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An analysis into East Jerusalem's housing environment: from social and climatic perspective

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ABSTRACT

The demographic growth in East-Jerusalem and limited land availability due to Israeli planning policies have led to the emergence of haphazardly designed housing developments that prioritize profit over culturally and climatically responsive design solutions. As a result, traditional values are lost, and the impact of climate change is exacerbated. This study evaluates the housing environment in Jerusalem from social and climatic perspectives, using locally produced architectural design solutions to identify sustainable indicators. The study emphasizes the importance of building layouts and design principles that were developed by Jerusalemites in their early attempts to modernize while rooted in traditional values. Field and ethnographic research provides a comprehensive understanding of layout designs, decisions related to thermal comfort, and cultural values associated with the living environment during the early modernity phase. Morphological analysis of plan layouts identifies common design principles frequently employed in relation to climatic, social, and environmental factors. Additionally, the study conducts a systematic literature review of previous research to identify the approaches and methodologies used in detecting indicators of climate-responsive architectural design. These indicators are used alongside field analysis to evaluate and compare cases and identify problematic issues in contemporary housing development designs. The study presents guidelines for future sustainable developments based on locality.

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1. Introduction

The impact of climate change is becoming more evident, urging the world and communities to react proactively in considering the environment. One sector to consider and one that encompasses each individual is housing (Ohchr 2020). Housing plays an essential role in achieving and defining sustainability and can have a determining effect on the urban ecology. It affects people's quality of life as well as the economy. Housing, traditionally and currently, is not meant to fulfill human need of shelter only, but also realize broader sustainable needs and requirements. In order to achieve an environmentally sustainable and sound housing design, traditional settings are essential to inform and teach professionals about the responsive relationship between the environment, climate, and building and site design (Edwards 1996; Marat-Mendes and Scoffham 1998). Today's modern housing developments are mainly concerned with solutions that increase profit margins, which often results in consumers suffering from poor ventilation, lack of climatic comfort and being reliant upon electromechanical air conditioning for heating, cooling and lighting. While this is true in today's contemporary societies, modernity on the other hand is essential to humans too, and incorporating it into our life

is with no escape. Within a modern context, designers, architects, planners, professionals and policy makers are required to amalgamate between the values and lessons of the traditional and modernity's "problem solving" idiom. Here, modernity is not a matter of a stylistic attitude promoting ornament-free architecture, but should be seen as a dialectic relation based on efficiency and lessons from the past that are "domesticized" (see Daher 2015) according to people and to what makes sense to them in terms of their needs and economic circumstances. In the case of early modernity in East Jerusalem, social, cultural and climatic aspects became increasingly important, and witnessed a successful interpretation of that relationship at its initial stages. People's initial attempts and trials in the city had adapted modernity and tailored it according to their living style, needs, culture and climatic conditions whilst linking it to the prevailing advancement in technologies and the political situation at the time. This initial adaptation, once linked to sustainability is challenged today along with the rapidly changing socio-economic structure of the world and its political turbulences, hence Jerusalem's rich historical system of values, traditions and culture is struggling for validity today.

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1.1. Brief contextual background in East Jerusalem

In Jerusalem, the traditional lifestyle associated with the culture has ceased to develop over the past 60 years. Following the Israeli occupation of the city in 1967 until this day, restrictions on Palestinians are imposed through urban planning policies, building laws and regulations. Through the imposition of foreign values enforced as international and modern standards (that dictates the building size, areas, materials, form, etc.), which set an example towards non-sustainable developments that negate traditional values, resulting in the deterioration of the traditional environment, both physically and socially. In stark contrast, in the years leading up to 1967, during the Jordanian rule of the city (1948–1967), early modernity successfully addressed sustainability issues of building form, climate control, while maintaining the social infrastructure. However, the pluralistic approach by the Israeli Jerusalem municipality and Israeli national planning authorities had urged Jerusalemites to abandon these approaches through other restrictive standards. Refusal to abide by these resulted in building permissions being withheld and being subject to possible demolition orders along with other vital problems and difficulties.

The political situation in East Jerusalem also threatens the traditional and unique architecture in the city. Briefly, this is achieved through setting new municipal boundaries for the city that is surrounded by a concrete Separation Wall that divides Jerusalemites from the rest of the West Bank and the potential vacant area that can cater for their growth. Palestinian Jerusalemites, who were granted residency in their city by Israel following its occupation in 1967, are required to live within these drawn boundaries. This is enforced by regular inspections and failure to comply can threaten their right to live in the city. Overall, this has resulted in a limited area designated for Palestinians to live and grow, which affects the development of their economy and the built environment, leading to a loss in the traditional urban fabric and character. This together with the lack of investment and planning in East Jerusalem by the Jerusalem municipality, results in people building without permissions which can result in high fines and demolition orders. Today, a majority of the residential construction is unauthorized in East Jerusalem (Bimkom 2014). Those who do own land and could afford to build are required to apply for permissions that are very expensive and demand a long waiting period and complicated process with limitations according to the laws. Many advocacy and humanistic agencies and non-governmental organizations call for further development on an urban planning level and housing sector to satisfy the demand for new housing stock to fulfill the growing

need of Palestinians in the city. This is likely to lead to further serious problems and changes to the built environment. Hence, it is important that architects and communities are aware of the importance of developing a more culturally, socially and physically sustainable environment that is anchored on traditional, climatic and local consciousness.

1.2. Aims and objective

This study aims to evaluate the housing environment in Jerusalem from both climatic and social perspective in order to identify appropriate sustainable indicators based on architectural design solutions. It deliberates on the role of locally produced architectural design solutions in achieving thermal comfort, which is grounded in the values of traditional settings through climate-responsive building forms, layouts and design principals. These values are based on patterns developed, tried and tested by Palestinian Jerusalemites in their early attempts of embracing modernity. Also, they embrace traditional settings in terms of environment, culture, context, and climate, and highlight people's approaches to sustainability. By using such indicators, the study evaluates the new developments in the contemporary housing environment in East Jerusalem and identifies problematic issues through a comparison developed towards the end of the study. Ultimately, the study aims to provide hints for sustainable development in the city by establishing and defining appropriate design solutions that emphasize locality and sustainability based on its unique climatic conditions.

In order to evaluate the housing environment in accordance with human thermal comfort, climatic and social consideration, a set of questions have been formulated: *What are the main attributes of a socially and climatically responsive architectural design suitable for residential building in East Jerusalem? What physical elements are essential to achieve this? How can locally produced architectural solutions, which have already been tried and influenced by the traditional lifestyles of Jerusalemites, inform design decisions in new contemporary developments that take into account the climatic, social, and environmental conditions of Jerusalem?*

To achieve answers and results, the study surveys 31 residential building that emerged at different periods in the neighbourhood of Shufat, East Jerusalem. It documents their plan typologies, analysis and compares them to achieve the following objectives:

- To demonstrate the role and effectiveness of locally produced and developed architectural design solutions as an adaptive interpretation of the relationship between thermal comfort and the built environment in modern standards.

- To shed light on a neglected period of research and study: the early modernity stage in the city.
- To identify sustainability indicators by considering climate-responsive architectural design in Jerusalem.

To accomplish the aims and objectives of this study and investigate appropriate design solutions for a comfortable indoor environment in Jerusalem, a systematic literature review was conducted on thermal comfort strategies used in vernacular dwellings. The review focused on passive cooling, natural ventilation, and solar energy for heating, and utilized the Scopus database to retrieve relevant studies. These scholarly works were examined to provide insights on the latest research methodologies and to give an overview of similar studies conducted in residential buildings across various climatic conditions, and particularly hot and dry climates. The review aimed to identify gaps in the existing literature and inform the current study.

Based on its findings, the study suggests that a continuity of values grounded in sustainable considerations of the climate, social, and environmental factors can be achieved in Jerusalem. To achieve this, designers and architects need to develop physically and socially sustainable solutions that build upon the traditional built environment and the community's identity over the years.

2. Methodology: Vernacular architecture and the discourse of thermal comfort

2.1. Systematic literature review

The aim of this section is to conduct a systematic literature review of previous research to identify the approaches and methodologies used in detecting indicators of climate-responsive architectural design, which will help to identify the research gap and establish the novelty of this research. It seeks to answer the following questions: What methods have been used to assess the impact of architectural design attributes, such as typologies, sizes, layouts, floor plans, openings, and arrangements of spaces and rooms, on achieving quality indoor thermal comfort? Which historical periods have been addressed in these assessments?

To do so, the study turns to the Scopus database and searches for articles using the keywords "vernacular," OR "architecture," OR "thermal comfort" in April 2023. The Scopus database is commonly used in systematic literature reviews related to the built

environment due to its broad scope (Chellappa and Srivastava 2022; Hosseini et al. 2018). The search yielded 92 articles after applying rules such as publication years between 2020 and 2023 and English language, including all document types such as journal articles and conference papers.

After a thorough review of the articles, 10 articles were excluded from the sample as they do not address residential buildings, but instead address public buildings such as mosques and industrial buildings. Following the refinement, 82 articles were included in the sample. The detailed literature review was then summarized according to three categories; methodology, type of cases (contemporary or/and vernacular), and the type of climate addressed. Following this, three major observations could be outlined as follows:

Group one of articles, demonstrated in Table 1, is based on achieving results through the comparison of thermal comfort in traditional vernacular environments and contemporary housing examples within the same context and under similar climatical conditions and geography. Results from this group builds on comparison showing that vernacular dwellings are more thermally comfortable than contemporary building through the employment of climatically responsive technologies, materials, building techniques using passive cooling means. Among the 82 articles reviewed, this approach was followed in 33 of them. Within this group, it was shown that vernacular construction methods and the use of available materials were able to provide comfortable indoor environment, while different results were not attainable in contemporary examples, as shown in studies by Bencheikh and Bederina (2020); Gazquez, Hernández, and López (2022); Hailu, Gelan, and Girma (2021). Another major set of research concentrates on understanding the indoor environment through climate-responsive construction techniques, materials, architectural elements and typologies as means for more thermally comfortable performance employed solely in vernacular dwellings and draws lessons to take into consideration in future designs, for instance studies by Izadpanahi, Farahani, and Nikpey (2021); Li, Jin, and Guo (2022); Pilechiha et al. (2022). Ten articles did not define their cases as either vernacular or contemporary, and mostly included systematic review articles, material engineering lab experiments, and research related to lower carbon footprint and less energy consumption.

A second observation is based on the methods utilized to achieve results as shown in Table 2. Many of the methods utilized in the studies varied between the use of computer software and simulation in order

Table 1. Observations from literature review based on traditional or/and contemporary dwellings cases.

Vernacular cases	Contemporary Cases	Comparative vernacular and contemporary cases	Undefined cases	Total
33	6	33	10	82

to replicate examples and test their behaviors by providing certain climatical and contextual criteria similar to reality (Gottkehas Kamp and Willmann 2022; Henna, Saifudeen, and Mani 2021). Other methods use statistics and mathematical equations to test temperatures, humidity and deal with thermal comfort as sets of numerical data to build evidence. Another third approach- in contrast to the above that bases the subject on an engineering science- involves people as end-users to provide data on how they perceive thermal comforts in budlings according to a set scale pre-defined by the researchers to score their satisfaction and comfort conditions. This is argued to perceive people as passive receivers who respond to the thermal conditions according to their behavior, psychology, physiology and ability to adjust to the design of the physical space (Chang et al. 2021; Hosseini 2022; Kürüm Varolgüneş 2020; Peker 2022). Others also combine several methods within the same research to achieve results such as Ozarisoy and Altan (2021); Qian et al. (2023).

The third and final observation relates to the type of climates that most researches address. According to Table 3, most of the researches focus on hot and dry climates including arid, semi-arid and hot-humid climates, as well as the tropical and semi-tropical climates. Continental and cold climates are less considered. Although the Mediterranean climate is similar to hot and dry climates, it has its distinct climatic characteristics, and the architecture developed around its basin reflects these differences. What this systematic review indicates is that fewer recent studies have been conducted on bioclimatic architecture within a Mediterranean climate (Ozarisoy and Altan 2021), particularly in Palestine.

Based on the above analysis, three observations can be summarized as essential guides for the novelty of this study:

- Many studies ignore the decades-long adjustments and changes that communities have made to adapt from different settings before gradual settling to new and recent contemporary housing. Focus is given into a comparison between the traditional and the recent, thus ignoring and limiting possible solutions and indicators to investigate the mood of production that emerged following people's moving from traditional settings as a result of the modernization and which can have possible indicators towards sustainability. There is a need to investigate the ways in which people perceive and re-conceptualize and how they have adapted and sustained their everyday lives in accordance with local climatic characteristics following their move from traditional settings as a result of modernization.
- A need to approach the topic of thermal comfort and sustainability through the design of physical space from a socio-cultural and ethnographic perspective, rather than focusing solely on scientific definitions, technical solutions and standards (Healey and Webster-Mannison 2012) that is also not limited on single-case studies. The literature in this respect is growing and highlights the different variables grounded in history and culture, which carry social meaning (Peker 2022). People's socio-cultural practice is changeable according to the different parameters that can evolve and change such as materials, techniques, and values (Fouseki et al. 2020), and their decisions towards thermal comfort are a reflection of cultural values associated with their living environment and the knowledge accumulated about the environment and buildings.
- A need to conduct more research on contemporary and vernacular architecture around the Mediterranean basin, drawing on important lessons

Table 2. Methods utilized in housing studies on thermal comfort.

Simulations/computer software	Measurements	Simulations and Measurements	Review articles	Survey	Combined survey and measurements	Total
17	34	10	6	8	7	82

Table 3. Climate-based distribution of articles: Keywords analysis.

Climate type	Articles' distribution based on climate types
Arid	13
Semi-arid	4
Hot and dry	11
Mediterranean	4
Hot-humid	5
Sub-Saharan	2
Mild	2
Tropical	13
Sub-tropical	3
Continental	5
Cold	4
Ambient	1
Multiple/undefined	15

to improve issues related with housing thermal comfort, especially given political and natural disasters that may threaten vernacular architecture limiting the possibility to examine it further.

Based on the above analysis, the methodology followed in this study is qualitative (descriptive) and empirical rather than experimental. It builds on observations and analyses of housing typologies and the design of physical space that is organized and conceptualized by people according to the socio-cultural, environmental, and sustainable values associated with their traditional environment. The study combines on-site ethnographic research with occupants and architectural analysis of building typologies in relation to thermal comfort, utilizing a handful sample of housing from a neglected and understudied period in the production of a modern architectural living environment and style based on adaptive methods rooted in traditional values. This will enable the evaluation of the performance of contemporary developments in the city of Jerusalem in this regard.

2.2. Field study and data analysis

The field study is divided into three parts based on the historical timeline of construction in the city, as well as different political dynamics and rules that shaped life there. Each period is represented by different housing typologies and can be categorized as follows: The first initial phase (Phase I) (1948–1967 during the Jordanian Rule); and the second adjustment phase (Phase II) (1967–late 1980s) following the Israeli occupation; and the new contemporary development, which began after the city was divided from the rest of the West Bank and the Separation Wall was built early 2000. Although, Phase I and II took place at different times and at political settings, they were continuous and based on sustainable references to the environment, climate and culture developed by people. This approach construes architecture as a cultural and social process beyond its discipline, based on the notion of “learning by doing” and “learning by living”.

The present study first builds on a previous study and survey conducted by the author (Samman and Saifi 2021). This earlier study examined the first encounter with modernity (Phase I) in Shufat, a neighbourhood to the north of the Old City of Jerusalem. The neighbourhood has flourished from a small village and become connected to the city. The previous study analyzed the characteristics of a handful houses in the area in relation to an adaptive approach to modernity based on the owners' previous lives and houses in the traditional village from a socio-cultural, and economic perspective. The current study draws further on empirical data and ethnographic research to explore the relationship between these houses and issues related to climate

and sustainability. The houses selected for analysis were identified using an aerial map and by noting the construction dates engraved at their entrances (Figure 1). Only houses overlooking the main street were selected, and all selected houses were visited when entry was allowed. Plans were sketched, front façades were documented, and these were drawn using AutoCAD. The houses were analyzed after being categorized according to their characteristics, such as opening, orientation, space morphology, geometry, sizes and other details. During visits that took place between 2017 and 2019, users were interviewed to provide insights related to general uses of the space according to seasonal changes. Questions were asked about the spaces used in different seasons, the types of heating devices used, and the main spaces used and why. A total of 19 houses out of 53 were documented during these visits, as shown in Table 4.

For the purpose of this study, the author revisited the houses previously surveyed and examined examples with new floors added after the year 1967 (Phase II). Plan typologies from this period were outlined, and alterations/adjustments were compared to the existing floors that belonged to the Phase I. Differences and similarities were drawn between the new and existing floors. Cases that were built entirely following the years of the First Intifada (Uprising) in 1987 were excluded, as they demonstrate other stylistic approaches interrelated with different political dynamics and require a separate study. The visits took place during the autumn of 2022 and winter of 2023. Of the 53 houses, 15 had added new floors during the set period and 9 only allowed entry (Table 4). These houses were drawn using AutoCAD and put into tables, which were then compared with the original footprints of the lower floor. Differences, similarities, and significant changes were outlined and will be presented further in the study.

Regarding the new contemporary developments, their large number and various locations made it difficult to conduct a physical survey for each case individually. Therefore, developers' websites in the area were visited and plan typologies recorded as representative examples of the situation in the city. These websites provided plan typologies, 3D drawings of flats under construction, and were offered for sale. This approach has also ensured that the cases under study had obtained official building permissions from the Jerusalem municipality, as houses without approvals may not follow codes, making evaluation difficult. Three representative examples were chosen from these websites. The plans were schematically redrawn, and spatial relationships were identified. Each case represented a typical floor plan, including the plan of each flat.

Each of the results from the above periods is represented separately in the following sections. To achieve a climatically responsive architectural design, several factors such as architectural design,

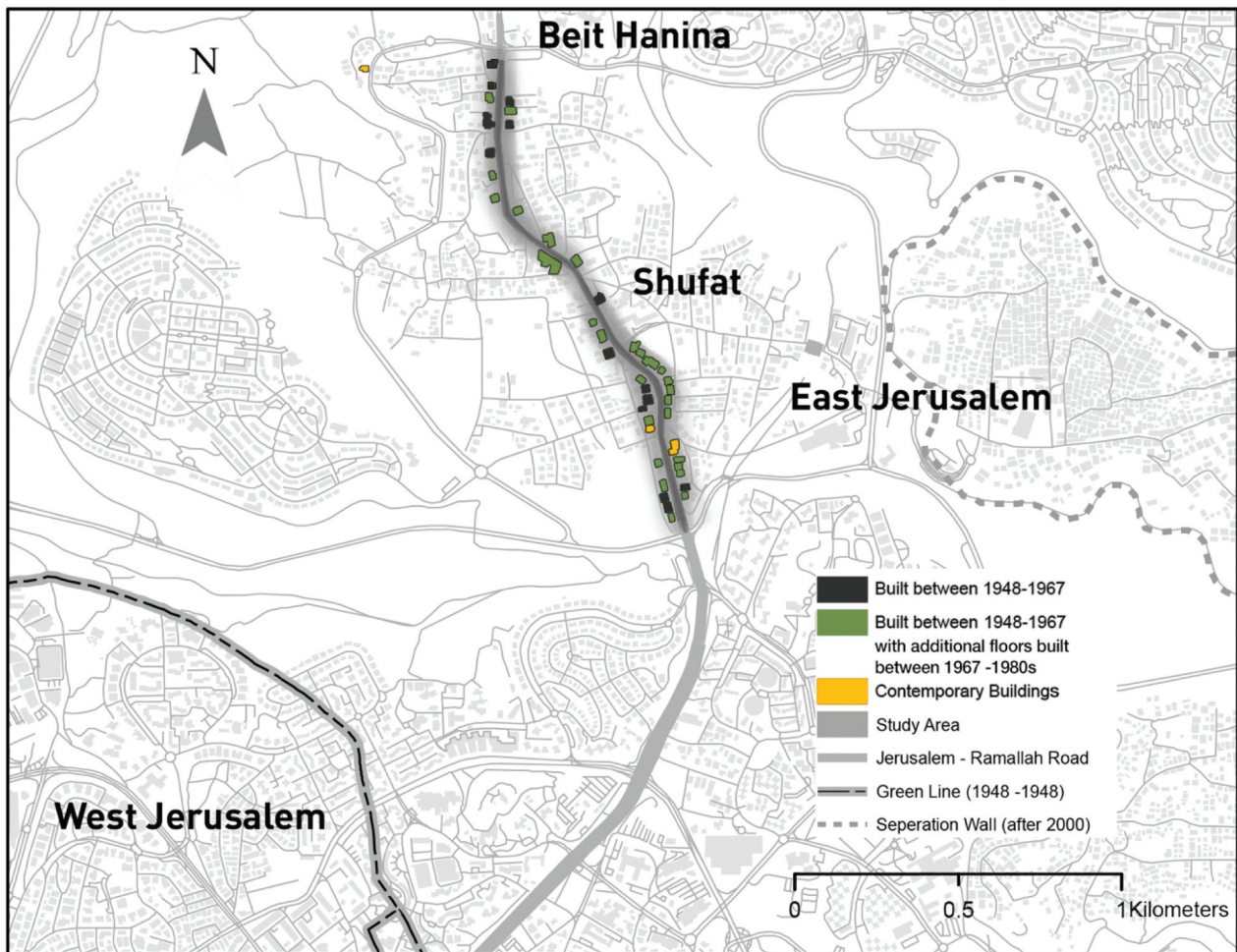


Figure 1. Study area map: Shufat neighbourhood and case Locations.

Table 4. Summary of field study results from Phases I and II: Overview of case collection.

Phase	Total number of buildings (old and new)	Built between 1948–1967	Altered	Demolished	Allowed entry and documented	Did not allow entry
Phase I	75	53	6	1	19	27 *
Phase II		Added new floors after 1967- till early 80s 15			Allowed second entry 9	

Note: * originally was 28 during the first visits and 27 after demolition of one building.

environmental conditions, and occupants' use of their living spaces need to be considered. Therefore, data was analyzed according to these factors. Morphological analysis of the plan layouts of the cases studied helped to identify common design principles that were frequently employed in relation to climatic, social and environmental factors. Taxonomies were established to categorize the design principles and characteristics of the housing units, which included Phase I, Phase II, and new contemporary developments. Additionally, systematic reviews were conducted to validate the attributes of a climate-responsive architectural design found in the literature, and content analysis based on VOSviewer to provide insights into the main subjects related to this. Once attributes were identified, they were correlated with the taxonomies

and compiled into detailed categorized criteria for evaluation. Subsequently, the cases from the field study were compared and evaluations were made. Figure 2, illustrates the various steps taken in the methodology, and detailed explanations are provided in the discussion section. Towards the end of the study, a set of considerations is also provided to establish a basis for future developments that should take place based on the traditional setting and socio-cultural life in the city.

In summary, the general methodology adopts an empirical and qualitative descriptive research approach, which enables gaining a comprehensive understanding of layout designs, decisions related to thermal comfort, and cultural values associated with the living environment. Ethnographic research is used to support this approach.

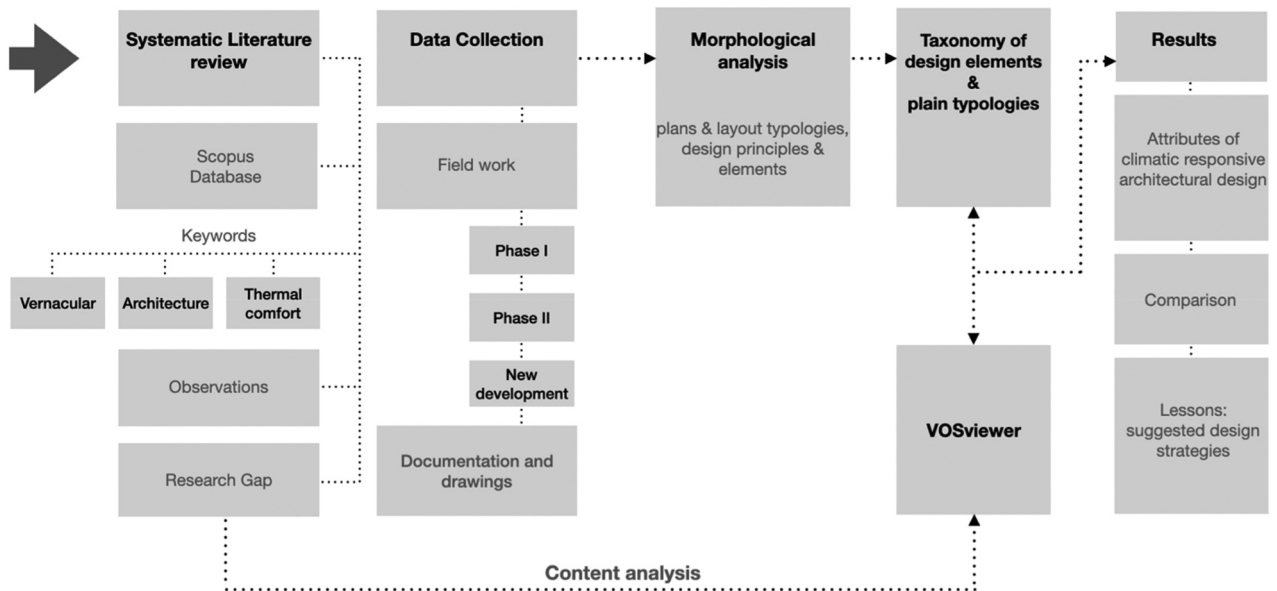


Figure 2. Methodology flowchart.

3. Literature review

3.1. An overview of the traditional rural Palestinian architecture

The traditional settlements of Palestine (villages and cities) display how the local climate, environment and culture played a major role in defining housing characteristics. It also reflects how people connected with their surrounding environment based on their living style and need, which is mainly associated with farming and animal herding, as well as the cultural, social and economic state that was echoed in the physical form and gave their architecture its characteristics. Houses were built in a traditional way through utilizing the local and affordable building materials and techniques according to the topography and climate in each region in Palestine. While the architecture of the urban setting is complex, the rural architecture of the settlements accentuates a genuine identity of the majority of Palestinians who lived in rural areas. Therefore, this section concentrates on this architecture.

The climate of Palestine is distinctive to the Mediterranean except for the desert areas, with longer months of hot summers and cold and rainy winters. Geographically, there are three main areas that are associated with different climates and they run as three parallel strips respectively along the north-south; the flat coastal areas along the Mediterranean planes; the mountain upland areas and the desert area along the Jordan valley.

Focusing on rural settlements in the upland areas where most of the historic cities and surrounding villages are concentrated (Jerusalem, Nablus, Hebron) (Amiran

1953), houses were mostly of a single room and single story. They had a square or rectangular plan with a dimension of 5×5 or 4×4 meter, and are referred to as the "peasant house" (A'miry and Tamari 1989) or the "Shepherd house" (Al-Ghadban 2008). Typically, a group of repetitive houses were organized in a cluster protecting an inner courtyard (Housh), where usually the extended families of the same clan (Hamouleh) would live. The empty areas in between are utilized for agriculture, storage and as a potential area for future expansion. Expansion is usually horizontal based on adding new rooms when needed and in some cases vertical expansions are detected. Therefore, the characteristics of the form can be interpreted as being modular, with a series of simple cubes with flat façades and domed roofs (vaults and barrels) built with the local stone.¹ This modularity allows for flexibility in terms of additions or removal in spaces between the empty areas. The whole village is organically organized along the landscape in a horizontal manner, displaying an awareness of the topography and the human scale as well as the climate (Figure 3). A larger communal building shared by all the residents can be found in the village to receive more guests (referred to as the Madafah meaning guest house) and is typical in Palestinian villages.

Internally the small and limited closed indoor spaces of the houses were specifically utilized for particular needs such as sleeping, thus providing privacy and protection from environmental conditions for people and their animals. Outdoor spaces were also used for daily and domestic activities, such as cooking and treating the harvests from the fields. Depending on the disparity in the social, economic and tribal status of

¹More complicated examples can be traced in villages with clans typically involved in governmental administration, politics and the military, they were richer and are referred to as the "Throne Villages". Generally, no distinction of religious association like Islam or Christianity reflected on typology of the houses (Doumani 1995, 29–30).



Figure 3. A view of the abandoned traditional Palestinian village of Lifta, located in Jerusalem.

the owners as well as to the nature of work and family members, the closed space is divided into two through a raised slab called (Mastabeh or Rawieh), reached through a few steps creating an entry space and another space for family use. Underneath the steps is where the livestock were kept, to provide protection from theft. The lower entry space is used for food storages (Qa'El-beit) if animals were not involved (Hadid 2002). Houses were organized on multiple functionality, like laying mattresses at night to sleep family members and then collected during the day and stacked within a niche in the walls to allow free movement. Other distinct functions such as toilets, bathrooms and kitchens did not exist.

Although in rural settlements no defined semi-closed spaces were constructed to support the closed ones, the spatial qualities and relationship customary in the formation of a Mediterranean hierarchy of spaces between semi-open and closed spaces were recognized as an important asset by people. The historic and valued technique to create pleasant environments through semi-open spaces was achieved through a canopy created with the help of climbing plants in front of the house. This specific outdoor open but shaded area over a paved slab (referred to as the mastaba/Saha) acted as a transitional space between the public/private, outdoor/indoor, and climate/micro-

climate. It was common to create this interchangeable semi-open space which made use of the varying different degrees of latitude of the sun during the day and during the different seasons, through the usage of climbing vine trees (Dalieh). The use of such sustainable means helped to create different desired conditions in each season. The vine tree will grow in summer and provide shade protecting the house from the direct sunlight while still allowing the air flow. Then, during the fall season it will lose its leaves and allow direct exposure to the sunlight that can heat the house. The vine tree also provided a food supply through its leaves and fruits. The use of the climbing trees is also common in residential areas in the dense cities in Palestine, which serves as a passive cooling system. Often vine trees were planted in large pots on roof tops and were allowed to spread over a thin mesh creating an overhang that provides shading and protection to the roof, which allowed the space to be used as a roof garden. The plants were watered by rain water that were collected in wells. The careful use of available resources created a sustainable means of planning. For instance, houses and village fences were achieved through planting cactus plants that acted like fences around the houses and villages as means of protection (Figure 4). Also, all houses in the coastal planes and mountain areas utilized respectively



Figure 4. The traces of cactus plants acting as fences in the traditional villages.

sand or lime natural stone as a building materials that comprised of large chunks collected from nearby sites, built as load bearing walls that can reach up to one-meter thick in some cases and up to four meters in height. In the desert areas, earth-mud bricks replaced the use of stone. The use of natural materials for the walls allowed for a suitable micro climate for the users' comfort, through acting as barriers to heat transfer.

Roofs were constructed as vaults or groin vaults from stone, with joints that employed mud, dirt, wooden stems, twigs, reeds or branches depending on availability, earth strata or availability of trees in mountain areas (for further reading see Canaan, 1933; Dalman 1964; Jäger 1912). Other primary climatic parameters in the space formation in traditional houses is taking good advantage of the climatic conditions of the Mediterranean, especially the sun energy both in summer and winter. Houses had minimal openings and were located at a higher level of the walls, which allowed the hot air to rise and exit from these openings. On a larger scale, the dense clustering of the houses provided shade on the narrow alleys and streets outside. This allowed people to move and walk protected from the direct sun. Also, taking the advantage of one another, houses were attached, which reduced the external wall area and minimized the exposure of radiant sun and heat into the buildings. Courtyards were able to receive direct sunlight, however, making use of the west direction meant that the summer breeze of the Mediterranean

would cool the rooms at night, whilst the south direction heated the walls and space in winter.

This tradition sustained in rural settlements during the Ottoman period in the late 19th century and early 20th century and during the British Mandate in the country beginning with the First World War and ending with the Israeli occupation in 1948.

3.2. Sustainability and vernacular architecture in Palestine

According to IPCC, the building sector is responsible for 32% of energy consumption, with a significant percentage of this being attributed to residential buildings (IPCC 2014). Statistics indicate that the housing sector expends most of its energy consumption on achieving thermal comfort through cooling, primarily during summer months (IPCC 2007). That is because many contemporary residential buildings rely heavily on mechanical air conditioning to achieve thermal comfort, especially in hot climates, resulting in high expenditures on electricity bills and a large demand for electric consumption (Fernandes et al. 2020). In light of the growing concern surrounding climate change, numerous scholars and researchers are exploring the impact of vernacular architecture on sustainability. Evidence suggests that earlier traditional building methods were mindful of their climate, local resources, and materials, and incorporated these factors into their living styles, becoming the basis for strategies and models for sustainable architectural design. These strategies include consideration of building form, construction materials, orientation, topography, and vegetation that have the potential to influence the energy required for heating and cooling (Bougdah and Sharples 2010; Sarte 2010), as well as human health and indoor thermal comfort.

Given that each locality has its unique context and varying lifestyles, ensuring thermal comfort requires a thorough analytical approach that considers contextual requirements, such as local climatic challenges and building development limitations. Achieving thermal comfort is a complex process that not only involves spatial organisation and physical adjustments to buildings but also integrates human dimensions, including social interactions and adaptations to climate variations and barriers. Studies are emerging to explore the potential of locally produced design solutions to address issues of thermal comfort in buildings, particularly in low-income communities (Peker 2022). Emphasis is given to existing solutions to thermal comfort through locally produced design solutions which can be effective in addressing issues related to natural ventilation, shading, and insulation, as well as the use of local materials and labor (Peker 2022).

Within a Mediterranean context, many scholarly studies emphasized the significance of studying

vernacular architecture from a sustainability standpoint. Fernandes et al. (2020) have identified similar strategies utilized around the Mediterranean basin in construction methods and natural ventilation methods of vernacular residential architecture. They compared cases from several regions, though based on different cultures. Moreover, other related studies show that many cases around the basin share some common features such as building techniques and the use of traditional courtyards to improve thermal performance (Galán-Marín et al. 2018). Ozarisoy and Altan (2021) review of existing literature on the use of bioclimatic design elements in the context of the South-eastern Mediterranean climate provided an overview of the theories, methodologies, and case studies related to bioclimatic design in this region. Their review aims to create comfortable and sustainable built environments by harnessing natural elements such as sunlight, wind, and water, and they identify the best practices and areas for further research.

Research on vernacular architecture in Palestine, which is located in the same Mediterranean region and has a rich history of traditional settlements, has been limited and scattered across various aspects of the topic, particularly with regard to socio-cultural values that affect vernacular strategies used in residential buildings. Most studies have focused on conserving or using vernacular architecture and its elements. Abdel Hadi (2013) compared the thermal performance and cost of old and contemporary buildings in Palestine and found that traditional buildings had better thermal performance and were more cost-effective. The use of courtyards is a crucial element in achieving better thermal quality in Palestine and is argued to be an important traditional building method. Studies have suggested that the concepts behind the courtyard solution need to be re-evaluated and reintroduced in the retrofitting of existing contemporary residential buildings (Hussein, Barlet, and Semidor 2010) and provided clues related to improving and enhancing the living quality of residential buildings that could be also attained with modern housing designs such as balconies, gardens and private outdoor spaces as means to enhance sustainability in housing (Hussein, Barlet, and Semidor 2010). Additional studies based on comparative analysis between the vernacular and contemporary discuss parameters related to building materials, openings, and vegetation in both settings, revealing that new development of urban residential buildings lack reference to sustainability (Tawayha, Braganca, and Mateus 2019), especially with high-rise and high-density housing. Suggestions to improve housing in Palestine include addressing issues related to land use and community participation during the design process as a culturally

sensitive and sustainable solution (Itma 2014). Other suggestions include adaptive reuse, which can transform existing buildings into affordable housing units and preserve the cultural heritage of the built environment (Itma and Salama 2023). Additionally, the need to support of incremental housing as a strategy through gradual housing building over time as an affordable solution for low-income families who cannot afford building a complete house at once, especially with the change of the traditional family structure into nuclear (Itma 2015) and in the face of modernization and globalization (Amad 2012).

Although the literature has largely recognized and acknowledged the quality attributes of vernacular architecture in Palestine, particularly in contrast to the inadequate thermal performance of contemporary residential buildings and envelopes, most of these studies have focused on comparing traditional and recent construction techniques without accounting for the initial stages of adapting modernity in the region. This period of transition towards modern standards across the region, including Palestine, remains insufficiently documented and explored. This era coincided with the post-colonial period across the Arab world, during which many nations sought new and contemporary modes of expression to assert their independence and openness to the wider world in relation to concepts like regionalism, nationalism, local customs and climate. Recently, a growing literature is emerging to show that this neglected period/region of study has developed identities and qualities associated with the complex architecture and culture of the “Mediterranean modernism”, defined as a “modern architecture that responds to program with cues derived from vernacular buildings so as to infuse spatial and material concerns with context and culture” (Lejeune and Sabatino 2010, 6). Yet, it has a distinct tectonics nature of using solid walls and characterized with the smooth whitewashed surfaces and simple volumes, unlike western architecture that was associated with the construction of framed systems of concrete and steel (Lejeune and Sabatino 2010, 4). Despite being underestimated and overlooked, a growing number of cases from around the basin are surfacing regarding the adaptation of modernity and its mitigation of climate issues at the time through locally produced solutions (see Arbid and Oswalt 2022; Isenstadt and Kishwar 2008; James-Chakraborty 2014). Thus, this article will contribute to this growing literature by investigating the means and methods of adapting the modern life whilst still referring to the traditional life and characteristics according to the local environment, climate and socio-cultural values from a sustainable perspective. It will also seek to explore which traditional elements were used and

adapted to the modern houses at the time, why they were lost, and why they are not as prominent in our recent age.

4. Modernity in Jerusalem

Modernity took place in Palestine and in Jerusalem during the late Ottoman period in the late 19th century. The occupation of Great Syria including Palestine in 1832 by Mohammad Ali Pasha of Egypt led once more to Ottoman control where new reforms were introduced in the "Tanzimat" Charter relating to land ownership (Schölch 1984, 460). The new Ottoman reformation allowed for non-Muslims to own and build in the holy city. The arrival of foreign missionaries brought new advancements in the building sector and allowed exposure to emerging technologies and affected the architecture of Palestine in major cities. Similarly, new developments in the infrastructure such as the train line (Hijaz) and ports allowed for the transformation of ideas and goods and helped in the gradual modernization of the Ottoman empire and revolutionized building techniques and the importation of new materials (Fuchs 1998). During this period, traces of western influences resulting from the extensive colonization of Europe could be depicted (see Kark 2002). Thus, the influence was mainly reflected in the mansions of the affluent Palestinian residents of the city (the rich, intellectuals) who took residence in areas outside the walled city. The expansion to the outside was possible due to the construction of new roads that led to new neighborhoods, which since then had ultimately changed all aspects of life and needs that were once centered inside the walled city.

Although the new mansions of the affluent Palestinians were representative of the "modern" house, which were detached and included separate spatial functions including services, all built under one roof; they were influenced by the resident's previous traditional building's form, design and construction methods, which were based upon traditional living patterns. This influence is believed to anchor on the building form and design of the "three bay" houses of Syria and Mount Lebanon; the Turkish "konak" where a free standing house stand detached within a single walled garden; the Syrian "Iwan" a central hall area similar to a courtyard flanked by rooms; and the Venetian rural Palaces "Villas". The spatial formation is based on the hierarchy of enclosed, open and semi-open spaces (Fuchs and Meyer-Brodnitz 1989). Within the enclosed houses, traditional courtyards were turned into the "Liwan" configuration or the central hall, which is a centrally located closed space that acts as a transitional space and also allows for daily activities uses such as a living room – that leads to other several spaces for guests and the residents. The mansions also included separate bedrooms,

kitchens, bathrooms and toilets as well as spaces for workers. The stylistic language of the façades varied and often incorporated a mix of Neoclassical styles such as the Renaissance and Baroque as well as oriental. The local building materials and motifs were in stone and employed in a broadly Eclectic manner. Traditional load bearing construction including vaulted roofs were also common. The use of traditional materials, the optimal use of orientation and openings, and the use of semi-open porticos responded well to the local climate and provided well-lit and well-ventilated interiors. Gardens were planted with Citrus, Olive trees, Jasmine and vine trees, and provided shade and gave protection from winter winds. Therefore, these first attempts towards modernization are considered as an adaptation of the traditional lifestyle.

The building techniques and expansion continued during the British Mandate. However, as a colonial supremacy, the British imposed modernity as an abstraction that created social divisions between the elites and the peasants, as well as among Palestinians and the new Jewish immigrants (see Crinson 2016; Fuchs and Herbert 2000). Thus, while the accumulation of the high eclectic styles borrowed from the west is seen in the urban fabric, the traditional architecture continued and maintained its genuine expression and characteristics in rural areas (Khasawneh 2001).

The adoption of modernity in the rural areas around the main cities as in East Jerusalem advanced only after Jordanian Rule (between 1948 and 1967). This is because the peasants in the surrounding villages were still dependent on their land cultivation to provide for their living. For many, the use of agricultural land for development was not economically realistic. However, the changing life style in the Arab world after the ease from colonial powers that brought new prosperity (see Arbid and Oswald 2022) allowed many of the peasants to consider investing in their lands by building houses to sell or rent in accordance with modern standards. Parallel to this, many of the prosperous families who continued to live within the walled city, realized that the congested life there could not provide the modern lifestyle of comfort, which encouraged them to rent or buy land from the peasants. At the time, modern advances at a national level-like connections to electricity and water allowed the newly adapted modernity to become the most adopted architectural approach that became widespread in Palestine. This is explored in detail in the following sections.

4.1. Adaptive modernity in rural East Jerusalem: Phase I

The following became a new type of architecture for both the peasants and those who could afford a more comfortable life, and this became the prevailing trend

of modernity in Palestine. This architecture embraced modern living standards and was the product of skilled builders working between the periods 1948 and 1967 and was based on tried and tested precedents. Following the war with Israeli in 1948, Jerusalem became divided into East and West, where the East became under the Jordanian Rule. With modernity, new building and construction materials were introduced, not only in Palestine but throughout the region, which allowed an exchange that influenced the reformation of all the social strata's at the time. The political dynamics that allowed for this adoption and exchange has been studied thoroughly elsewhere, so the following section will concentrate on the adaptation of modernity in residential architecture in terms of its social, climatic and sustainability aspects.

In East Jerusalem, and along the north-south road that links the city of Ramallah to Jerusalem and specifically around Shufat, Beit Hanina, Al Ram and Beir Nabala, new neighbourhoods with detached houses started to emerge. Other areas that were developed in this way include Azarieh and Ras El-Amood to the south-east of the city. All the houses were built individually as private detached houses or in some cases apartment buildings with maximum three floors. They were self-built by individual initiatives through affordable payments and without government subsidies.

At the time, one of the key factors in the design of these new modern houses both internally and externally, was that of privacy. Externally, this was achieved by adhering to the setback regulations and by building fences around the plots, which provided privacy from neighbours and allowed for airflow and exposure to more sunlight in all directions. Internally, all houses included designated functions with separate bedrooms for parents and children (regardless of gender), as well as toilets, bathrooms and kitchens. The typical plan configuration of the houses followed the Liwan scheme (a term still used by people today), being approached by the domestic and main entrance and this remains an important feature of that period. It is adopted and adapted from the traditional courtyard configuration but contains a covered central hall, which was also featured in urban mansions in the late 19th. The liwan is smaller compared to the mansions and acts as both a transitional space and a living space. Being enclosed and protected by the surrounding rooms keeps the space warm in the winter and cool in the summer. The fenestration is limited to a small window overlooking the main entrance balcony. It was observed that the liwan space configuration was found to be present in all 19 of the houses visited. During the visits, some occupants mentioned that: *"The space of the liwan is really awkward to lay furniture, however, it is the warmest room in winter and the coolest in summer"*. Another occupant referred to the

use of central heating units: *"Our house is the only one that has an installed central heating system in the neighborhood. It is made of cast iron, unlike newer ones that are made of aluminum. It takes longer to cool down, but heats up more efficiently. However, it is not necessary for this house and is barely used"*. Besides the liwan, another formal living room referred to as the "Salon" was located to the front of the houses and had a separate entrance to receive guests, a reproduction of the Madafah room found in villages, whilst still having an access from inside the house. The protrusion of this room holds both social and environmental significance. Socially, it projects a sense of prestige and importance when it comes to receiving guests, while also maintaining privacy from the rest of the house. Environmentally, the protrusion provides shade to adjacent balconies, preventing direct sunlight, and its isolation means it requires minimal energy consumption for heating, except during occasional times.

The houses also made use of the new emerging technologies at the time, namely the use of skeletal systems cast in reinforced concrete. Concrete has enabled the construction of multi-story buildings in a faster time resulting in high productivity in the use and design of spaces resulting in more efficient land use. The system and the advantage of curtain walls allowed for larger openings, but it also reduced privacy and solar control, therefore it was avoided. Externally, the houses were clad in natural stone, as an obligation rule enforced in the city since the British Mandate. The stone was hewn from nearby quarries and cut manually into irregular blocks. The mechanical cutting of stone was not available at that time, and it was expensive to refine the stone in-situ and this led to the use of cheaper rusticated stones (Tubzeh). The use of cantilevered slabs for balconies along with other structural elements broke up the flat façades. The projection of some rooms, especially the salon, towards the front breaks with the tradition of plain cubical forms, and creates shade and shadows on the side of the buildings. A portico/balcony (referred to as Veranda or Baranda in Arabic) is the main feature of the architecture of this period and is mainly located at the main entrance and to the rear of the building. Multiple balconies were used and kept spacious for use. Its purpose is not only for use as alternative space of living according to the seasons but works as a semi-open space that protects the main rooms from receiving direct sunlight. They were deep to keep enough shade and the windows were directly aligned towards these balconies, which allowed sunlight to penetrate when the angle of the sun was low in winter. All openings were minimal to control sunlight. Toilets and bathrooms had smaller openings and overlooked the rear or side façades. One of

the occupants referred to the balcony facing the south saying: *"We call this the house's heater. During sunny winter days, it becomes our living room, and we even receive guests here"*.

The liwan would usually open to a bedroom on one side and into a transitional space that leads to the second bedroom, the toilet/bathroom and the kitchen. All bedrooms were spacious and had two windows aligned at different locations to allow for cross ventilation. Kitchens were the smallest rooms, as fridges and cooking stoves were not available at that time and cooking still took place in traditional stoves. A dining table was positioned at the centre of the kitchen as there was no separate dining area. However, most kitchens have access to the garden through the back balcony, and food drying according to the harvests of the seasons took place there. Some occupants complained about the small size of the kitchen, however, in relation to heat and cooling issues, one mentioned that: *"the kitchen overlooks the north-west, I prefer this location, I never need a heater here"* when asked why, she referred to the lack of need of heating the space in winter, as the heat of the oven and the cooking steam in winter heats the small space and it is also shaded in the in summer by the balcony and do not receive direct sunlight.

The introduction of toilets and bathrooms expressed modernity through expressions of hygiene. Internal plumbing and running water pipes allowed toilets to be integrated into the main house. Ceiling heights of the houses were higher than three meters to allow hot air to rise. The bathrooms however had lower ceilings as storage was located in the space above and were accessed by a ladder from the adjacent rooms. The upper room provided extra storage space (Sideh – meaning attic) and maintained the low bathroom ceiling, which according to some residents this enabled the hot air generated by the steam of the showers to heat the space in winter and not needing a heater.

Regarding heaters and heating of spaces, most houses initially relied on portable and limited gasoline heaters during winter and did not install wall-mounted air conditioning units. Occupants mentioned that this was the only heating source available and affordable at the time and it allowed them to move it with them to the different spaces they use during the different time of the day. An occupant mentioned that: *"locating the heater in any of the rooms allows us to heat the space within minutes, as we can close off the rooms and seal it from the rest of the house. Whilst in summer, we open all the doors to allow air to circulate"*. Other portable methods included the use of woolen carpets instead of synthetic ones to warm up their living spaces, as wool is a natural insulator and can help retain heat, making it a good choice for cold climates. During summer, these carpets were stored away to keep the ground cool.

The attitude towards the environment was also expressed through the sanitary solutions utilized in the houses. Although they were connected to water and electricity through the central companies, the sanitary infrastructure was not available during that period. As a solution, all houses had dug large holes in the backyard, acting as septic tanks, directing the sewage from the bathrooms and kitchens and allowing it to decompose with the help of planting a Berry or an Eucalyptus tree nearby. These trees rapidly absorb the surplus waste water and release pure water vapour, as such they prevented the overflow of the ditches and grew rapidly creating shade to the buildings. Along with that, gardens were planted with Citrus, Olive and other trees, and watered from the well that collected rainwater from the flat roofs of the buildings. However, during the time, the city lacked proper urban planning or even a land registry. General rules and regulations were set regarding heights, setbacks but no areas designated for public use or open recreational space. Gardens acted as spaces for recreation.

The houses of this period displayed a consideration of sustainability whilst adapting traditional life into modern living. Although there are some variations in terms of proportion, regularity and flexibility among the houses, they comply with modernity's general approach to problem-solving through tackling the issues of functionality that are shaped according to their living style, culture and environment. Progressiveness of people aligned with the apprehension of sustainable living is distinctive as they treated their building as "never finished". To them, houses were meant to grow according to their possible future changing needs, an example is leaving location of columns on the roof slab accessible in case of new additions.

4.2. Alterations and additions: Phase II

After 1967 and following people's previous experience and trials in adopting modernity, new changing needs urged people to carry adaptations and alterations further. During this period, a second generation of children needed housing. Generally, the families in Palestine provide a living space for their male children when reaching the age of marriage. As such, people were building/adding new floors that had self-contained flats according to the number of their children. This was realized through vertical expansion technologies and was more convenient and cheaper than purchasing another plot and building from scratch. Additions during the modern period replicated the customary expansion in traditional settlements for extended families, but this time vertically. Thus, according to modern living standards, each nuclear family occupied a floor in these vertical flats. Many of the houses observed had added one or more floor on top whilst keeping the same footprint of the existing floor.

Comparing the new additions to the existing floors, the new floors acted as a revision to the earlier attempts built before 1967 (Figure 5), which considers the issue of functionality and a more practical use of spaces.² Thus, new additions attain privacy based on the social life through a more appropriate spatial organization, based on the hierarchy of private-public spaces. The liwan plan configuration kept its general characteristics as a transitional and living space at the same time. It centralizes the house and is flanked with other rooms. However, in some cases, the wall that separated the liwan from the main front balcony was removed, allowing a larger open-plan configuration. This allowed a better organisation of furniture and better use of space like locating a formal dining table. The liwan as such continued to be protected from direct sunlight in summer and is kept warmer in winter.

The new flats encompassed enlarged kitchens (often replacing the main bedroom) and improved the connection to the liwan. This helped to maintain privacy for the bedrooms, which were located to the back and separated from the rest of the house through a transitional space unlike previous footprints. A main bathroom centralizes the two bedrooms. Now that kitchens were closer to the living space, they continued to be closed and secluded rather than being open to the living space. According to one of the occupant, it was essential to avoid aligning kitchens towards the west, where the wind flow would carry cooking smell into the house rather than pushing it to the outside. He stated that: *"We learned from my mother's house on the ground floor that when the kitchen faced west, the whole house would smell."* He also emphasized that: *"the bedrooms are now separated from the rest of the rooms and we only use them when we go to sleep. They all now face west, which allows for a good summer breeze at night while sleeping"*. This was attainable due to the fact that piping (water and sewage) was exposed rather than embedded within the walls, which allowed for flexibility in changing the layout. Nevertheless, as flats were located at higher floors and were accessed via stairs, direct access to the salon was not possible from the outside. In the new spatial organization, visitors were guided into the salon through the liwan.

The success of these alterations and adaptations to reflect modern living styles, is dependent upon social and environmental considerations, as in the use of balconies, opening-wall ratios and

orientation. Climatically, the balconies at the rear façade around the bedrooms allowed these semi-open spaces to act as shading, protecting rooms from direct sunlight in summer, whilst still allowing it to reach the rooms in winter. The sizes of the balconies followed the same size and proportion of the existing ones below. An important climatic consideration was the fact that single housing units occupied the total floor, which allowed the houses to receive the different directions of the sunlight. Thus, families continued to use the different balconies at different time of the day and according to the different seasons.

The fact that the same extended family occupied the same building on a single fenced plot allowed all family members to use the garden. At the time, cars were limited and streets were not as dense as today, allowing people to park outside or allocating a small portion of the garden for parking purposes. The rest of the garden was a place where children would play and share with their relatives, as public parks and recreational spaces did not exist in the city. What was also important was the street feeling/environment. Since people owned these houses they cared for the cleaning and general maintenance together with their neighbours.

Aesthetically, these houses adopted similar details to keep up with the existing floor/s, like the use of the same stone type and colour when possible, and similar proportions and size of openings. However, the new Israeli administration in the city brought in new advancements in the building sector with materials and other decorative elements influencing the architecture to come. This allowed the exploration of colorful ceramic tiles in bathrooms, replacing the white smaller tiles as well as floor tiles that used the mechanically poured terrazzo tiles rather than the decorative handmade ones. Thus, wrought iron sanitation lines are replaced by PVC pipes exposed to the side of the buildings as sanitation infrastructure was implemented in the city. It is also very common to see antennas in the form of the Eiffel tower at the roof tops of these houses, it is only for decorative reasons but indicated that the television was available in almost all of the houses (Figure 6).

This period was much affected by the turbulence of the First Intifada (in 1987) due to the limitation in economic conditions, strikes, closures, etc., which led to the signing of the Oslo Accords³ between the Palestinians and Israelis and later resulted in the separation of East Jerusalem from the rest of the West Bank.

²Although many people were building new houses during this period and were influenced by post-modernity that affected the stylistic approach of the houses, through employing more new plan typologies, ornamentation on façades and opening started to look like arches that were larger. These cases are not surveyed here and demand a separate study. However, this part concentrates on the additions made to the houses that already existed during the period of the Jordanian Rule.

³A peace agreement between Israel and the Palestinian Liberation Organization, which was signed in 1993 and mainly aimed to allow Palestinians self-determination and led to the establishment of the Palestinian National Authority over the West Bank and eventually East Jerusalem.



Figure 5. Schematic analysis of houses from Phase I and II.

5. Contemporary context and new housing development in East Jerusalem

The building of the Separation Wall early 2000 around Jerusalem led to its isolation from the rest of the West Bank, which had affected the housing character and

availability as well as the inflated real estate sector in general. The physical separation, which was also accompanied by the drawing of new municipal borders, excluded many neighborhoods from the suburbs of East Jerusalem where many Palestinians had lived.



Figure 6. A typical television antenna in the form of Eiffel tower.

This was reinforced further through other laws, such as the “centre of life policy”⁴ that restricts Palestinian Jerusalemites from living outside these borders (Jefferis 2012). The social segregation and physical separation had forced Jerusalemites living outside the borders to abandon their houses, and seek alternatives within a very limited area designated for Palestinians in East Jerusalem (for further reading see Saifi and Samman 2019). This had placed an economic burden on people and increased the cost of land and construction. Furthermore, the lack of urban planning in East Jerusalem, and the absence of a holistic approach and strategies to control demand and supply in the housing sector, allowed the market to impose profit-oriented strategies and not to act as part of an “integral social mechanism”. This led to serious problems and environmental degradations. Natural demographic growth had also complicated the issue of housing availability as younger generations that sought housing within the limited area were not able to afford the high cost within the available housing stock.⁵ The increase in demand led to a haphazard new development of housing and uncontrolled growth of the urban

fabric towards the rural settlements, and ultimately led to changes in their character.

The new private developments that emerged as a result are based on unsustainable considerations leading a serious degradation in quality of life. Their dominating nature over the environment and their density is an outcome of repetitive and standardized building patterns that depend on identical layouts and similar construction building materials and techniques (Figure 7). Aside from the lack of concerns towards sustainability, the new developments do not have a satisfactory quality in all aspects such as environmental, socio-cultural or spatial. Additionally, housing regulations imposed by Israeli administration that are grounded on the pluralistic approaches depicted around the world, lack policies towards offsetting the cost and supply in the housing market either by market control or through the provision of subsidies to Palestinians. Further inequalities both physically and socio-economically are being created in the East.

Similarly, the changing needs of the society in East Jerusalem, along with the restrictive building laws that do not grant Palestinians adequate building percentages on their own land unlike West Jerusalem, and there are still wide discrepancies between both parts of the city (Bimkom 2014; NRC 2017). This has led to inappropriate architectural practices that negate the tried and progressive initial approaches of modernity that adapted the lifestyle of earlier traditional settings. One of the problems of recent houses is the limited internal space in order to minimize the high taxes imposed on housing (Arnona) that factors in size and location. In order to achieve more flats to increase profit and to fulfill the growing need, the area is limited between 80 and 120 square meters per flat. That is since the larger the area is the larger the housing taxes are, which puts a large burden on the Palestinians residents who suffer lower income compared to Israelis living in the same city. The house taxation also uphold limits to the apartment sizes to a maximum of 120 square meters, by increasing enormously the calculation of taxation fees per meter square when exceeding this area. The limitation of the houses size affected the social and cultural living styles of its residents. The limited indoor space hindered receiving guests and carrying many traditions and customs on several occasions such as holiday celebrations, funerals, birthdays, and weddings that are celebrated in rented halls.

The high cost of land and permissions together with restrictive laws made it difficult for people to experiment in the building design, space, forms and even

⁴A policy, which the Israeli ministry of interior began implementing in 1995. It is enforced only on Palestinians holding Jerusalem identity cards to live within the new defined municipal borders in order to maintain their legal status in the country. Palestinians are still required to provide documented proof that their “centre of life” is within these boundaries (Jefferis 2012).

⁵An average apartment around 120 meter square can cost today around half a million U.S. Dollars in East Jerusalem. while the average rent price varies between 1000–1500 U.S. Dollars per month.

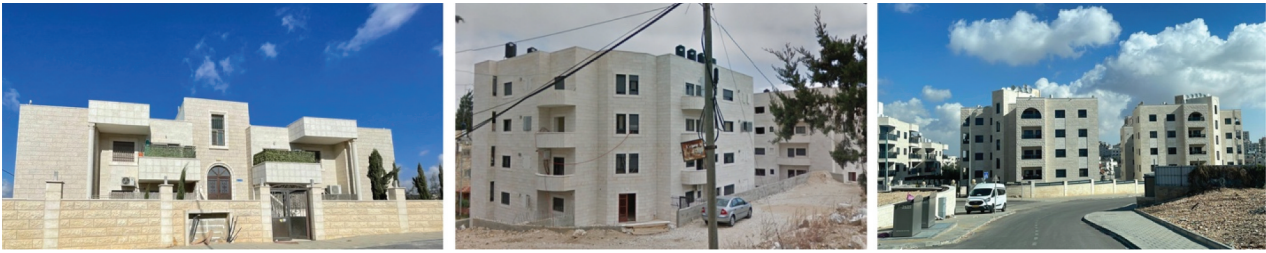


Figure 7. A sample of the new contemporary housing development in East Jerusalem.

façade details. Land owners, developers and construction firms were using this situation to develop housing with reduced costs with the primary goal to increase profit margins, which resulted in more commercially based solutions that are standardized, with monotonous architectural elements based on repetition and uniformity, to allow optimal and rational solutions in time and space. Hence, the new developments ignored the spatial organisation that is based on the interaction between indoor and outdoor and the introverted spatial organisation has become inevitable.

With regard to the new contemporary developments selected for this study, three developers' websites have provided plan typologies, areas, and 3D drawings of flats that are currently under construction and are being offered for sale (Al-Tameer 2023; Bounyan 2023; Yaboosre 2023). A total floor plan has been redrawn schematically and analyzed, as shown in Figure 8. The evaluation is based on the orientation of the buildings, the sizes and locations of different rooms, the sizes of openings, semi-open spaces in the form of balconies, ventilation of service rooms and their locations, and the general layout of the main living spaces.

As demonstrated in the three representative cases in Figure 8, many of the houses rely on electromechanical resources and energy consumption to heat and cool the spaces during winter and summer. Since floors have more than one attached housing unit, they cannot provide an equal distribution of sunlight and ventilation. For example, some rooms may overheat in the summer, and many are disadvantaged from benefiting from cross-ventilation due to having only one window. Upon closer inspection of the cases, it becomes evident that the majority of the bedrooms only have one window. While large windows (sometimes ceiling to floor) are oriented towards the south without the use of shading elements to prevent heat gain in the summer. Additionally, the relatively low ceiling height, which is standardized to less than three meters, is further lowered by the use of false ceilings to install electrical and mechanical systems, which trap hot air close to human activities.

Another problem is the haphazard spatial organisation of the functions/rooms within the plan

configuration, such as the inappropriate location of certain functions that do not take advantage of sun orientation. To protect more common areas such as living and dining from heat transfer, rooms that are used less frequently during the day, like toilets, bathrooms, and laundry rooms, should be positioned in a more efficient way as buffers. However, this is not the case in the new developments. The cases analyzed show that they follow an open plan scheme, which includes the kitchen, dining space, and the living space. They do not apply the buffering strategy to contain spaces for proper heating or cooling according to the seasons, abandoning any reference to the traditional courtyard scheme and the *liwan* and the responsive-climate efficiency design solution associated with it.

Another design problem in the new developments is the insufficient degree of semi-open spaces to provide greater human comfort within the design. In many cases, it is limited to one single small balcony that is not deep enough to be used by people for hanging laundry and storage, and in many cases, they are built without a roof. As seen in the cases, each flat is entitled to one balcony only, which is relatively the size of the toilet. Besides, none of the examples shown have a balcony located towards the south. The use of balconies with no shaded overhang, or random positioning without taking benefits of the orientation, is also noticeable. Another examined issue is the use of simple planar forms instead of utilizing the projection of certain spaces scheme as a method to create shade and shadows to control exposure to direct sunlight.

On a larger scale, the positioning of more high-rise buildings in proximity to each other or even next to a low-rise building based on the same set-backs standards. This variety in building heights affects the open space in between and forms an obstacle in allowing the flow of air, and some buildings to benefit from the sun, wind and sometimes view by creating shadows that drops onto adjacent building façades.

Similar problems also apply to services such as toilets, bathrooms, and kitchens, which are typically ventilated through small windows that open into a common shaft. However, these shafts are often proportionally inadequate in terms of their width-to-height ratio, which

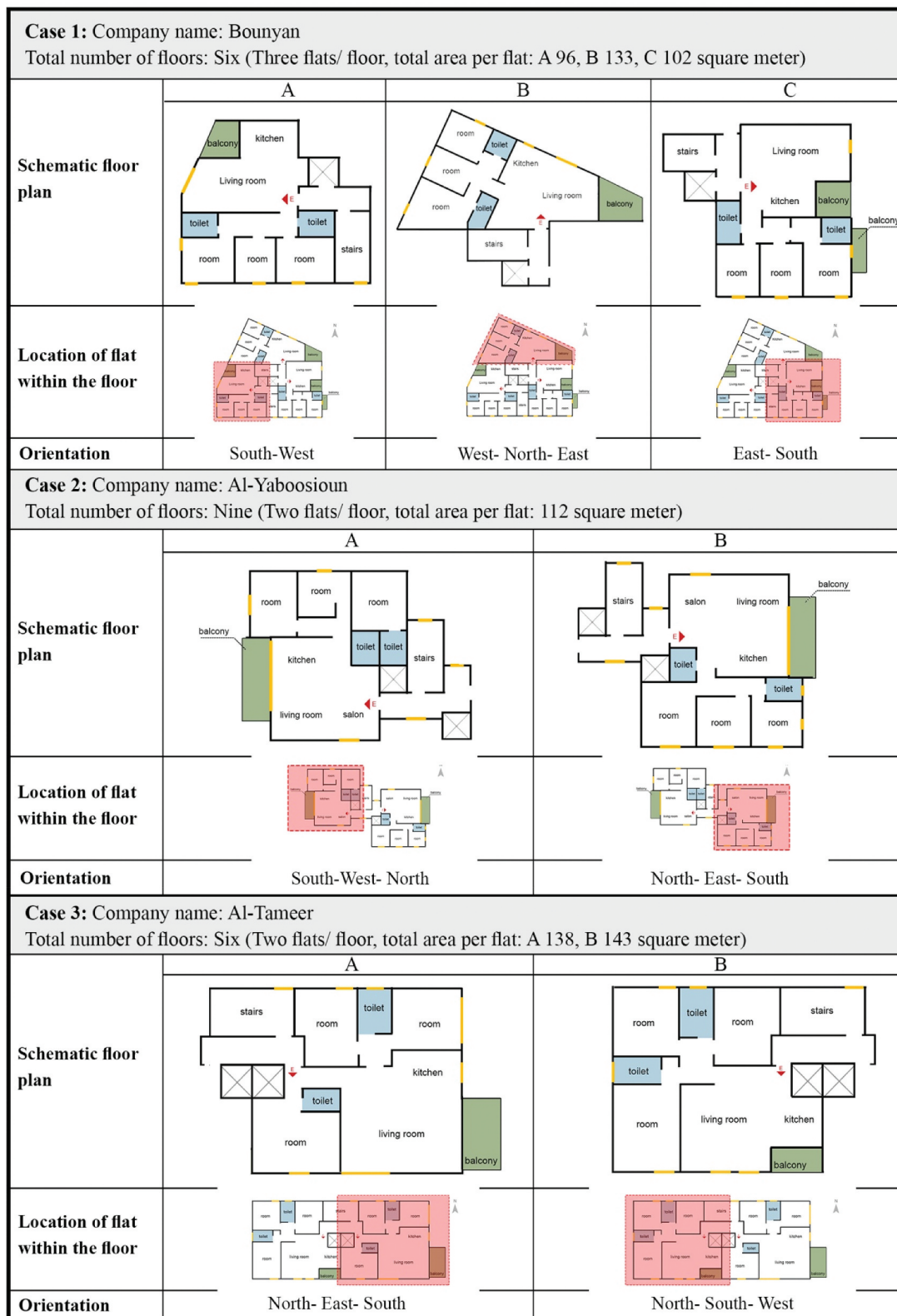


Figure 8. Schematic analysis of the new contemporary houses plan morpholog.

prevents adequate light and ventilation from entering these spaces and forces people to rely on artificial lighting during the day. In the cases analyzed, it was found that most flats have bathrooms and toilets that lack a direct opening to the outside, even when they are located on exterior walls providing windows is often avoided.

This poor design outcome is not the only issue; another critical problem is the standardized construction

techniques used across all cities and regions in Palestine and Jerusalem, without regard for the distinctive environmental and climatic conditions of each area.

Considering the new housing developments (that are still scarce and limited) offered in the market for those who could afford to buy them is challenging on a social and environmental level. As the land is limited in size and extends vertically to include more flats and therefore

Table 5. Evaluation criteria based on attributes of climatic-responsive architecture design for the case studies.

(A) Criteria	(B) Details	Phase I	Phase II	Contemporary	
Cooling/passive cooling	Medium-sized and limited windows.	√	√/X	X	
	Thermal buffering of main living space.	√	√/X		
	Microclimate control with deep and efficient semi-open spaces, such as balconies, shading.	√	√	X	
	Use of balconies according to different sun directions.	√	√	X	
	Use of opening towards west to harness summer breeze.	√	√	√/X	
	Use of shading elements on openings facing south.	√	√	X	
	High ceiling.	√	√	X	
	Projection of form (i.e., non-planner) to create shades and shadows.	√	√	√/X	
	Use of vegetation and trees.	√	√	√/X	
	Green cover of gardens.	√	√	X	
	Avoid paved solid surfaces for car parking.	X	X	√/X	
	Heating	Many windows facing south for maximum sunlight exposure.	√	√	X
		Thermal buffering of main living space.	√	√	X
Avoiding open plans and isolating rooms.		√	√	X	
Small-sized windows towards the north and west.		√	√	X	
Low bathroom ceilings for better heating.		√	√	X	
Natural ventilation/lighting	Sunlight and wind penetration to all rooms.	√	√	√/X	
	Sunlight and wind penetration to bathrooms and kitchens.	√	√	√/X	
	Cross ventilation with a minimum of two opposite windows per room.	√	√	X	
	Single apartment per floor (i.e. not attached in the same floor).	√	√	X	

Legend: √ used, X not-used; √/X varies.

more families, the ground floor area is designated usually for car maneuver and parking. This leaves very limited space for the creation of a shared garden and a place for vegetation. Thus, due to the fact that the residents do not belong to the same family, privacy issues become critical. As a solution, it became common to designate part of the garden to ground floor flats only and enclosing it with fences. Doing so would allow investors to sell these flats for a higher price, which also creates further problems on the well-being of the residents occupying the upper floors who cannot enjoy the outdoor space (for further reading see Samman and Saifi 2022). Nevertheless, the lack of investment in public spaces along a dilapidated infrastructure in East Jerusalem is also accompanied with the lack of investment in transportation system, which encourages a dependency on personal cars. Climatically, the lack of greenery and vegetation around the apartment in favour of asphalt surfaces helps in reflecting and trapping the heat. Moreover, due to the high cost, people avoid to dig and build wells or make good use of the natural resources such as collecting rain water, which could help to grow plants and trees.

This kind of architecture cannot evolve or change in space and time. The rigidity of this architecture does not allow people to alter or change their living spaces physically and aesthetically. The once sustainable attitude rooted in the Palestinian culture of keeping the possibilities of future need and change is lost and ultimately it means the loss of cultural continuity and its spirit.

6. Discussion

Thus far, the study has shown that the physical form of the traditional dwelling in East Jerusalem, which was rooted in people’s living style, accommodation needs and responsive to the culture, environment and climate, was abandoned in favor of modernity during

the middle of the last century as means to meet new expectations. The study does not view this as a negative development, but rather as a progressive and humanistic attitude. People in East Jerusalem made choices based on their affordability, abilities, social and cultural needs, whilst considering the environmental and climatical factors, adapting to changes in time and space. Modernity was not simply a matter of style, but a constructive means to embrace advancements while retaining the identity and characteristics of the locality. However, today, much of the new development in the city are abandoning references to the traditional life.

To highlight the problems associated with new contemporary development and to determine the attributes of a responsive architectural design that takes into account the advantages of the Mediterranean climate in Jerusalem, an evaluation criteria is established as shown in Table 5. The evaluation is generated according to two bases: (A) general criteria derived through content analysis validated through the systematic literature of this study presented in the methodology section; and (B) detailed taxonomies retrieved from morphological analysis of the cases that correlate with the criteria in (A). While column (C), (D) and (E) evaluate the general approach of design strategies detected from the field study in Phase I, Phase II and contemporary developments, respectively. The general criteria of the extensive literature review were extracted through the use of VOSviewer version 1.6.19 (0), where all 82 articles collected from the Scopus Database were uploaded and visualized. Figure 9 shows that each node represents a keyword used in the 82 analyzed articles, with the size of the node reflecting the frequency of “occurrence” (the larger occurrences are, the larger the node is). The keywords were initially set by selecting the unit of analysis to “All Keywords” and setting the minimum occurrence to 10. The program clusters

limitations imposed through laws and regulations that are politically grounded, this is shown to be also affecting their thermal comfort and their dependency on electromechanical solutions pushing further economic burdens in terms of energy consumption and inflated real estate prices. Thus, the Jerusalem municipality, that sets these rules along with professionals, policy makers, designers and architects, is aiding in the climate change challenges. Whilst the change of such policies is tied to political negotiations that lay beyond the scope of this article, some design strategies and guidelines can be followed to achieve better sustainable quality even within the limitations imposed by the building codes and regulations according to the followings:

- Protection through buffering strategies of the main living areas where families spend most of their time, by placing service rooms (e.g., toilets, bathrooms, laundry) as buffers towards undesirable sun orientation and wind to help reduce the need for mechanical air conditioning and improve passive cooling.
- Limiting the size of windows and avoid using large openings. Also, place more windows facing south for better intake of winter sun, which also respect privacy and cultural norms.
- Provide deep, shaded balconies or other shading elements towards the south and west direction.
- If designing detached flats on each floor is inevitable, allow all housing units to face south to optimize solar orientation.
- Ensure that all rooms have enough openings for natural ventilation, including kitchens and bathrooms.
- Encourage cross ventilation and airflow, by providing multiple openings facing different directions within the same space.
- Instead of using open-plan layouts design solutions, consider subdividing spaces for better temperature control in both summer and winter.
- Use design strategies to create shade and shadow through projecting masses as buffers to main living space, rather than relying on flat, planar forms.
- Increase ceiling heights in main rooms for more efficient cooling of living spaces in the summer. And decrease ceiling heights of bathrooms through creating attics above to allow for better heating of bathrooms with water steam in winter and extra storage space.
- Avoid using ground floor gardens for parking, and instead use underground solutions. Design garden areas to allow planting with indigenous plants that require less watering and can be interchanged seasonally, such as Vine trees, Olive trees, and citrus trees as a strategy to provide

shading and to increase air moisture that facilitates cooling the airflow before it reaches the building.

- Consider using roof gardens as common spaces for entertainment, which can also function as insulation when shaded by climbing vine trees.
- Avoid high garden walls that block airflow to neighboring plots, especially in hilly topographies.
- For low-income families, consider incremental housing as an affordable strategy that allows building homes gradually over time.

Although the above have been discussed and articulated through a qualitative approach based on observation and ethnographic research, more quantitative studies will be necessary to evaluate the different housing typologies of each period in Jerusalem. This can help to develop further approaches that can contribute to the quality of indoor spaces.

7. Conclusion

The purpose of this paper was to evaluate the housing environment in East Jerusalem through considering the role of locally developed architectural design solutions in relation to thermal comfort in the modern houses in East Jerusalem. This has helped to identify sustainability indicators by considering climate-responsive architectural design in the city based on an analytical assessments and evaluation of several housing cases that emerged at different periods. The study has argued that modern architecture, that was adapted from the traditional life of Palestinians, has the capacity to provide thermal comfort and can be responsive to climatical, environmental and social aspects. These successful examples can help professionals, designers and policy makers to re-conceptualize the issue of thermal comfort and responsive architectural design solutions during the production of contemporary housing by taking into account the local social values and climate. And a need for an immediate intervention is necessary. There is a loss in the sense of seasonal change, accompanied with drought winters and continuous heat waves in Jerusalem that leads to the consumption of energy resources all around the year. A proper ecological site and building proposal can be attained by designing with the climate, a valuable asset that allows for comprehensive design in harmony with the environment. The local climate including its positive and negative aspects, if considered properly, would allow for the buildings to take good advantage. For instance, allowing sunlight penetration into the building by maximizing the number of openings facing the south, controlling their size and providing efficient shading

elements. More common spaces, such as the living rooms should take advantage of the conditions of the wind and sunlight direction and strength, and its direction and orientation should be accounted for. Making use of cooling breezes in hot summer to provide proper cross-ventilation and protection from colder winds in winter is essential. Thus, other functions (bathrooms, laundry, corridors, stairs and even bedrooms) that are scarcely used during the day can be more efficiently oriented to act as buffer zone to shield the common living areas from the heat of the afternoon sunlight. Also, the size of windows aligned according to each sunlight direction should be considered, allowing sunlight penetration when oriented towards the south, thus keeping minimal opening at the north, and west facing walls.

Whilst this study focuses and highlights on the attitude and responsibilities of policy and law makers towards climate change, there are parts in the same city that are in a worse situation and suffer further human-comfort and humanitarian concerns due to the complete absence of laws and regulations. The Shufat refugee camp and the Kufur Aqab area are examples in East Jerusalem (UNRWA, 2015). The hazardousness of these zones is growing with no control and further studies are needed to address the problems. Today many social problems are emerging on a daily basis that fills the news and the social media among Palestinian Jerusalemites such as problems over car parking, invasion of privacy between the residents and the neighbours, which results in the spread of crime.

Although the study does represent the problematic attitude in the new developments today, it does not dictate certain solutions to solve it. It is the responsibility of the architects and designers to seek solutions based on the trials and past experience of people. Through creating their own interpretations to the context and climate in a more responsive, sensitive and conscious manner that will be better placed “to mobilize maximum available resources for sustainable, human-rights based development” (Office of the High Commissioner Ohchr 2020).

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