🏆 *reviewed paper*

Urban Nexus: An Approach for Regenerative Urban Environments (Public Spaces Located in the Urban Fringe)

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1 ABSTRACT

The built environment is the main habitat for human beings, this makes it act as a driver for climate and biodiversity changes, with multiple potential opportunities for alteration and transition. Therefore, it may be essential for the built environment to go beyond ordinary actions not only to limit the negative impacts, but instead aim for benificial outcomes. Analysing and desigining the urban built environment from the perspective of ecosystems functions and services could help in creating cities where positive restoration of and integration with local ecosystems could be recognised. Urban regeneration could be useful in this regard as it is defined as a comprehensive integration of vision and action aimed at resolving the multi-faceted problems of urban areas in order to improve their quality of life. However, the rapid urbanisation - especially with the exploding urbanism of some cities - controlled sustainable development and carefully considered urban regeneration have not always been achieved. It is also argued that one of the strategies for successful urban regeneration is “High-Quality Architectural Design and Public Space as a Catalyst for a Better City”. At a more local perspective, new urban expansions in Egypt lack one of the relavant quality-of-life pillars. Public spaces are currently losing their role in the new communities located in the urban fringe of Cairo. In such context, new urban nucleii are expanding disregarding the necessity of collective public spaces (a continuum of public realm) due to the privatization, disconnection, and introversion. Thus, the aim of this research is to introduce the Urban Nexus, a new approach merging the contemporary trends and emerging theories to design sustainable urban development solutions. The nexus approach seeks to understand risks, engage decision-makers, and enable action with the aim of attaining knowledge integration, efficiency, synergy and ‘win-win’ solutions. This could be achieved through bridging/ integratng Ecosystem services preserved through Nature Based Solutions (NBS), Human Centred Design (HCD) and the Star Approach, in order to reform public spaces acting as a catalyst for the urban regeneration. Ultimately the study would contribute in improving the built environment and in providing a better quality of life in new urban expansions.

Keywords: Human Centered Design, Nature Based Solutions, Ecosystem Services, Urban Nexus, Quality of life

2 INTRODUCTION

2.1 Background

Urbanization is an inevitable phenomenon expanding worldwide, predominantly changing the land use on a large scale and encompasses essential land cover change, even if it is carefully planned (Wang et al., 2021). Around 68% of the world’s population will be living in urban regions by 2030 (Blanco, Pedersen Zari, Raskin, & Clergeau, 2021). The African urban population is undergoing the highest rate of urban growth in the world, at 3.3%, and most likely will double by 2050 (Julia & Andrey, 2013). The rapid or unplanned urbanization results in the risk of extreme social instability, risks to crucial infrastructure, potential water crises and the possibility for spread of diseases. If not well managed, rapid urbanisation could be a huge environmental and human health risk and a threat to sustainable cities by 2030 (Nhamo et al., 2021).

2.2 Problem Definition

Growing cities generate conflicts that need to be carefully negotiated and managed (Lehmann, 2019). In the past three decades, the Egyptian capital, Cairo, has experienced a significant boom in the urban expansions including building gated communities and new fringe cities, such as 6th of October and Sheikh zayed,

located in the west. Such trends have grown rapidly since 2010,which have made a lot of Egyptians eager to own a property in one of those well planned new cities and luxurious gated communities (Aboubakr et al., 2020). Recently, several studies discussed that those new expansions lack some of the main urban features that the old, dense and kind of informal fabrics have. Public spaces are considered one of any built environment pillars. It is the main context for social and economic activities that might happen in any community, leading to enhancing the sense of belonging. From Agora of the polis, and open marketplaces of Medieval cities to today's shopping malls, corporate plazas, atria and festival places, public spaces have been a prominent element affecting the design of cities for centuries (Naguib, Abdel-Salam, & Saadallah, 2020). However, cities are undergoing a rapid transformation of public spaces as a result of economic and cultural globalization, demographic transformations, marketing strategies, urban planning, design approaches, privatization and others (Haas & Olsson, 2014). This led to misunderstanding the concept of public spaces within the new urban expansions and communities especially in Egypt.

Figure 1: Examples for the privatized urban spaces located in Sheikh Zayed city, Cairo, Egypt (Researcher)

2.3 Public Spaces

Urban open spaces are one of the fundamental elements shaping cities, they play an important role in urban sustainability and human health (Kefale, Fetene, & Desta, 2023). Several planning researchers and pioneers like George Perkins Marsh, JohnWesley Powell, Patrick Guedes, Sir Ebenezer Howard, and Frederick Law Olmsted, have integrated urban spaces, ecosystems and their services in the process of urban design and planning since the 19th century (Blanco et al., 2021). According to (Lehmann, 2019), attractive public spaces that provide distinctive life experiences result in increasing the liveability of cities. Therefore, it could be debated that the improvement of public spaces is one of the major drivers for urban regeneration, leading to the promotion of social inclusion and creating more interesting and diverse cities (Jacobs, 1961). Urban regeneration is mainly concerned with the rejuvenation of deteriorated urban areas, through interventions such as rehabilitation of old districts, enhancement of living conditions in residential areas, revitalization of public spaces, and renovation of urban infrastructure (Abdo, Abdel-Salam, Ayad, & Taha, 2019). Consequently, the revitalization of public spaces is considered one of the main catalysts for creating regenerative urban environments according to Lehmann (2019) when he stated the ten main strategies of successful urban regeneration.

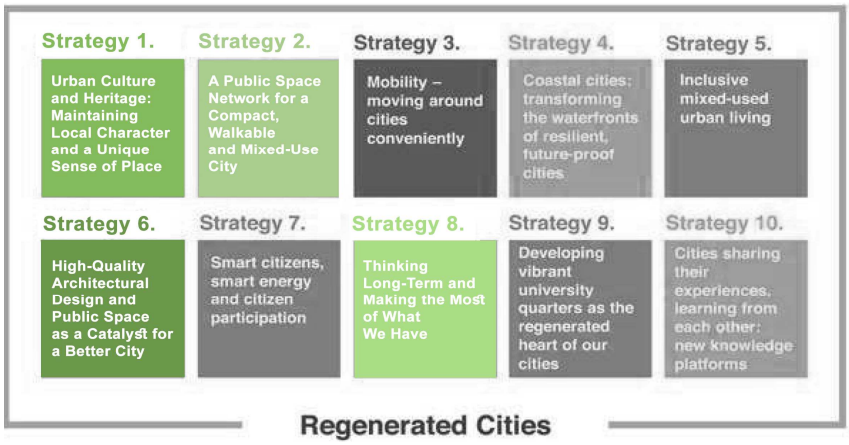

Figure 2: The 10 strategies for successful urban regeneration recommended by Lehmann (2019)

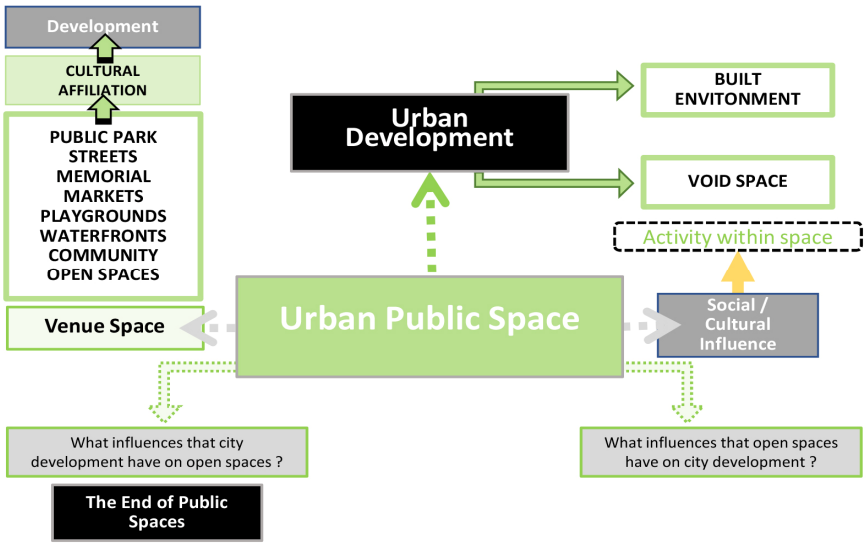

Figure 3: The relationship between urban public spaces and city's development, Adapted from (Ramlee, Omar, Yunus, & Samadi, 2015)

2.4 Urban Ecosystems

Urban ecosystems are cities, their surroundings, and social and ecological systems where citizens inhabit (Maes et al., 2016). They are the main container, including all other ecosystem types (forests, water bodies and agricultural areas) which are influenced by human activities. Urban ecosystems guarantee the provision of essential services for city dwellers (Ahern, Cilliers, & Niemelä, 2014). Those services could be objects, features and processes carried by ecosystems that secure the people's health and wellbeing (Pan, Page, Cong, Barthel, & Kalantari, 2021). It is highly debated that ecosystem services should integrate with urban planning (Ahern et al., 2014). Urban open spaces are fundamental providers of a wide range of ecosystem services in cities, consequently they are one of the main supporters of urban resilience and sustainability (Ibes, 2016). Therefore, Professionals, planners and designers need to take into consideration the preservation of those services through adopting innovative solutions and planning frameworks.

Figure 4:The services provided by the ecosystems classified to 3 main categories (https://www.euskadi.eus/)

2.5 The Urban Nexus Approach: A New Dimension

Although the new communities located in the Egyptian urban fringe are well designed aesthetically, they lack the presence of collective non-privatized open spaces that all people could use freely. The privatisation of public space is growing rapidly, the investment in the public domain is relying more on the private sector, which increases the challenges that cities face. Most of the - so called- public spaces are located within shopping malls like mall of Egypt and mall of Arabia, or business parks like Arkan Plaza and capital business park. Moreover, the lack of any sort of seating or shading elements forces the users to enter the restaurants and cafes. The only possible form of open green spaces could be found inside the luxurious gated communities. Therefore, it is time to benefit from the various urban design tools to achieve the best and most optimum solutions. Architects, urbanists, and urban design pioneers have been calling for the adoption of more integrated approaches, proclaiming that planning and design tools must be amplified as they are

ISBN 978-3-9504945-2-5. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, H. R. KAUFMANN – Ljubljana, Slovenia

considered the fundamental tools for effectively creating regenerative urban environments. Architects and urban designers play a crucial role in augmenting creative alternatives to the ordinary known forms of urban regeneration (Lehmann, 2019).

Attempting to find solutions in a certain field can cause a problem in another. This may be due to lack of proper analysis leading to negative impacts on policies and technological choices. Therefore, the nexus approach tends to understand risks, engage decision-makers, and enable action. It investigates the different pathways that lead to sustainable development and green growth (UN(ESCAP), 2016). A dominant interpretation of the nexus approach is that it stresses knowledge integration, efficiency, synergy and 'win-win' solutions (Nhamo & Ndlela, 2021).The key of the urban nexus is designing sustainable urban development solutions, in order to guide stakeholders with the aim of creating collaborations between different sectors, authorities, and technical domains. This is with an attempt to increase the performance of institutions and optimize resource management quality (Lehmann, 2018).

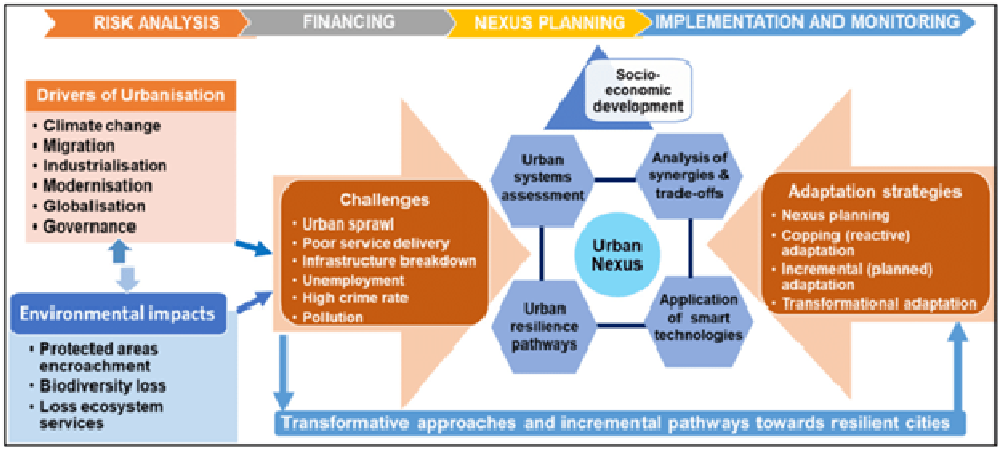

Figure 5 Key elements of urban nexus design, Lehmann (2018)

3 METHODOLOGY: INTEGRATING URBAN DESIGN TOOLS AND APPROACHES

In order to create regenerative environments, addressing the main isssues that cities undergo is more important than technological solution, while thinking of a comprehensive framework and adopting a reconstructive governance to guide the process, with appropriate indicators to monitor the progress and implementation (Lehmann, 2019).

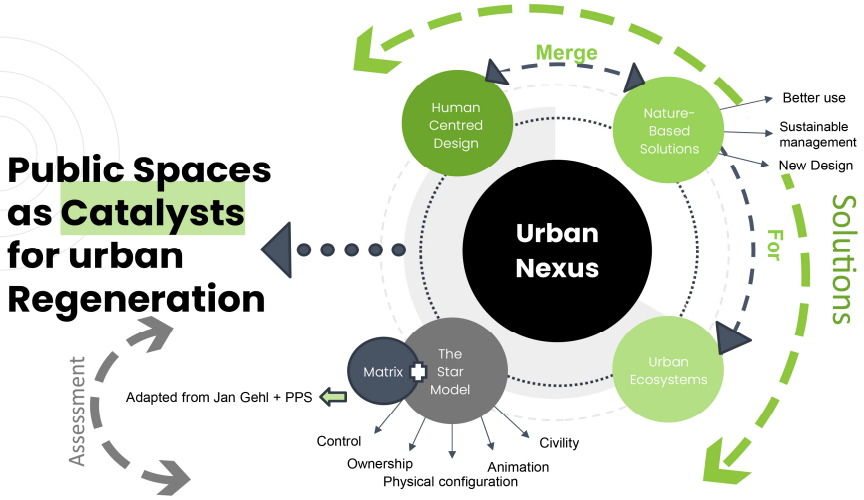

Figure 6: The proposed research hypothesis (researcher)

3.1 The Star Model

George Varna created a diagnostic model that uses simple and measurable tools to evaluate the liveability of public open spaces. It could easily be used by professionals either planners or academians as well as regular people with no experience in urban design. The model emphasizes the attributes related to the publicness of urban open spaces concerning their liveability. Five main dimensions form the star model (Meta-themes):

ownership, control, physical configuration, animation and civility. Those five themes incubate 19 indicators as shown in Table (1). Each indicator is evaluated on a measuring scale of, where 1 is the lowest and 5 is the highest.

The Star model quantifies the quality of open spaces on 3 main levels as described by Aboubakr et al. (2020) as follow:

(1) For comparative purposes: measures the degree of liveability of public places compared to each other; (2) For producing analytic and normative/perceptual stars: a more objective measure of liveability to be compared to the sense of liveability held by specific social groups and individuals; (3) For further expectations: serves as a point for future assessments of certain spaces.

Although the star model offers definite indicators, the model should be used with a certain degree of common sense, as some of the indicators should be evaluated by the researchers.

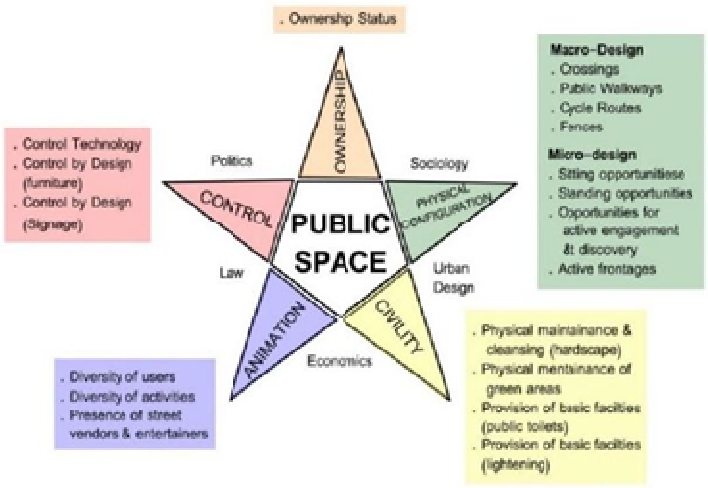

Figure 7: The Star Model (Aboubakr, Nasreldin, & Abdelfattah, 2020)

Theme's indicators	5 High	4	3	2	1 Low
Owner-ship status	Public authority elected democratically	Governmental authority or public organization	Public-private partnership or joint venture	Administration	One or more private entity
CO1: Control technology: CCTV cameras	No cameras	Few (hard to see and cover less than half space)	Few (easily seen and cover less than half space)	Many cameras (hard to see and cover more than half the space)	Many cameras (easily seen and cover more than half the space)
CO2:By design: Sadistic Street Furniture	No cameras	Present of one element (in one or two places)	1 to 2 elements (in less than half the space)	1 to 2 elements (in more than half the space)	More than 3 elements in the entire space
CO3: Control by design: Signage	No cameras	1 or more sign preventing 1 behavior	1 or more sign preventing2 behaviors	1 or more sign preventing 3 behaviors	1 or more sign preventing more than 3 behaviors
PC1:Macro Crossings	Present in all directions	Present in 3 directions	Present in 2 directions	Present in one direction	None
PC2:Macro Public walkways	Connected on all directions	Connected in 3 directions	Connected in 2 directions	Connected on one direction	None
PC3: Macro cycle routes	Connected by cycle routes in all directions	Connected by cycle routes in tree directions	Connected by cycle routes in two directions	Connected by cycle routes in one direction	Not connected by cycle routes in any direction
PC4: Macro fences	None	All around but lower than the average person or high but see through points in all directions	All around but lower than the average person or high but see through points in tree directions	High opaque fences surrounding the place with viewpoints in 3 or four directions	High opaque fences surrounding the place with viewpoints in one or two directions
PC5: Micro Sitting Opportunities	More than 2 comfortable sitting opportunities present along the edges	Presences of benches and other sitting opportunities along the edges (but not comfortable)	Presence of comfortable sitting opportunities in one or two areas of the place	Presence of non-comfortable sitting opportunities in one or two areas of the place	None

Theme's indicators	5 High	4	3	2	1 Low
Micro Design Walking Opportunities	Even and easily walkable along the entire space	More than 75% of the space has even and easily walkable surfaces	From 50% to 75% of the space has even and easily walkable surfaces	From 25% to 50% of the space has even and easily walkable surfaces	Less than 25% of the space has even and easily walkable surfaces
PC7:Micro Design Active engagement	Presence of more than 3 different elements	Presence of three different elements	Presence of two different elements	Presence of one element	None
PC8:Micro Design Active Frontage	Depth of building surface and several details in façade	Some depth in building surface and several details in facades	Little depth in building surface and few details in facades	Flat building surfaces, facades with few details	Facades with no details, and flat surfaces
Maintenance and Cleansing	Clean and well maintained nothing broken	Generally clean (slight signs o' wear)	Less than 50% of the place is dirty and untidy	From 50% to 75% of the place is dirty and untidy	More than 75% of the place is dirty and untidy
Green Areas	Tidy – trimmed	Tidy (signs of wear)	Deteriorated (broken – unhealthy)	Deteriorated (overgrown– untidy)	None
Toilets	Free access-well maintained – easy to find	Free access not well maintained easy to find	Free access well maintained hard to find	Not well maintained hard to find or paid access	None
Lighting	All site well lit	More than 75% of the place well lit (1 to 2 dark areas)	About half the space well lit (several dark areas)	About 25% of the place well lit (generally dark)	Only 1 to 2 lights in the place (generally dark)
A1: Diversity of users	Diverse users all over the place all the time				1 to 2 types of users
A2: Diversity of activities	Diverse activities all the time				Only 1 kind of activities
A3: Presence of street vendors	Present all over the place all the time	Present 4 to 6 times/year all over the place	Present 2-to 4 times in certain areas	Present 1 to 2 times a year in certain areas	None

Table 1: Calculating te 19 indicators of the star model (Aboubakr et al., 2020)

3.2 The Public Space Qualities

Since it was mentioned in the previous section 3.1 that the star model has some weaknesses whereby it neglects the fact that each public place has its own identity, consequently the model should be used with a fraction of common sense. A primary matrix was created based on the studies of Jan Gehl concerning the studying of public life, Mathew Carmona's listing of public spaces qualities, the place diagram developed by

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the Project for Public Spaces (PPS) and the 19 indicators measured by the star model, to act as an aiding tool for assessing the quality of public spaces.

Table 2: The 12 quality criteria for good public space by Jan Gehl, adapted from (Dietrich & Kengyel, 2016)

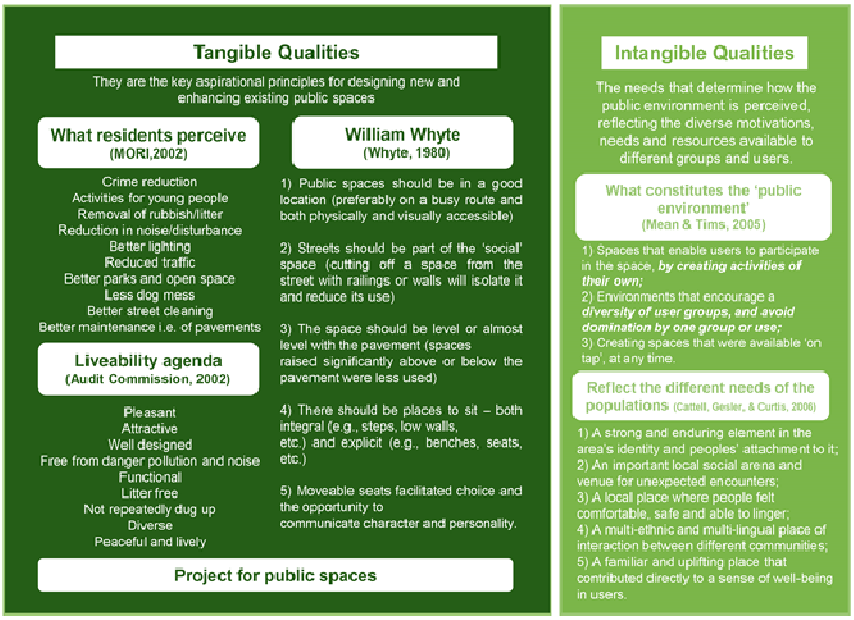

Table 3: The Tangible and Intangible qualities of public spaces reviewed by Matthew Carmona (Audit Commission, 2002; Carmona, De Magalhaes, & Hammond, 2008; Cattell, Gesler, & Curtis, 2006; Mean & Tims, 2005; Mori, 2002; Whyte, 1980)

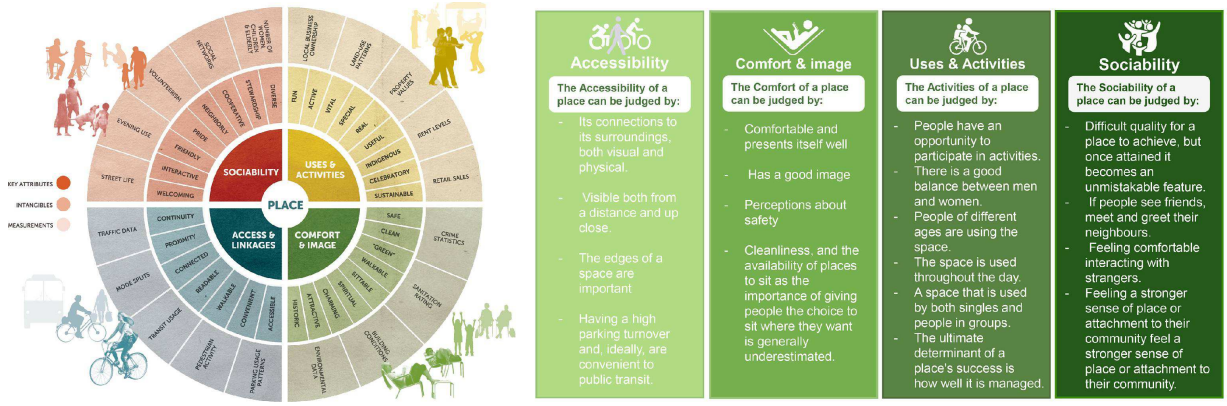

Figure 8 : What makes places succeed, adapted from (PPS, 2000)

The unstable climate variations in the 21st century put pressure on the place diagram as it does not contain a clear perception or solutions for the climatic conditions in terms of comfort. Several authors such as Marcus & Francis (1997) and Whyte (1980) stated the importance of sunlight and temperature and considering reduction strategies in case of overexposure. Also, the airflow was highlighted in studies by Jan Gehl and

William Whyte due to its role in decreasing the distressing climatic conditions (Gehl, 2011; Whyte, 1980). Consequently, when evaluating the "Place Diagram," based on the currently existing public spaces as examples, several questions arise concerning the delay in the improvement of adaptation efforts in terms of urban design and climatology (Santos Nouri & Costa, 2017). The following Figure (9) illustrates the necessity for including the expected climate change consequences. Therefore, the place diagram by Santos, Nouri and Costa was enriched with new qualitative and quantitative features shown in Figure (10) in order to question the pedestrian comfort. This is achieved by examining several theories aiming to integrate the measurable data and intangible elements of the outdoor thermal environments with the design of the public open spaces to make it climatically responsive.

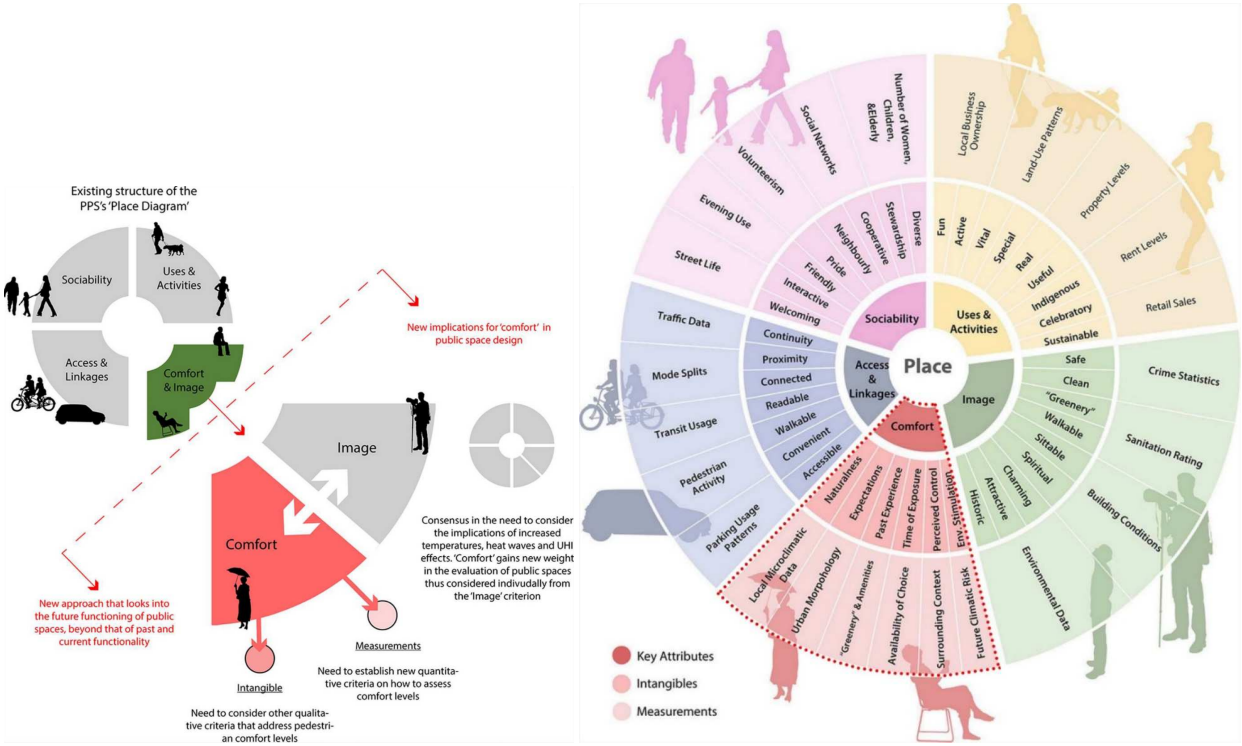

Figure 9 (left): Extending the "Place Diagram" to consider new implications on pedestrian comfort in the light of climate change (Santos Nouri & Costa, 2017). Figure 10 (right): Restructured Place Diagram by Santos Nouri & Costa (2017), the original adapted from (PPS, 2000)

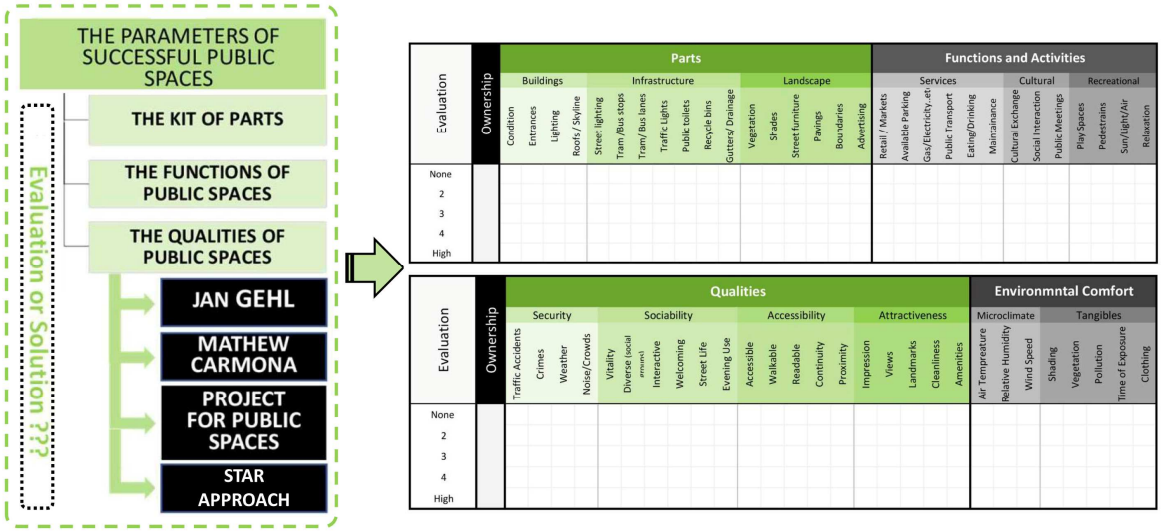

Figure 11: The initial proposed matrix for public spaces qualities (Researcher)

3.3 The Proposed Matrix for Public Spaces Assessment

The following matrix shown in figure (11) gathered the common qualities between the previously mentioned pioneers' theories and approaches shown in Tables (1), (2) ,(3) and figures (7) and (8). The matrix gathered

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the common qualities between Jan Gehl, Mathew Carmona and the Project for public spaces. Also from the restructured place diagram illustrated in Figure (4 - 6) which focused on the comfort parameter. The Matrix can be used as a generic tool in assessing the quality of public space design in further studies.

The matrix was tested on two urban spaces located in the western expansion of Cairo. Americana Plaza is a public space located in district two in Sheikh Zayed city. This space accommodates several economic and social uses including shops, restaurants, cafes, cinema, and an indoor kids playing area. It represents a magnet for a wide range of social groups of Sheikh Zayed residents, along with users from all over Cairo (Aboubakr et al., 2020). The second space is the Capital business park located on the 26th of July corridor and owned by the Al-Durra group. This park allows people to escape the crowds of the capital cities (Atwa, Ibrahim, Saleh, & Murata, 2019). It provides employees with safe workspaces in the form of designed green areas surrounding the buildings in the morning, while, besides the morning it is open to the public at night. It accomodates several uses including shops, cafes, restaurants, seasonal kiosks, kids area and a medical centre.

Figure 12: The selected two open spaces in Sheikh Zayed city for evaluation (Researcher)

3.3.1 Capital Business Park

The assessment and real life observations showed more information and differences in the characteristics of the two spaces. For example, being privately owned lowered the results of Capital Business Park in many dimensions. The user of space has to pass several gates and check points at the entrance. Also, it lacked any public furnishing and shadings, which forces the pedestrians to enter the restaurants and cafes. This is a huge reason to downgrade the space's assessment, in addition to the poor vegetation and shading, although the place is well designed and maintained.

Figure 13: Capital Business Park (Source: Researcher)

3.3.2 Americana Plaza

Americana Plaza received higher results due to the presence of clean, free access, and easy to find toilets. However, the physical configuration was less pleasant than Capital Business park and that is why it received slightly lower results. At Americana Plaza the other restriction is not present as it is not located in a privately owned entity, and users pass through the entrance check point easily and find several public amenities with no obligations.

Figure 14: Americana Plaza (Source: Researcher)

Evaluation	Open space	Ownership	Parts														Functions and Activities											
			Buildings				Infrastructure							Landscape					Services						Cultural			Recreational			
			Condition	Entrances	Lighting	Roofs / Skyline	Street lighting	Tram /Bus stops	Tram/ Bus lanes	Traffic Lights	Public toilets	Recycle bins	Gutters/ Drainage	Vegetation	Shades	Street furniture	Pavings	Boundaries	Advertising	Retail / Markets	Available Parking	Gas/Electricity..etc	Public Transport	Eating/Drinking	Maintainance	Cultural Exchange	Social Interaction	Public Meetings	Play Spaces	Pedestrains	Sun/Light/Air	Relaxation
None	Capital Business Park							√																						
2										√						√									√		√			
3									√				√	√	√				√											√
4					√	√	√										√					√				√		√			
High		√	√	√							√	√						√	√		√	√							√	√	
None	Americana Plaza							√																						
2														√																
3		√		√					√				√		√			√										√			√
4			√		√	√	√			√	√					√	√	√			√	√		√	√		√		√	√	
High											√	√							√				√			√					

Table 4: Matrix adapted to evaluate the parts, functions and activities in each of the two spaces, continued in Table (5)

Evaluation	Open space	Ownership	Qualities																	Environmntal Comfort							
			Security				Sociability						Accessibility					Attractiveness					Microclimate			Tangibles				
			Traffic Accidents	Crimes	Weather	Noise/Crowds	Vitality	Diverse (social groups)	Interactive	Welcoming	Street Life	Evening Use	Accessible	Walkable	Readable	Continuity	Proximity	Impression	Views	Landmarks	Cleanliness	Amenities	Air Tempreature	Relative Humidity	Wind Speed	Shading	Vegetation	Pollution	Time of Exposure	Clothing
None	Capital Business Park		√	√																							√		
2						√		√																√		√	√			
3					√					√			√				√						√		√					√
4							√		√		√			√	√	√												√		
High		√										√						√	√	√	√	√								
None	Americana Plaza			√																										
2			√																					√		√	√	√		
3		√			√											√	√						√		√					√
4						√	√	√	√	√	√			√	√			√	√	√	√	√						√		
High												√	√																	

Table 5: Matrix adapted to evaluate the qualities and evironmental comfort in each of the two spaces (Source: Researcher)

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4 POSSIBLE SOULUTIONS AND INTERVENTIONS

4.1 Nature-Based Solutions

Nature-based solutions (NBS) is a concept that emerged attempting to integrate ecosystem-based approaches in order to achieve sustainable development goals. They are also considered as the optimum solution for preserving the ecosystems and its services (Balzan, Zulian, Maes, & Borg, 2021). Since 2010, the strong relation between NBS and mitigating the environmental challenges has been a crucial dimension in the urban regeneration mechanisms. It is preferable to apply NBS in urban design to secure the engagement in sustainable urban development. Therefore, urban planners and decision makers became more interested in exploring the evidence of the NBS potentials to cope with these challenges. In NBS, ecosystem services play vital roles in addressing urban challenges and with the potential of designing sustainable urban environments (Pan et al., 2021).

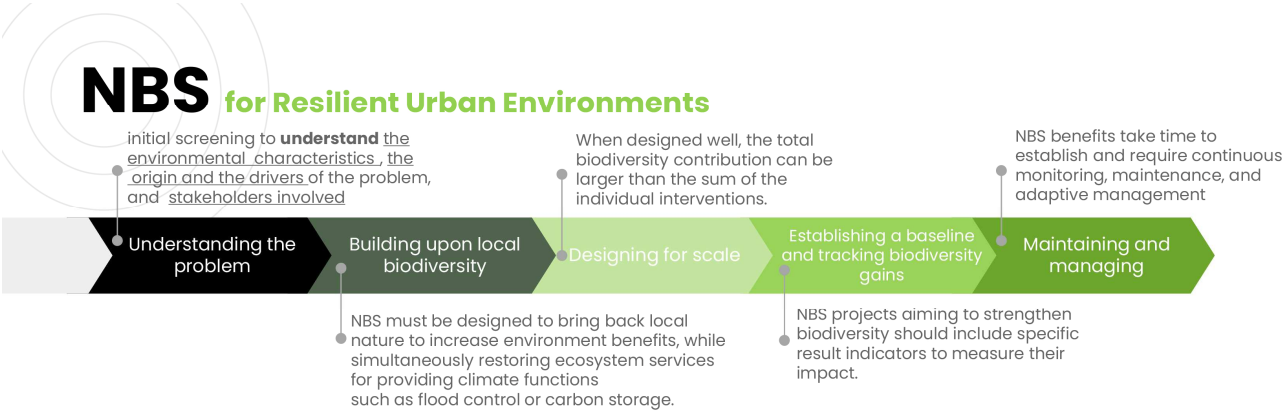

Figure 15: Steps for NBS implementation to achieve resilient urban environments (World Bank Global NBS team)

According to the UN environment programme, NBS require an important change of approach in the decision-making process at the institutional and planning level, which is summarized in three main aspects shown in figure (16). The third aspect emphasizes the importance of citizens participation which is one of the Human-Centred design approach main characteristics.

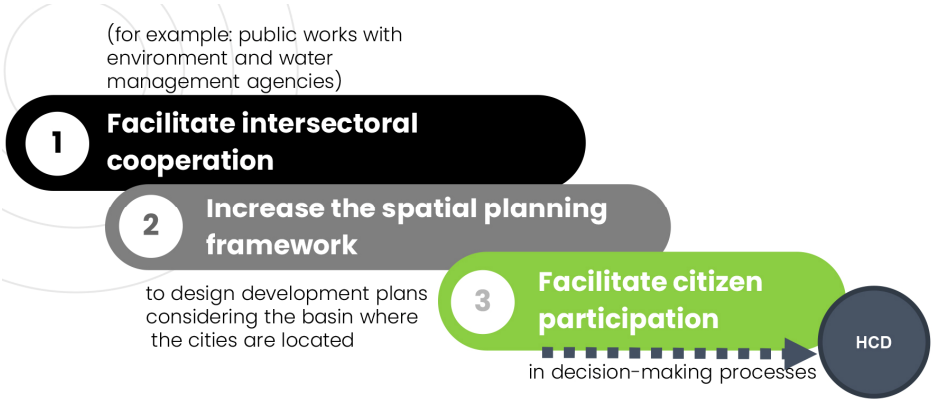

Figure 16: The aspects of change in NBS' approach in decision making (UNEP,2001)

4.1.1 Human-Centred Design (HCD)

According to the previous figure (16), HCD is one of the NBS pillars. Creating effective and sustainable products or services in developing communities, urges designers to understand the social factors, cultural context, and needs of their intended users (Donaldson, 2009). However, understanding user needs can be challenging when designers come from different cultural and socio-economic backgrounds than their targeted users. Design Thinking or Human-Centred Design (HCD) methods provide a wide range of tools that guarantee the participation of the potential users in the design process while taking into consideration their needs and generating solutions (Brown, 2008; Magidsohn, 2019). Human-centred design is an approach that begins with the end-user of a product. It has a different methodology from the commonly used ones, where the products were made first then tested by the users after being created. What is unique about this modern design process is that it analyses the experience of the end-use, assuming that understanding the

roots of the problem enables the designers to come up with the most suitable user-friendly solutions (Magidsohn, 2019).

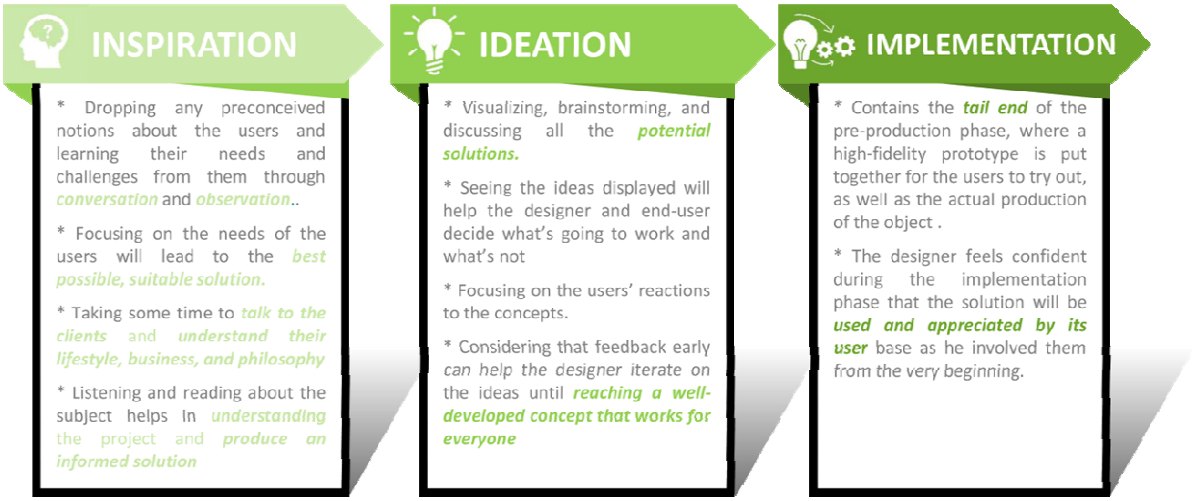

Figure 17: The simplified process of HCD (Keating, 2017)

5 CONCLUSION

A wide spectrum of underused, or misused spaces with different scales are distributed through the urban fabric of cities. They require a communal perception to coinjointy understand their diverse locations and practices. Several criteria and evaluations could be carried out to enable further amplification and deep analysis of the characteristics of these spaces, such as the background of their formation, their scale and shape, the surrounding context, the influence of urban planning on them, and their ownership.

Therefore, based on the study carried-out it could be argued that it has directed the attention to the complexity of parameters affecting the design of public spaces. The physical parameters have been considered through a quantitative integrated approach. An evaluation matrix was designed to assess the missing qualities and physical elements in each space. Also, the matrix could be used in further experiments studying other spaces. In addition, some transformative approaches like the preservation of ecosystems services through Nature-based solutions and the Human-centred design approach were discussed. They are all linked through nexus planning, providing solutions to transform urban areas into resilient and sustainable cities of the future. The majority of future urban developments and their imminent potential would depend on reusing the existing land and urban voids to create regenerative urban environments. This paper presents some of the accumulated key studies on urban spaces that could contribute to the provision of an integrated and comprehensive understanding for professionals and decision makers. It also proposes possible solutions that can be implemented by planners, designers, and urban policy makers in order to create regenerative urban environments leading to ecologically sustainable, economic and social development. Moreover, it visualises alternative urban scenarios, forecasts future demand and simulates the benefits of various density types to better inform policies and decision makers, by reconsidering new urban communities in terms of overall quality of urban life.

The introduction of the urban nexus approach in terms of urban design and planning could positively aid the urban regeneration process as it understands risks, engages decision-makers, and enables action. It also asks what are the different pathways that lead to resource security, sustainable development, and green growth.

6 RECOMMENDATIONS

It is highly recommended that the ownership of – the so called – public spaces in new urban expansions should be reviewed carefully, as they lack the main feature characterizing them which is "publicness " itself. Serving a specific social group does not properly aid the development process as such a community has to be homogeous. Also, urban spaces should not only be judged according to the fancy designs and facilities, but also taking into account the quality of services it provides is a must. For that reason the study adopted several asessment tools and approaches to cover all the possible aspects and details shaping the open public spaces.

ISBN 978-3-9504945-2-5. Editors: M. SCHRENK, V. V: POPOVICH, P. ZEILE, P. ELISEI, C.BEYER, J. RYSER, H. R. KAUFMANN – Ljubljana, Slovenia

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