordering principles	Symmetry		The façade is symmetric about the vertical axis
			The façade is asymmetric about the vertical axis
Ordering principles	Rhythm		Rhythmic composition by repetition and change in size Rhythmic composition by repetition and change in shape
Ordering principles	Unity		One of the unity aspects is harmony. The harmonic proportion can be calculated by the following formula: (c-b)/(b-a)=c/a

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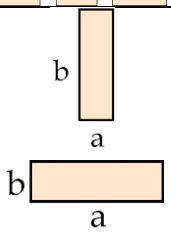
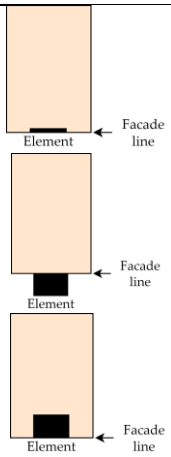
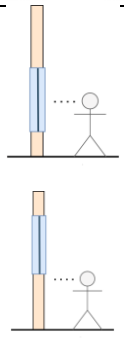
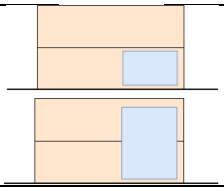
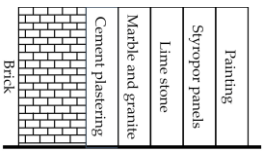
			Unity in building facades can be achieved by, texture; color; briefing; proportion; solid and void; form [89]
Elements	Shape		Different shapes of elements such as rectangle, square, arc
Elements	Formal type		Vertical elements, where a <b Horizontal elements, where a>b
Elements	Position of the element regarding the façade line		The element is with the façade line The element is eclipsed regarding the façade line The element is recessed regarding the façade line
Openings (window)	Height of the window from ground level		The window is within human sight level The window is above human sight level
Openings (window)	Size of window		The window is one floor size The window is two floor size
Material	Finishing material		Using different materials for façade finishing in two ways: • The building material is the same as the finishing material • The finishing material is different from the building material

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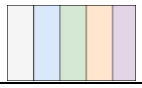
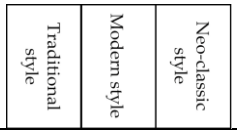
Color	Monochrome color		Using different tones of one color
	Diverse colors		Using different colors, even harmonic or contrast
Style	Hybrid style		Using different architectural styles within one façade

3.2.11. Findings and discussions of step one

Following the analysis of the selected house samples, the study discovered the following typo-morphology characteristics related to house plans:

- Factor of relationship between house and public domain (street), two types are observed:
  - Courtyard houses often have a direct connection to the street; this is mainly observed in the period (1900-1929) (Figure 6).

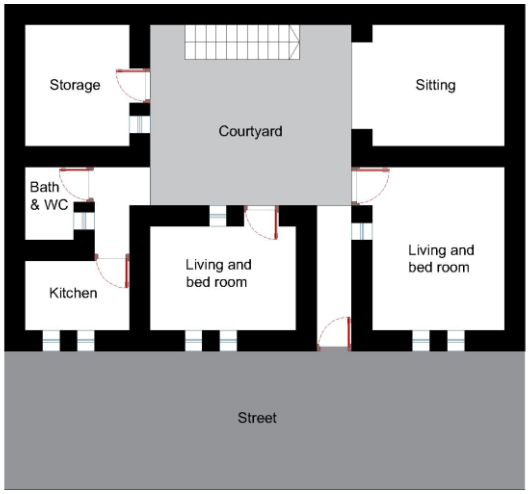


Figure 6. A courtyard house in the period (1900-1929) shows a direct connection between the public domain (street) and the private domain (house). By authors.

  - The British occupation of Iraq in 1917 and the subsequent establishment of the first Iraqi national government on August 23, 1923 marked the start of a sequence of cultural, social, and technological transformations [90].

The issuance of Iraq's first law of municipal administration, Law No. 84, in 1931, followed by the Roads and Buildings System Law No. 44 of 1935, brought about significant changes in the urban fabric, road designs, residential blocks, and plot sizes. These laws introduced new standards and regulations for house designs. [90]

The introduction of the transitional zone, which consisted of an open space typically used for garages and gardens, led to a shift in the relationship between houses and public domains from direct to indirect. This resulted in the creation of a setback space, where a fence, usually an opaque wall, separates the house from the street (Figure 7).

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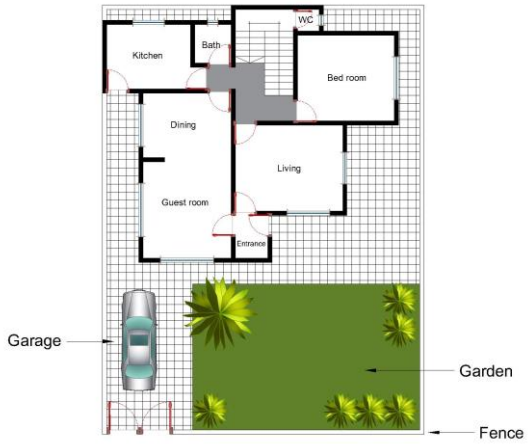

Figure 7. House in the period (1930-1959), with setback including garden and garage By authors.

- Factor of house ground level regarding the street level, two types are recognized:
  - The house is on the same level with the street.
  - The ground level is elevated by half or one floor, with a ramp leading to semi-underground areas that typically serve as garages and storage spaces, this is mainly found in the period (1990-2020)
- Factor of house layout patterns, includes the following items:
  - Relationship between indoor and outdoor spaces, including three types:
    - There is access in the front of the house that leads to indoor spaces then there is another access at the back that leads to outdoor space, this is mainly found in houses with backyards (Figure 8).

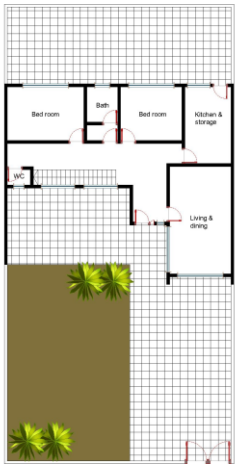

Figure 8. House from period (1930-1959), shows the relationship between indoor and outdoor spaces as a pattern of (outdoor-indoor-outdoor) By authors.

    - There is access in front of the house that leads to indoor spaces, in this type usually there is no open space at the back of the house, and it includes small open spaces for natural lighting and ventilation (Figure 9).

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Figure 9. House from period (1990-2020), shows the relationship between indoor and outdoor spaces as a pattern of (outdoor-indoor) By authors.

- Stepping from public domain which is an open space to another open space which is usually courtyard, then having access to indoor spaces, this is mainly found in courtyard houses of the period (1900-1929) (Figure 10).

Figure 10. House from period (1900-1929), shows the relationship between indoor and outdoor spaces as a pattern of (outdoor-outdoor-indoor) By authors.

- Enclosure, includes two types:
  - Open inwards and closed outwards, this is usually found in courtyard houses (1900-1929), where the spaces are oriented towards the courtyard (Figure 11).

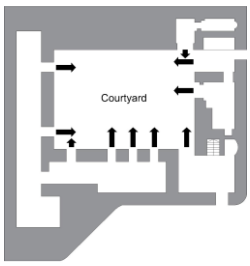

Figure 11. House from period (1900-1929), showing the inward enclosure of spaces towards the courtyard By authors.

- Open outward, this is found in houses where the indoor spaces have access and view towards the outdoor spaces (Figure 12).

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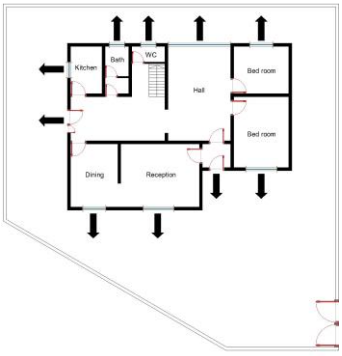

Figure 12. House from period (1930-1959), shows how indoor spaces are opened outward for view and circulation By authors.

- The location of the house within the land plot is classified into 11 types, indicating a wide range of possibilities for how the house is situated within the borders of the plot. For example, in courtyard houses, the house covers the entire plot of land, while in houses with a setback, there is open space remaining within the plot.
- Shape of plan layout, includes two types:
  - This typology pertains to house plans with irregular geometrical shapes, which are commonly seen in traditional urban areas where the houses are designed to conform to the irregular and winding pathways and alleys in the area. [85] Houses of this type could be found in the areas inside first ring road in Erbil (1900-1929) (Figure 13).

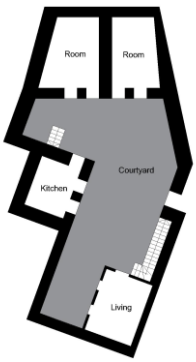

Figure 13. House from period (1900-1929), shows a geometrical irregular layout By authors.

  - Houses with a plan that has a regular geometrical shape are often seen in modern urban areas where the plots are arranged in a grid pattern. Although, for design, orientation, or social reasons, such houses may have some irregularly shaped parts.
- Ratio of house mass to open spaces area, includes two types:
  - When the house has a larger built-up area compared to the open space, it is usually observed in houses built on relatively small plots of land where most of the land is utilized for the built-up area (Figure 14).

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Figure 14. House from period (1900-1929), shows that mass area is bigger than open areas By authors.

- When the house has a smaller built-up area compared to the open space, it is usually observed in houses built on relatively large plots of land in the periods (1930-1959) and (1960-1989) (Figure 15).

Figure 15. House from period (1930-1959), shows that house area is smaller than open areas By authors.

- Indoor spaces distribution patterns, includes the following variables:
  - Space configuration inside the house, includes six types of arrangement and relation:
    - Centralized indoor spaces are typically found in courtyard houses, where the central courtyard serves as the focal point for activities.
    - Non-centralized indoor spaces lack a central area of focus.
    - Scattered spaces can be found in courtyard houses, particularly those from modern periods (Figure 16).

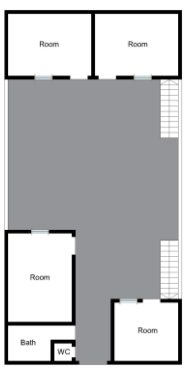

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Figure 16. House from period (1960-1989), shows scattered spaces around an open courtyard By authors**.**

- Spaces are densely organized with small open spaces between them.
- Spaces being of equal size are a rare occurrence as different functions demand varying sizes of spaces.
- Different sizes of spaces are commonly found in samples.

- Accesibility and circulation, includes:
  - Number of entrances from outdoor to indoor spaces. Two types are found. In the first type the house has only one entrance, which directly leads to the courtyard of the house or in an inclined path for privacy purposes. This is commonly observed in courtyard houses. The second type has multiple entrances leading to various indoor spaces such as guest room, living room, and kitchen.
  - Two types of circulation patterns are noticed, radial circulation is found in houses with dominant central space. Network circulation combines between points in the space in the shape of an intersected web. [89]
- Location of vertical circulation (staircase) in the house. Three types are recognized, at the front, middle and back part of the house.
- Functions of spaces, include the following:
  - Five types of functional zones are noticed in the samples, each representing a physical and direct relationship between spaces that are grouped based on the following aspects:
    - Privacy, including the separation between genders and strangers with family members, for instance isolating guest room and dining from other parts of the house. With the guest room having direct access from the outside. Bed rooms also grouped in one zone usually located at the back of the house (Figure 17).

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Figure 17. Houses from periods (1930-1959) and (1960-1989), show functional zones By authors.

- Family daily life, this includes spaces that are frequently used by family members, such as zone of living and kitchen.
- Service spaces, this type of zone is mostly includes spaces that are serving the family members, such as bath, WC and storage.

- Location of functional zones inside the house. Three types are recognized, the zone is located at the front, middle and the back part of the house. The location of the zone is influenced by above mentioned items of privacy, family daily life and service.
- Functions of spaces inside the house. In the process of analysis for the selected house samples, the paper recognized the following spaces:
  - An entrance can refer to either a passageway that leads to interior areas or simply a doorway that provides direct access to the interior from the outside.
  - Courtyard, a main space in open courtyard houses, it is the center for daily family activities, in some samples they are including greenaries and fountains.
  - Multi-purpose room, in traditional houses usually a room have more than one function, for example the same space is used for sitting and dining and at the night it will become a bed room. For that it is not possible to recognize the specific functions of the spaces.
  - Guest room, it is usually used for guests and strangers, having its own entrance.
  - Dining room usually connected with the guest room. Mostly this space is used for serving food for guests.
  - Living room is used for family members gathering, in some samples it has a direct access from outside.
  - Kitchen, it is usually used for cooking and sometimes for family dining and even sitting.
  - Interior hall, it is a central space in the house, surrounded by other interior spaces, usually used for family gathering and sitting. In some examples, staircase is located in this space.
  - Bed room, including bed room for parents and bed rooms for children. Usually located at the back of the house for privacy.
  - Bath and WC, commonly they are separated in two different spaces; in some houses they are within one space.
  - Storage, mostly linked with kitchen, it is used for storing dry food or house stuff.
- Dominant space, it is the largest space in the house; usually the courtyard is a dominant space in courtyard houses. In some modern samples the guest room and living room are dominant spaces in the house.

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  - Position of the dominant space, it is located in the front, middle or back of the house.
- Façade parameter, includes the following variables:
  - Spaces adjacent to front facade parameter. Samples show that spaces are differ in their location on the front façade, mostly guest room, living, kitchen are observed.
  - Shape of the window in the plan layout, four types are recognized, straight, right angle, tapered and round.
  - Ratio of Solid (wall) to void (window) in the plan layout of spaces, two types are recognized, the first when the total length of wall adjacent to façade is larger than the total length of window or vice versa. This type differs according to the function of the space and view to outside spaces.
  - Location of the entrance regarding the elevation, two types are found. The entrance is located at the center of the façade, or at the side. When it locates at the center, then it leads to more than one space, but if it is located at the side of the house usually it leads only to guest room. In courtyard houses the entrance is located to the side of the courtyard or having an inclined path in order to trap visibility from outside to the courtyard.
- Shape of the entrance in the plan layout, three types are observed, even the doorway of the entrance is parallel to the façade line, or perpendicular or tapered. This orientation is related to privacy and the view of interior spaces from outside.

In the analysis of the selected house samples, the study discovered the following typo-morphology characteristics related to house facades:

- Composition of mass, includes the following variables:
  - Height of the house, three types are observed, one floor, two floors and three floors. The latter includes a service floor, ground floor and upper floor.
  - Regularity of mass, two types are found. Masses are regular in form comprising of basic geometrical shapes (Figure 18), or the masses are irregular in shape.

Figure 18. House facades from period (1930-1959) , show regularity in masses By authors**.**

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- Composition of the façade, includes the following variables:
  - Ratio of solid to void. In some examples the area of solid (wall) is bigger than the area of void (window). This is related to socio-cultural factors especially the factor of privacy and the visibility of indoor spaces from outdoor. Also the desired view from inside to outside. It is noticed that the traditional houses with direct relationship to street, usually have small size windows (1900-1929) Figure (19). With the advance in technology and the change in way of life, windows became larger.

Figure 19. House facade from period (1930-1959) show small size windows By authors.

  - Mass articulation even by using different mass heights or using pitched roofs. (Figure 20)

Figure 20. House from period (1990-2020) shows pitched roof Source website.

  - Façade articulation by using different colors in the same façade or using different textures of different materials within one façade.
  - Multi-layering of façade means that the façade comprises of multiple connected masses used in different layers.
- Ordering principles, includes the following variables:
  - Symmetry, it is observed that facades are even symmetric about the facades vertical axis (Figure 21), or they are unsymmetrical.

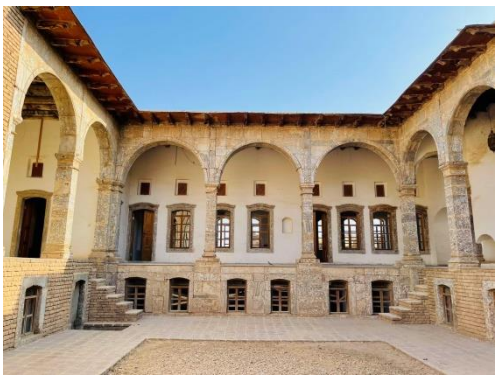

Figure 21. Symmetric house facades from period (1900-1929) By authors.

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- Rhythm, this is achieved by repetition and change in size of elements in the façade, or repetition and change in shape. (Figure 22)

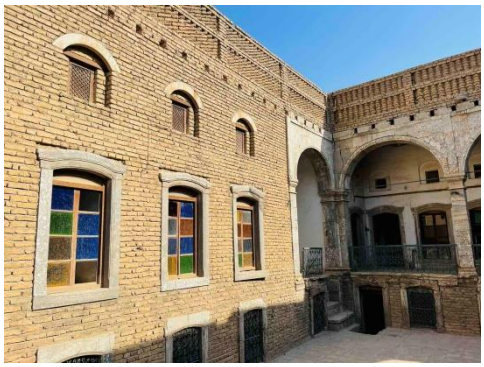

Figure 22. House shows a rhythmical arrangement of façade elements from period (1900-1929) By authors**.**

- Unity of mass and façade. The effective features are texture; color; briefing; proportion; solid and void; form.

- Elements of the façade. The elements that are found in the samples are entrance, window, balcony, canopy, overhang, columns, and ornaments. The analysis of those elements are conducted through the following variables:
  - Shape of façade element, rectangular, arches and curves are observed.
  - Formal type of façade element, two types is recognized, horizontal and vertical element.
  - Position of the element regarding the façade line. Three types are observed, the element with the elevation line, eclipsed element and recessed element (Figure 23).

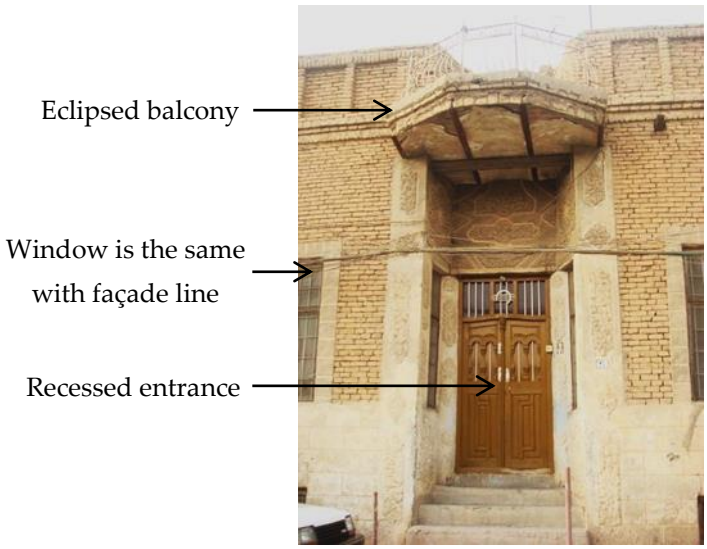

Figure 23. House shows the relationship of different elements with façade line from period (1930-1959) By authors**.**

- Openings, includes the following elements:

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- Height of the window from ground level. Two types are noticed, the height of the window is the same level of human sight. The height of the window is above human sight level. The latter can be seen in courtyard traditional houses where the house is directly located on the street, raising window traps visibility of indoor spaces from outside.
- Size of the window. In traditional houses the size of windows that located on the front façade is relatively small, while windows that located on the inner courtyard are bigger, due to increasing privacy and reducing visibility. In the modern design houses, window size became bigger, in some examples it expanded to two floors.

- Finishing materials. It is noticed that diversity of finishing materials are used in the facades, such as brick, cement plastering, marble, granite, lime stone, painting, polystyrene.
- Using colors in the façade. Samples showed two types, using monochrome colors in the façade and using contrasting colors in the façade.
- Using hybrid style or mixed style within one façade.

3.3. Step two: Developing a framework for the sustainable tangible and intangible factors that effects on the continuity of architectural identity

For this purpose an analysis for previous studies was done. The tangible and intangible factors are extracted from the studies, and then they are categorized and clustered (Table 6).

Table 6. tangible and intangible factors that effects on the continuity of architectural identity.

Factors effecting the continuity of architectural identity	Tangibility of factor	Reference
Physical form	Tangible	[34] [27] [35] [37] [24] [38] [40] [41]
Self-identity	Intangible	[33]
Sustainability	Tangible and intangible	[53]
Economy	Tangible	[53]
Environment	Tangible and intangible	[48]
Politics	Tangible and intangible	[48][49][45] [52] [51]
Religious believes	Intangible	[48]
History as a concept of time	Tangible and Intangible	[25] [27][28][29][44] [30]
spatial organization	Tangible	[27]
Building material	Tangible	[27][67]
Context as a concept of place	Tangible	[27][43]
Culture	Tangible and intangible	[54][37] [43][30][47]
Cultural change	Tangible and intangible	[54][37]
Sense of belonging	Intangible	[42]
Social factors	Intangible	[39]
Function	Tangible	[39]
Cultural value	Intangible	[54]

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Socio-cultural factors	Intangible	[47]
Way of life	Intangible	[47]

3.3.1. Findings of step two

Upon analyzing previous studies, a set of factors that influences the continuity of architectural identity was identified. These factors can be categorized into tangible and intangible ones, with some being explicitly mentioned in the studies and others only implicitly traced. Some studies focus on the continuity process within certain periods and contexts through case studies, while others view it as a globally understood concept. The factors derived from previous studies are diverse and interrelated. To categorize these factors, this paper employed clustering method, which involves grouping items based on their similarity to one another. This allows for the identification of features and trends present within any arrangement or configuration of factors by grouping it into subsets [91]. (Figure 24).

In this paper, three distinct cluster groups were established based on the identified factors:

- Physical factors including tangible elements of typo-morphology of houses in Erbil city, found in step one.
- Intangible socio-cultural factors, found in step two.
- Tangible sustainable development factors, found in step two.

Some of studies previously grouped these factors into clusters, for instance, Rapoport see that the socio-cultural factors that are effecting on the built form in different contexts are, human needs, privacy, social factors, religion, cultural values and believes [92]. Also previous studies indicate that the main pillars of sustainable development in any society are related to factors of environment, economy and social issues [93, 94. 95].

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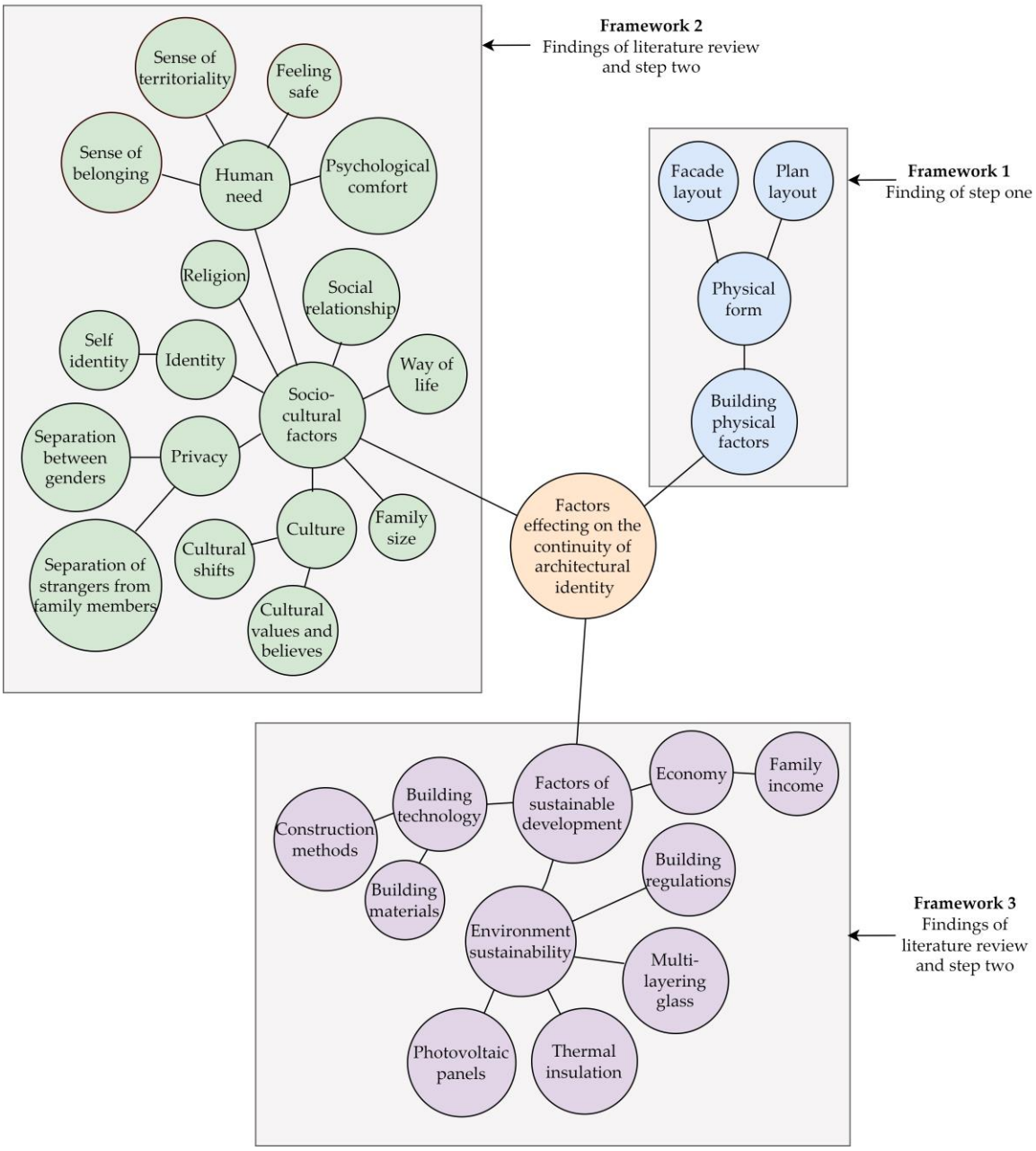

Figure 24. Cluster diagram of three frameworks including factors that effect on the continuity of architectural identity By authors.

The study concludes that by combining the findings of the first step of research, which include the typo-morphology of houses in Erbil city, with the clusters of factors in the second step of research presented in (Figure 24), and the factors identified in the literature review shown in Figure 1, which previous studies have associated with the concept of cultural heritage in certain societies, there are similarities between these two sets of factors. Therefore, the study assumes that the factors identified in the first and second step of research are elements that represent the tangible and intangible sustainable elements of cultural heritage in Erbil city that have a significant correlation with the process of continuity of architectural identity in houses of Erbil city, this hypothesis will be tested in step three of this study.

3.4. Step three: Questionnaire for perception survey

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The questionnaire survey have been designed to obtain the objectives of the research in this step, includes the following items: (Appendix 1)

1- A description about the research and the aim of the questionnaire.
2- General information about the participants including, age, academic qualification and job sector.
3- Part one includes questions about architecture identity as a tensional process between keeping past identities and create new ones, that have discussed previously in the literature review.
4- Part two includes questions that correlate the sustainable elements of cultural heritage which are derived from literature review and step two of this research as independent variables, and the process of continuity of architectural identity as dependent variable in order to identify which factors have more influence on the continuity of architectural identity in houses of Erbil city.

3.4.1. Sampling and procedure

Design of questions and instructions for respondents are summarized below:

- The questions are close ended, tried to be short and direct.
- The answers are designed on a five point Likert scales, including option of totally disagree, disagree, neutral, agree, and totally agree.
- The respondents have to choose only one option for each question.

Respondents are experts in the field of architecture, having different academic qualifications and job sectors. The respondents have to be settled in Erbil city or they have architecture carrier for a period in Erbil city. This is due to having a real perceptional response for the questions in the questionnaire that are related to architecture identity in Erbil city. A pilot study is conducted by distributing 25 questionnaire form as a hard copy, there was no feedback concerning non clarity in the questions. After that 85 electronic Google form questionnaire link is sent to experts in universities, public sector and private sector including architecture firms, the total forms that were distributed is 110 forms. The Google forms are sent via Email and social media (whatsapp, viber and messenger). Keeping in mind that the respondent matches the previously mentioned criteria to be able for response. As a result 79 forms are collected, so the ratio of collected forms to the distributed forms is:

The ratio of collected forms = 79/110X100=%71.81

3.4.2. Statistical analysis

The statistical analysis is conducted by using (SPSS) software version 26. The analysis included the following:

- Frequency of general information about respondents (Appendix 2)
- Reliability of the questionnaire
- Frequency of responses for part one and part two of the questionnaire (Appendix 2)
- Correlation between independent and dependent variables of the research for part two of the questionnaire
- Multiple regression for part two of the questionnaire

3.4.3. Statistical descriptive analysis of general information about respondents

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For academic qualification, the results show that %28.1 of respondents is holding a B.Sc. degree in architecture, %36.7 of respondents is holding master degree in architecture and %15.2 of respondents is holding a Ph.D. degree in architecture.

For working sector, the results show that %40.5 of respondents is working in university, %27.8 of respondents is working in government sector, %30.4 of respondents is working in private sector and %1.3 indicates other jobs.

For age, the results show that %53.2 of respondents' age is between 24-39, %44.3 of respondents' age is between 40-60 and %2.5 of the respondents' age is more than 60 years old.

For the part of general information about the respondents, we notice that there is a relative balance between the ratios of various categories; it means that the samples are covering all items of general information part of the questionnaire. This is obvious to receive responses from different respondents in order to increase the reliability of the questionnaire outcomes.

3.4.4. Reliability of the questionnaire

Cronbach's alpha is a measure of reliability that assesses the internal consistency of a scale or questionnaire. It ranges from 0 to 1, with higher values indicating greater internal consistency or reliability (Table 7).

Table 7. Reliability of questionnaire.

Cronbach's Alpha	N of Items
.854	69

In this case, a Cronbach's alpha of 0.854 indicates a high level of internal consistency or reliability of the scale or questionnaire. This means that the items in the scale or questionnaire are measuring the same construct consistently and accurately.

3.4.5. Statistical descriptive analysis for part one of the questionnaire

Part one of the questionnaire includes 10 questions related to architecture identity as a tensional process between keeping past identities and creating new ones. Some of the questions are derived from items discussed in literature review and others are added by the authors to maintain the goals of the research (Table 8).

Table 8. Statistical descriptive analysis of responses for part one of the research.

Questions	Totally disagree	Disagree	Neutral	Agree	Totally agree
Architectural identity is a static object that inherited from the past	3.8%	17.7%	16.5%	41.8%	20.3%
Architectural identity could be created at any time	1.3%	16.5%	17.7%	43.0%	21.5%
Architectural identity is the result of the tensional relationship between keeping past identities and creating new identities	0.0%	3.8%	19.0%	40.5%	36.7%
Factors affecting the process of continuity in architectural identity vary in different cultures and contexts.	0.0%	0.0%	3.8%	41.8%	54.4%
(Time) is an effective factor in the process of continuity of architectural identity	1.3%	3.8%	10.1%	46.8%	38.0%
(Place) is an effective factor in the process of	0.0%	2.5%	11.4%	44.3%	41.8%

continuity of architectural identity					
The level of identity representation, including (architecture, urban, planning, and region) impacts on the process of continuity of architectural identity.	0.0%	1.3%	15.2%	54.4%	29.1%
Functionality is more representing architectural identity	1.3%	29.1%	40.5%	22.8%	6.3%
Form as visual aspect is more reflecting architectural identity	0.0%	3.8%	19.0%	51.9%	25.3%
Non-physical aspects related to build environments and contexts mostly represent identities	1.3%	10.1%	41.8%	32.9%	13.9%

The descriptive analysis of the responses for part one of the questionnaire shows that there is a majority agreement about considering architecture identity as a static object and also about architectural identity that could be created at any time. They also agree about considering architectural identity as a result of the tensional relationship between keeping past identities and creating new identities. This proximity in responses show that there is no clear stand point for considering architectural identity as a process or unchangeable object, this is due to the different in perception towards the notion of architectural identity from different perspectives.

Majority of respondents agree about considering factors of time and place as two effective factors in the process of continuity of architectural identity.

More than half of respondents agree about the difference of identity representation in multiple levels, such as architectural identity, urban identity, city planning identity, regional identity.

Most of respondents have neutral perception about considering functional aspects of a building more representing the architectural identity. This question is linked with the question of considering non-physical aspects related to build environments and contexts mostly represent identities, where majority of respondents also have neutral stand point about this question. Here it is concluded that functionality is related mostly to socio-cultural factors that is non-physical and they have no visual cues. In the contrary respondents agree that visual aspects of architecture are more representing architectural identity.

3.4.6. Correlation between independent and dependent variables of the research in part two of the questionnaire

Part two of the questionnaire includes questions to find the significance of correlation between independent variables of (physical factors related to typo-morphology of plan layout, physical factors related to typo-morphology of façade, socio-cultural factors and sustainable development factors), and dependent variable of (continuity of architectural identity) (Figure 25).

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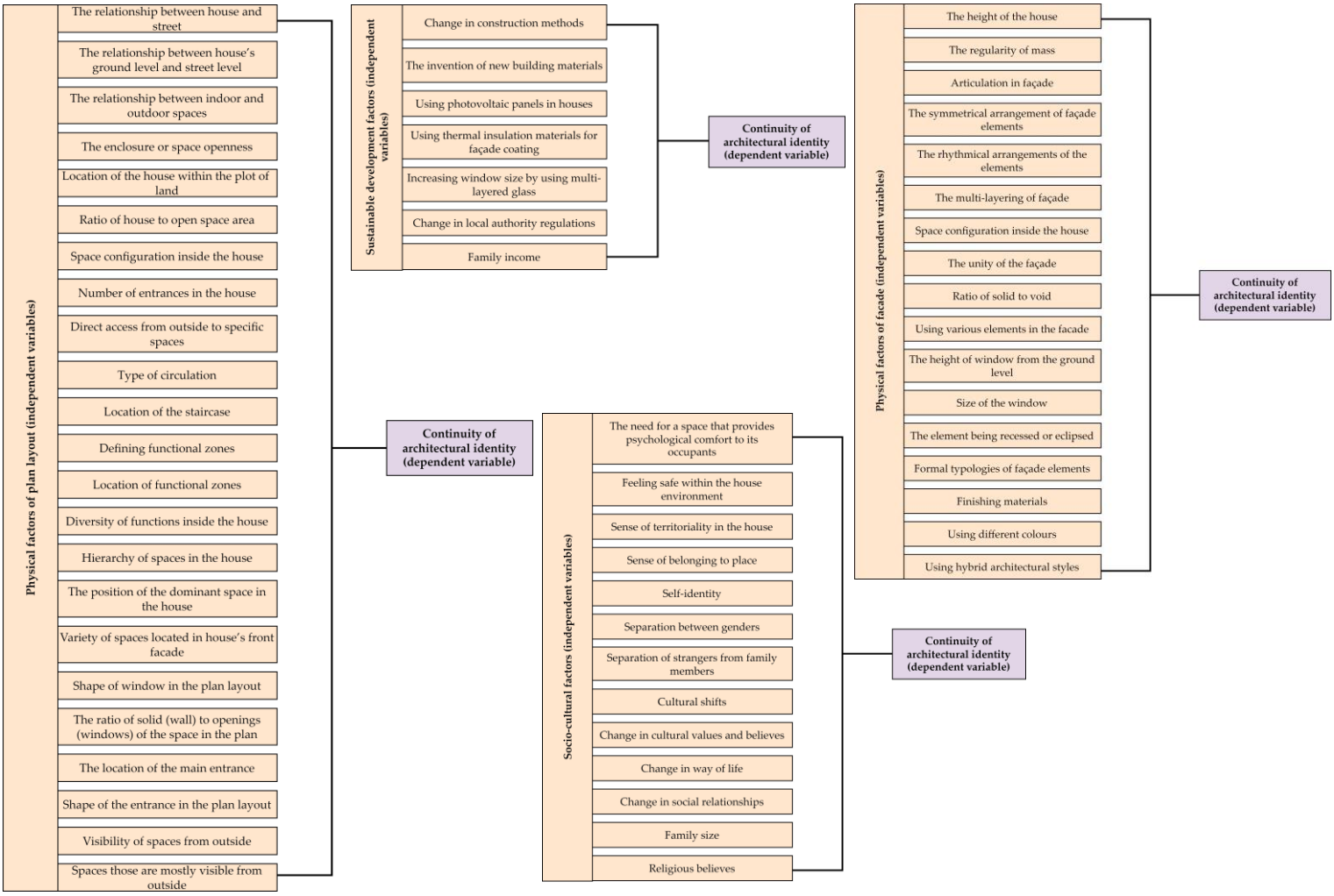

Figure 25. Correlation between independent and dependent factors of the research By authors**.**

3.4.7. Correlation between independent and dependent variables

In part two of the questionnaire, a total of 59 questions asked to respondents on the influence of the independent factors of the research including physical factors of house plan's and facades typo-morphologies, sociocultural factors and sustainable development factors on the continuity of architectural identity in houses of Erbil city.

A Pearson correlation was conducted to examine the relationship between independent variables and dependent variable of the research (Table 9).

Four hypotheses have been raised to explore the significant correlation between independent and dependent variables of the research:

H1: There is a positive relation between physical factors related to house plan layouts aspects in Erbil city and the continuity of architectural identity.

H2: There is a positive relation between physical factors related to house façade aspects in Erbil city and the continuity of architectural identity.

H3: There is a positive relation between sociocultural factors and the continuity of architectural identity.

H4: There is a positive relation between sustainable development factors and the continuity of architectural identity.

The results are shown in (Table 9), and showed the following:

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- A significant positive correlation between the variable of (physical factors of plan layout) and (the continuity of architectural identity) ($r = 0.772$, $p < 0.05$)
- A significant positive correlation between the variable of (physical factors of facade) and (the continuity of architectural identity) ($r = 0.661$, $p < 0.05$)
- A significant positive correlation between the variable of (socio-cultural factors) and (the continuity of architectural identity) ($r = 0.605$, $p < 0.05$)
- A significant positive correlation between the variable of (Sustainable development factors) and (the continuity of architectural identity) ($r = 0.390$, $p < 0.05$)

All correlations are significant at the 0.01 level.

Table 9. Correlation analysis between independent and dependent variables of the research.

		Continuity of Architectural Identity
Physical factors (plan layout)	Pearson Correlation	**.772****
	Sig. (2-tailed)	**.000**
	N	**79**
Physical factors (façade)	Pearson Correlation	**.661****
	Sig. (2-tailed)	**.000**
	N	**79**
Socio-cultural factors	Pearson Correlation	**.605****
	Sig. (2-tailed)	**.000**
	N	**79**
Sustainable Development factors	Pearson Correlation	**.390****
	Sig. (2-tailed)	**.000**
	N	**79**

It is concluded that in the case of Erbil city there is a significant correlation between the independent variables of (Physical factors of plan layout, physical factors of façade, socio-cultural factors and sustainable development factors), and dependent variable of (continuity of architectural identity). It means that it is crucial to consider those variables in the case of studying the process of continuity of architectural identity in houses of Erbil city.

3.4.8. Multiple regression analysis

Once the overall influence and correlations between the variables were identified, a multiple regression analysis will be carried out to further investigate the relationship. This involves predicting the dependent variable based on its covariance with all the relevant independent variables and creating an equation that provided the most accurate prediction of the continuity of architectural identity from several independent variables.

In this study four group of factors including physical factors related to typo-morphology of plan layout, physical factors related to typo-morphology of façade, socio-cultural factors and sustainable development factors are representing the independent variables, and the continuity of architectural identity as a dependent variable. The multiple regression model is as following [96]:

Continuity = β + β1 physical factors related to plan layout + β2 physical factors related to facade+ β3 Socio-cultural factors + β4 Sustainable development factors + ε

Where, Continuity = the Continuity of Architectural Identity

β = constant

ε = standard error

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3.4.9. Regression model

The regression model is a very good model with a strong relationship between the independent and dependent variables (Table 10).

Table 10. Regression model.

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.988[a]	.976	.975	.04553	2.308

a. Predictors: (Constant), Sustainable Development factors, Physical factors(façade), Socio-cultural factors, Physical factors(plan layout)
b. Dependent Variable: Continuity of Architectural Identity

Below is the interpretation of parameters:

- R=0.988: This indicates a very strong positive correlation between the independent and dependent variables. The closer the value is to +1 or -1, the stronger the relationship.
- R Square=0.976: This represents the proportion of variance in the dependent variable that is explained by the independent variable(s). In this case, approximately 97.6% of the variability in the dependent variable of continuity of architectural identity can be explained by the independent variables of physical factors related to typo-morphology of house layout and façade, sociocultural factors and sustainable development factors.
- Adjusted R Square=0.975: This is a modified version of R Square that adjusts for the number of independent variables in the model. It is slightly lower than R Square but still indicates a strong relationship.
- Standard error of the estimate=0.04553: This represents the average amount that the dependent variable deviates from the predicted value by the model. In this case, the smaller the value, the better the model is at predicting the dependent variable.
- Durbin Watson=2.308: This is a test for autocorrelation, which is when the residuals are correlated with each other. A value of 2.308 indicates no significant autocorrelation.

Overall, these results suggest that the regression model is a good fit for the data and can be used to accurately predict the dependent variable based on the independent variable(s).

3.4.10. ANOVA analysis of regression model

The ANOVA analysis results suggest that the regression model is statistically significant and can be used to accurately predict the dependent variable based on the independent variables (Table 11).

Table 10. Regression model.

Model	Sum of squares	df	Mean Square	F	Sig.
Regression	6.234	4	1.558	751.656	.000[b]

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1	Residual	.153	74	.002
	Total	6.387	78	

a. Dependent Variable: Continuity of Architectural Identity

b. Predictors: (Constant), Sustainable Development factors, Physical factors(façade), Socio-cultural factors, Physical factors(plan layout)

3.4.11. Regression standardized residual analysis

It is noticed that standardized residual is located between 2 and -2; we can say that the residual is within an acceptable range and does not suggest any major problems with the model. In other words, the observed value is close to the predicted value and does not significantly deviate from what is expected based on the regression model (Figure 26).

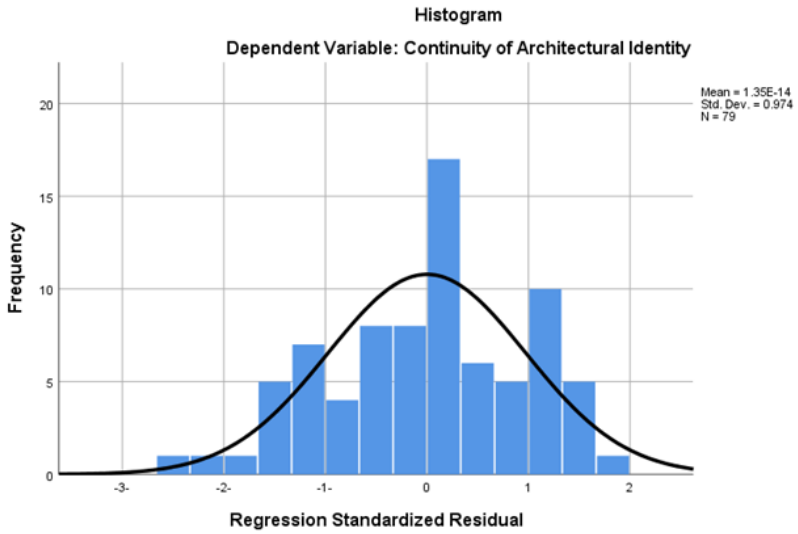

Figure 26. Regression standardized residual diagram.

3.4.12. Normal P-P plot of regression standardized residuals

The normal P-P plot of regression standardized residuals graph show that the residuals of regression model are normally distributed (Figure 27).

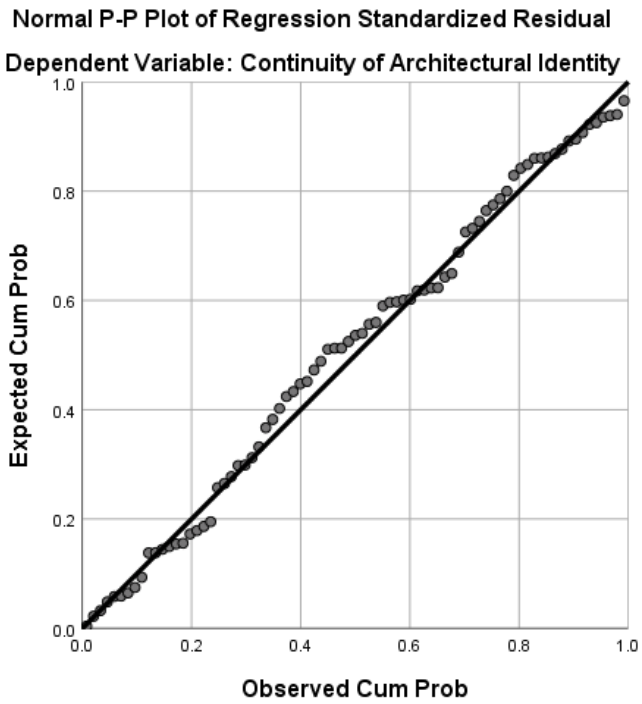

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Figure 27. Normal P-P plot of regression standardized residuals.

3.4.13. Coefficient analysis of regression model

The coefficient results suggest that the independent variables are significant predictors of the dependent variable, with a positive relationship between the two variables. The results also suggest that the coefficient estimate is precise and reliable, and that there is little collinearity between the predictor variables in the model (Table 12).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.419	.061		6.909	.000		
	Physical factors(plan layout)	.348	.014	.506	25.634	.000	.833	1.201
	Physical factors(façade)	.248	.011	.429	22.384	.000	.885	1.130
	Socio-cultural factors	.197	.010	.361	18.796	.000	.880	1.137
	Sustainable Development factors	.101	.009	.214	11.517	.000	.939	1.065

a. Dependent Variable: Continuity of Architectural Identity

In terms of importance, the (Physical factors of house plan layout) parameter (β=0.348, p= 0.000) and the (Physical factors of house facade) parameter (β=0.248, p=0.000) and (Sociocultural factors) parameter (β=0.197, p=0.000) and (Sustainable development factors) parameter (β=0.101, p=0.000) have significant positive associations with continuity of architectural Identity. These results reveal that (Physical factors of house plan layout) is the most influential in interpreting and contributing to the continuity of architectural Identity, because every unit of change in this parameter is associated with a 0.348 change in the continuity of architectural Identity.

The beta values represent the unique contribution of each variable and formulate the final equation of the model which is as follow:

Continuity of architectural identity =0.419 + 0.348 Physical factors of plan layout + 0.248 Physical factors of facade +0.197 Sociocultural factors + 0.101 Sustainable development factors + 0.061

4. Conclusions

Viewing identity as an ongoing process strengthens the link between the concepts of inheriting and creating identities, which exist in a state of tension with one another. The way in which architectural identity remains continuous varies across different societies, cultural contexts, and time periods.

The idea of cultural heritage pertains to the tangible and intangible sustainable elements of a particular society. It is intricately linked to all facets of a society and subject to adaptation and alteration in response to new societal developments.

This research established a correlation between the tangible and intangible sustainable elements related to cultural heritage, and the process of continuity of architectural identity in the specific context of Erbil city. This was achieved through the integration of several frameworks, which encompassed a physical framework examining the typo-morphology plan layout and facades of houses in Erbil city between 1900 and 2020, as well as a framework incorporating elements related to cultural heritage derived from prior studies.

Experts in the field of architecture were surveyed for their views on the relationship between the continuity of architectural identity and the tension between inheriting and

creating identities. The results indicated that there was agreement that place and time was two important factors in the process of continuity of architectural identity. The survey also revealed that architectural form was considered more effective in representing identity than the functional aspects of buildings.

Also the study revealed that there exists a significant correlation between the plan layout and facade typo morphology of houses in Erbil city - representing the tangible cultural heritage of the city - and the continuity of architectural identity. Furthermore, there was a noteworthy correlation between socio-cultural factors, such as intangible cultural heritage, and the continuity of architectural identity. Additionally, there was a substantial connection between sustainable development factors, including tangible cultural heritage related to the environment, economy, and building technology, and the continuity of architectural identity.

After conducting regression analysis and taking into account the opinions of architecture experts, it became evident that the most influential factors on the continuity of architectural identity in Erbil city are the physical attributes related to the typo-morphology of the house plan layout and the typo-morphology of the house façade respectively.

These results are helpful for researchers studying the continuity of architectural identity especially in Erbil city, as well as architects involved in design process.

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