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Analyzing the Biophilic Paradigm in Urbanism, Based on Content Analysis Technique

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Abstract

The lived experience of million years of human beings has been originated and evolved in nature. The connection between man and nature plays a fundamental role to respond his physical and mental needs. The increasing manifestations of industry and technology, simultaneously lifestyle changes in the contemporary era, have led to rise dissociation of urban environments from nature. Accordingly, numerous problems, such as; loss of biological species, deforestation, global warming, traffic, air pollution, etc., appear in the present cities. Consequently, Human beings; as the main stakeholders of urban spaces, have been suffered from various physical and mental problems, such as; movement disorders, hypertension, diabetes, alienation to the environment, neurological diseases, depression, anger, etc. due to the nature receding processes. Therefore, it is more necessary to address the approach, through human-nature reconnection by creation, revive and restoration nature aspects in urban spaces. In this regard, the research problem raised from the main question: What are the issues of Biophilic paradigm in urban planning and design? This research is based on the content analysis for systematic review (PRISMA).Accordingly, articles with keywords selected and screened from comprehensive scientific databases and the selected final articles were analyzed in-depth, to extract and define while expressing the Biophilic concept of urban planning and design, its dimensions, components and criteria. Biophilic urban development is a comprehensive approach; principally deals with the interaction of functional, structural and meaning dimensions, embodied environmental, sociocultural, economic, institutional , city spatial and time duration scales, simultaneously sensory design components and the embodied natural features. Consequently, enriched accessible natural urban spaces can directed to people wellbeing and their responsibility toward the natural values of the environment.

Keywords: Biophilic Urbanism; Human-Nature Connection; Urban Spatial Scales; Nature Pyramid; Content Analysis Technique.

1. Introduction

The city is a context where human life is made and affected by various environmental, cultural, social, economic and institutional aspects. The inharmonious expansion of contemporary cities has disrupted the balance between nature and city. The diminishing nature in the city has led to decrease in the quality of the environment, hence the human being, as the main user of urban spaces, has faced numerous physical and mental disadvantages. Therefore, it seems necessary to change the trend to achieve a healthy and sustainable life which is the present century prospect. The role of nature in cities, while impressive on the climate change adaptability and biodiversity, is important to improve urban spatial quality and consequently the sense of satisfaction and desirability of citizens' lives.

Enriching the city with nature, as an inclusive movement, is responsive to many issues in contemporary cities(Beatley,2016).Direct and indirect experience of nature in the built environment leads to a sense of life in citizens(Kellert,2018).Preservation of urban lands and its allocation to open spaces, green spaces and gardens is aligned with increasing environmental behaviors and trends among residents(Totaforty,2020). Biophilic urbanism is an ecological approach based on local characteristics that creates meaningful experiences of nature for people and promotes the individual and public well-being and health (Reeve,2015,Browning,2014).This approach has an irrefrangible relevance with the eco psychological strategies and has a significant effect on the revival and restoration of human-environment relation (Geakwad,2022). Biophilic urbanism experiences in different countries have revealed its potential environmental, cultural, social and economic potentials as a successful method for urban sustainability and resilient (Newman & Beatley,2013).

In this regard, the research problem was raised with the main question: How can biophilic urbanism responses to the challenges posed by the diminishing of human-nature connection in contemporary cities? In order to the topic, identifying the biophilic concept and its capacities in urban design and planning seems necessary. Therefore,

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the concept of biophilic in the urban planning literature is analyzed, while the existing definitions will be examined in terms of what dimensions and features are involved in the biophilic urbanism paradigm.

2. Materials and Methodology

This study is qualitative, through the chain logic of inductive approach. In terms of levels of analysis, it is interpretative. The selected strategy in this study based on Systematic Review through the Content Analysis Technique. To achieve the goals of the study , the PRISMA structured methodology, Preferred Reporting Items for Systematic Reviews and Meta-Analyses, has been used. Thus, there are five steps as shown in the figure 1, includes; identifying, selecting, evaluating, and synthesizing the data collect related to this study process relies on bibliometric analysis, systematic review, meta-analysis, and data-driven storytelling methodologies to conduct the research.

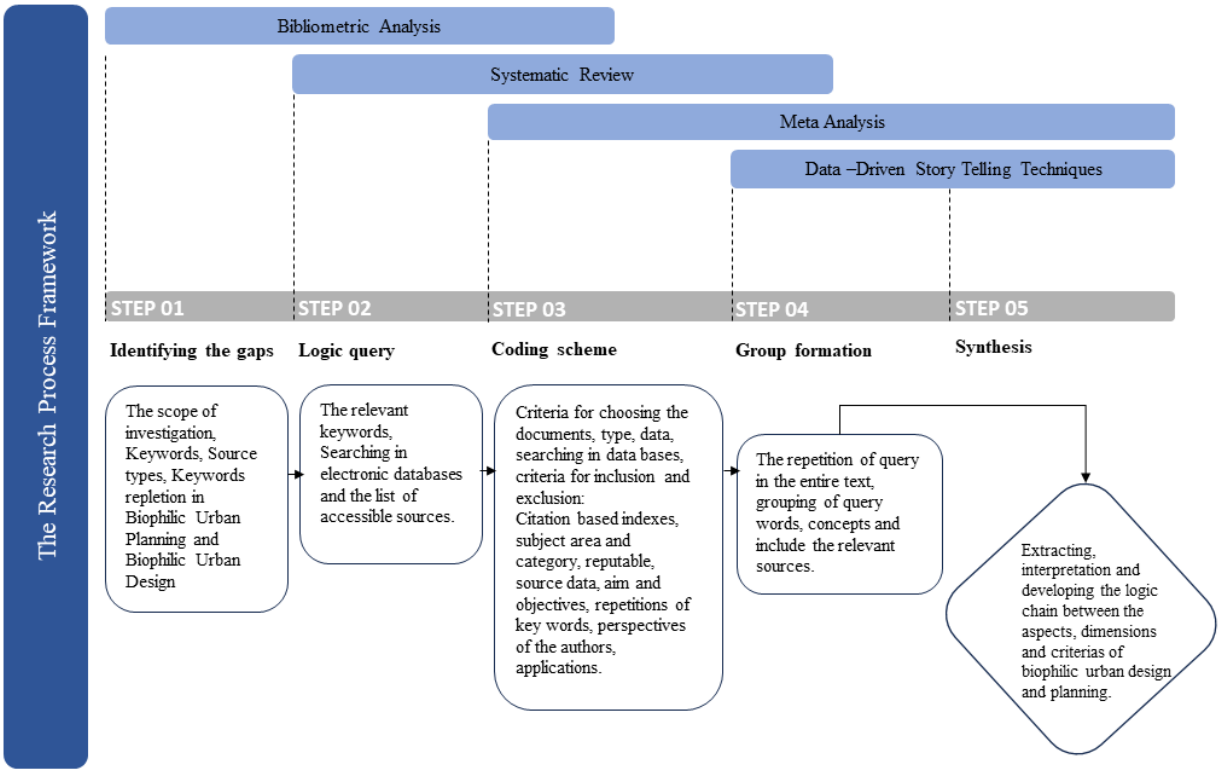

Fig. 1. Methodology framework of the study.

This study reviews the recent literature in the field of Biophilic urbanism according to preferential guidelines for systematic review and meta-analysis (PRISMA).This method consists of four steps: 1) searching based on online databases, 2) screening process, 3) access to selected articles, 4) summing up related articles. In the first step, to obtain relevant articles, four comprehensive databases such as; Google Scholar, Science Direct, Scopus and Web of Science were used. Thus, the keywords; "Biophilic Urban" AND "Biophilic Urban Planning" AND "Biophilic Urbanism" AND "Biophilic Urban Design" AND "Biophilic City" in the title and keyword section of the articles of mentioned scientific databases were searched.In addition to articles identified through database search, Google's search engine was used as a source of definition of specific terms related to this topic, as well as access to organizations working on the subject. Since this paper purpose is to discuss the analysis of biophilic in urban planning, meanwhile, to investigate more closely, studies in the field of biophilic urbanism (considering their data in line with this study) were added to this study. Hence, gray literature related to this study was used as another source of information including actions, conferences, reports, websites and policy documents. Terminology (biophiliccities.org, Activating Biophilic Cities, Connecting nature.eu) and (Biophilic Urban Planning, Biophilic Urban Design, Biophilic Urban Planning, and Biophilic City) were used as keywords that resulted in finding 483 articles. In the second stage and the screening phase of the articles, in order to identify a manageable subset of these articles, among the obtained results, the most relevant articles containing the word "biophilic city" and its derivatives, 235 articles were selected in English published between 2008 (starting the idea of biophilic in urbanism) to 2022.A wide range of information indicates the definition and characteristics of this term. In other words, the characteristics of biophilic city should be identified in order to achieve a precise definition of biophilic urbanism, its dimensions and components as a new concept that can be expanded and explained in the city spatial scales. Through reviewing the term biophilic urbanism, a wide range of its features identified with the general aim of achieving the concept of biophilics in urban planning and design. Furthermore,

resources which classified in the subject areas other the ones studied, are excluded from the research. Afterward, obtaining the full file of the articles, by reading the keywords, summaries and conclusions of each article and scanning its contents accomplished, the process continued to ensure whether they were related to the proposed study.81 articles, despite their titles including the vocabulary of this research, were excluded from the reference list due to lack of consistency in terms of content with other articles considered in this study and belonging to other sciences. Finally, 53 articles in the field of biophilic and urbanism as case samples of this research were analyzed by meta-analysis method. In the last step, to categorize the contents, in each article, the following items were analyzed: A) whether the substance of biophilic urbanism in the article has been investigated? B) Which features, elements and components are discussed? C) Are the spatial scales of biophilic urbanism mentioned in the paper? D) Have biophilic urbanism potentials been discussed in this article? In this study, 53 sources were mentioned. Figure 2 shows the systematic process of selecting the studied papers.

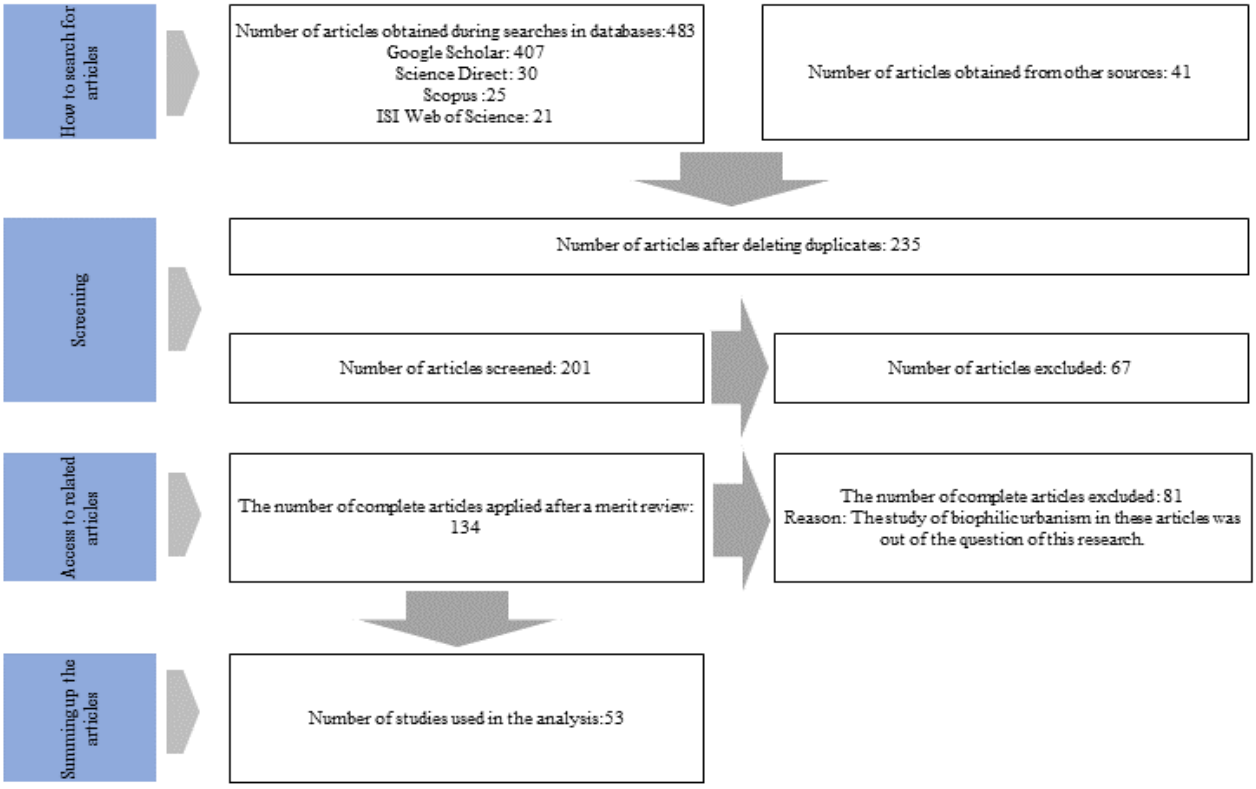

Fig. 2. The selection process and results based on PRISMA instructions . Source: Authors

3. Research History

Following the importance of human- nature bonding, the first research was conducted by German psychologist Eric Fromm in the 1960s.He used the term "biophilia", meaning, as; the inherent tendency of mankind to the phenomena of life (Fromme,1964).In 1984, Wilson introduced biophilia as the equivalent of human love for nature and its elements and addressed its significance in environmental psychology topics (Wilson,1984).Afterwards, in 1993, Wilson and Kellert wrote a book on biophilic theory and ethics approach to nature preservation, titled; "The Biophilia Hypothesis"(Kellert & Wilson,1993).The first article on biophilic approach in the built environment, was written by Kellert in 2008, in which he introduced and explained the dimensions, elements and approaches of biophilic design and the expansion of biophilia theory in manufactured spaces. In this regard, he refers in two types of direct and indirect experiences of nature, which are based on environmental facilities, natural forms and shapes, natural patterns and processes, fire, light, wind, place-spaces interactions and the evolutionary link between man and nature, correspondingly introduces the "Pyramid of Nature" based on human necessity of nature, in the time phases, include; daily, weekly, monthly and annually, integrated the built environment spatial scales enriched by nature elements and amenities(Kellert,2008).Following these researches, In 2011, Beatley wrote "Biophilic Cities: Integrating Nature into Urban Design and Planning", in which he addressed the importance of nature and its elements in the city in a technique of availability to all residents. He is the first theorist who introduced the biophilic approach into the discourse of contemporary urbanism and introduced it as an all-encompassing subject. He introduces the four

dimensions of biophilic urbanism and the characteristics of each one, meanwhile presenting the spatial scales of the city spaces relative to biophilic urbanism. Accordingly, suggests strategies for this approach (Beatley,2011).Recognizing the importance of biophilics in urban planning and design, Newman and Beatley wrote an article in 2013 describing its benefits, especially in the face of climate change, while introducing biophilic city as a sustainable and resilient city (Newman & Beatley,2013). In 2014, Newman researched Singapore as a successful city of implementing the biophilic approach in urban planning (Newman,2014).In the same year, Browning et al. expanded the idea of biophilic in the built environment, meanwhile considered its applications as a step towards the individual and public health and well-being. They also introduced the biophilic elements in to three categories: nature in space, nature of space and simulation of nature and suggested components for each one (Browning, Ryan, Clancy,2014). In 2015, a research by Reeve et al. signs the importance and advantages of biophilic urbanism for the residents of dense urban areas, such as; promoting physical and mental health while reducing psychologicaldisorders. They also noted; meaningful and direct experience to the nature have an effective while decisive role in environmental preferences of citizens (Reeve, Desha, Hargreaves et al,2015).The same year, Salingaros introduced biophilic design requires an understanding the logic of nature processes. Hence, he pointed out the prominence of visual and non-visual relationship with nature and its elements, meanwhile deliberated its implementation depends on the existence of nature elements, active and passive nature systems in urban and architecture spaces (Salingaros,2015).In a 2016 study, Littke considered the recognition of the biophilic approach in urban planning, to involve clarification and awareness of people through the policies of management institutions. She also emphasizes the requisiteness of using participatory perspectives in order to meet the people's needs, paying attention to the potentials of the city's ecosystem while regarding the indigenous scales (Littke,2016). In the same year, Kellert expanded his theory of nature experience and introduced biophilic design as an influential factor in strengthening the sense of place and belonging, lead to feel of integrated unified with it (Kellert,2016). Birkel and, in her research, considers biophilic urbanism as a positive development that leads to sustainability (Birkeland,2016).Desha and Baghdadi, In a 2017 study, described the biophilic urbanism in a way of ecological attitude and noticed the relationship between socio economic, cultural, environmental, urban management with the biophilic urbanism(Desha & Baghdadi,2017).while expanding his theory in 2018, Beatley, introduces biophilic urban planning as a global movement and cites its significance as an oath among urban designers and professionals (Beatley,2016).Following the researches in 2019, Xue considers biophilic urbanism as a method of city management and planning that work, life and entertainments are integrated in mixed uses, leading alight traffic transportation network, meanwhile progresses people's participation into the green spaces place making (Xue,2019).In a 2020 study, To tafortyperceives the biophilic urbanism as an approach to preserve urban lands and allocate them to green spaces, leading to improved sociocultural sustainability, hence spread of ecologist behavior among citizens (Totaforty,2020).In 2021, Taylor discusses the importance of visual aesthetic aspects of biophilic urbanism toward people's mental and psychological health (Taylor,2021). Panlasiguicites the biophilic urban planning equivalent to environmental justice, which leads to a wholesome ecosystem and human well-being through the pervasive nature network in the city (Panlasigui,2021).Lee and Kim mentioned the three dimensions of natural, technical and social biophilic urbanism, results in climate change adaptability, environmental preservation and restoration through biodiversity in urban environments (Lee & Kim,2021).Whilst the social and psychological aspects of biophilic urbanism becomes more substantial, Tirri, in his 2021 study, referred it as an intangible emotional value, which has been recognized through the blue and green infrastructures, especially urban green spaces, hence will be effective on increasing the positive emotion experiences among people. Meantime, the inevitability of thoughtful design, quality, variety, size and urban green space use, he mentioned (Tirri,2021). During his 2022 study, Geakwad; considered the biophilic approach into the field of place attachment and ecosystem aligned with Eco psychology. He states; in enriched nature environments, the human positive emotions are highly strengthened due to the human five senses activation. It also results whole nature experiences through the man innate tendencies to the life organisms, rather than the spaces in which simulated or virtual nature inspires just visual senses (Geakwad,2022).The Hung's research of 2022,represented the advantages of biophilic urbanism in order to the spiritual, emotional, mental and physical well-being of residents, accordingly introducing a variety of biophilic and scape.(Hung,2022).

4. Discussion

4.1. Biophilic urbanism

As mentioned, the concept of Biophilic urbanism (Biophilic urban design and planning),involved international attention by expanding research on the prominence of Biophilic approach and human-nature connection, through the publication of "Biophilic Cities, Integrating Nature into Urban Design and Planning " by Beatley, in 2011.The status of the urban concept of biophilic paradigm, as a new term in the urban literature, led some researchers to present studies in this field.

In 2011, Beatley brought the biophilic approach into contemporary urbanism discourse. He explained; the Biophilic cityis at its heart a biodiverse, multisensory, textured city abundant with nature, a place where in the normal course of work, play and life, residents feel, see, and experience rich nature, plants, trees and animals. In Biophilic city; nature is accessible in all times and places(anywhere, anytime).In order to attain the qualities

of Biophilic city; he brings forward the Biophilic Urbanism in four dimensions: Biophilic Conditions and Infrastructures, Biophilic Activities, Biophilic Attitudes and Knowledge and Biophilic Institutions and Governance, while offering indicators for each one. These key features based on the environmental, cultural, social, economic and institutional characteristics of each city. Beatley also considers biophilic urbanism as an effective strategy to promote man-environment relation. Consequently, he introduces the spatial scales of the city; Building, Block, Street, Community, Neighborhood, and Region(Beatley,2011,Beatley & Newman,2013,Reeve,2015,Tataforty,2020, Kim & Lee,2021).

Biophilic urbanism as an approach towards sustainable and resilient cities in which facing climate change, global warming, loss of biodiversity, reducing water resources and so on, can be answered by developing the usage of clean and steady energy, urban agriculture, indigenous materials and recycling, Beatley and Newman assumed (Newman & Beatley ,2013,Desha & Baghdadi,2017).Browning introduces the features of biophilic design: nature in space (visual and non-visual connection with nature, sensory stimuli, temperature, air, water, light, plants, animals, odors, natural systems), nature simulation (biomorphic forms and symbolic patterns, golden proportions, texture, color, natural materials, complexity and order) and the nature of space (landscape, shelter, mystery, fascination, risk/danger)(Browning,2014).

Salingarosdiscusses the creation of biophilic environments to recognize the logic of nature processes, in this regard, refers to biophilic systems, including passive systems, landscape and shelter, seduction and danger, order and complexity, meantime considers biophilic components as; air, water, light, plant, material and form. He also emphasized the importance of visual and non-visual connection with nature and its features in the built environment, through the creation of biophilic spaces, such as; green roofs, green walls, gardens and plant landscapes.(Salingaros,2015).

Reeve introduces the spatial scales of biophilic urbanism, as; building, street and city, meanwhile mention edits components, such as; green roof, green wall, building gardens and courtyards, rain gardens, pocket parks, green infrastructure, forestry and urban parks, strip green spaces, green belts, community gardens and urban agricultural farms.He also explained the benefits of biophilic urbanism, especially in dense urban environments, which promotes vitality and economic efficiency, while reduces physical and mental illnesses cost (Reeve,2015). Littke introduces Biophilic urbanism as a comprehensive approach in design and planning, accompanied by knowledge and cognition on urban nature, green spaces, urban structure, whilst focusing on the lifestyle, attitudes, and experiences of citizens. She considered the focal point of biophilic concept as the residents'sensory, intuitive and emotional connection with nature, technically integrated with sustainability, urban greening and local-scale policies, based on the city's ecosystem, residents' needs, institutions participatory and bottom-up insights (Littke,2016).

Birkel and considers the biophilic urban planning concept to be converged with positive development and sustainability. In her point of view, biophilic urbanism results in numerous psychological and physical advantages. This paradigm based on individual experiences of nature, becomes from the inherent human tendencies to life. On the other hand, Positive development based on the preservation of natural species and ecosystems, sub sequentlyre form of institutional organizations and physical structures, ultimately leading to ecological development, whilst improving the quality of life and social capital(Birkeland,2016). Dasha and Baghadadideliberate biophilic urbanism as an ecological approach through the relationship between socioeconomic, cultural, environmental and urban management states. Accordingly, they noticed its direct (e.g.trees shade, flood reduction, etc.) and indirect (e.g., treatment costs decrees, economic efficiency, etc.) benefits for citizens, which can be applied by the biophilic features, including; indoor plants, green roofs, green walls, green spaces around the buildings, streets with trees and vegetation, trees canopy, strip gardens, pocket parks and urban parks(Desha & Baghdadi,2017). Xue, elucidates the biophilic design, through biophilc dimensions and infrastructures (biophilic elements, biophilic management), sensory design (visual and non-visual connection with nature, airflow and thermal comfort), biophilic structures (forms and patterns, natural materials and colors).He assumes the concept of biophilic urbanism regarding to transportation facilities (public transportation, bicycle, path navigating), integration of work, life and entertainment spaces (shared spaces, management and maintenance facilities), green space place making (routine, specific programs) (Xue,2019). Totafortydeliberates biophilic city as a kind of sustainable city, in which, individuals environmental consciousness increases through direct and indirect experiences of nature, in small and large spatial scales of the city as well as inside and outside buildings, hence sociocultural sustainability, respect of nature, energy saving, tendency to organic products and positive values among citizens, strengthen. In biophilic city, the priority of urban planning is based on preserving the urban lands by allocating it to green spaces, gardens and parks, meanwhile noticing human needs and gauges, he states (Totaforty,2020).

Taylor, mentioned the importance of visual aspects and aesthetic perception of biophilic approach through the nature's patterns, forms and elements, subsequently introduced the psychological results of its application in built environments, particularly floors, walls and windows, results in reducing stress and mental fatigue, while improving concentration and efficiency of people's cognitive function (Taylor,2021). Panlasigu introduces Biophilic city as a biodiverse city in which, the ecosystem and people's well-being provided through local government, public participation, indigenous knowledge and prioritizing qualitative goals. Consequently, environmental justice will be fulfilled through the

measures, such as; vast nature grid in the city, natural resources assets conservation and extensive connection network between urban green spaces(Panlasigui,2021). Tirriexplicates the significance of the social and psychological aspects of biophilic urbanism and mentions it as an intangible emotional value complied through blue and green infrastructures, particularly urban green spaces. He points out the necessity of thoughtful design, quality, diversity, proportions and urban green spaces land use which promote socioeconomic efficiency, health and well-being among citizens (Tirri,2021).In their 2021 study, Lee & Kim deliberated the biophilic urban planning as an approach to response the climate change whilst categorized its strategies based on macro (region and city), me so (neighborhood and street) and micro(building) spatial scales, as well as the application methods of biophilic aspects, into; natural, technical and functional. they also introduced the profits of biophilic urbanism in three dimensions: emotional contact with nature, institutions and local government and economic efficiency, which eventually leads to emotional well-being, sustainability, ecosystem regeneration, energy demand reduction, social participation, biodiversity improvement and climate change adaptability (Lee & Kim,2021). Hung considers urban spaces with biophilic components to be full of life vibes in which people's spiritual, emotional, mental and physical health will be improved. He refers to four kinds of landscapes: cityscape, waterscape, meadows and tree landscapes (Hung,2022). Geakwad, contemplates the biophilic attitude aligned with place attachment and eco-psychology theories. Hence, the positive effects of enriched nature environments, stimulates the man five senses and let a perfect experience of nature, based on human innate tendency to life, performed, he signs (Geakwad,2022).

Accordingly to the Biophilic Urbanism approach, theorists have investigated their points of view through cities concerning human nature connections in design and planning successfully, such as; Singapore, Portland, Toronto, Chicago and Berlin.

4.2. Biophilic Urban Development Successful Experiences

-Singapore

Since 1965, Singapore has strived to become a "city within a garden." In that spirit, the city is working in many ways to integrate nature into denser, vertical urban environments, through a mix of regulations, subsidies and research and development. Green walls and rooftops, an urban trails network (known as "park connectors"), impressively restored urban waterways, and schoolyard gardens, are some of the ways Singapore is working to bring about its vision as a "city in a garden". the Park Connector Network (PCN) is an initiative to convert underutilized urban infrastructure like roads, canals, and railroads into recreational green spaces (Newman, 2014). Singapore's use of biophilic urban design via the Park Connector Network is an immensely important amenity that improves its citizens' quality of life, promoting fresh air, increased walkability, and a connection to the plant world. Biodiversity flourishes along the PCN, including 80 species of mammals, 395 species of birds, 110 species of reptiles, and 30 species of amphibians. Singapore's Park Connector Network demonstrates that urban planners can repurpose existing infrastructure to build healthy, biophilic spaces(Xue et al,2019).

-Portland

Portland, Oregon, frequently recognized as one of the world's successful biophilic practical experiences, through the most environmentally consciousness due to its high walkability, large community of bicyclists, farm-to-table dining, and over 4,000 hectares of public parks. It has an almost unfair abundance of natural beauty, including beautiful parks, leafy trees, vibrantly flowering shrubs lining quirky residential streets, the Willamette River meandering through town, and Mount Hood on the horizon(Beatley,2011,Beatley & Newman,2013).The city has designed and constructed over 2,000 green streets that are biophilic amenities performing the valuable role of controlling urban stromwater runoff. Community volunteers, known as Green Street Stewards, help to maintain the green infrastructure in neighborhoods across the city. Portland has spurred the installation of as many as 700 eco roofs in high density areas. It is one of the first cities to implement an Urban Growth Boundary, requiring increased density and compactness within the city while protecting farmland and natural areas outside of the boundary(Desha & Baghdadi,2017).

-Toronto

Toronto, Canada, has a high rich biodiversity which accomplished with the biophilic urban development strategies, such as; urban forestry and parks embodied about the half city area ,vast network of ravine systems includes 17 percent of the city area , resiliency specially to climate change adaptation, green transportation to set the long-term low-carbon goals and strategies to reduce local greenhouse gas emissions and improve citizens health, grow economy and improve sociocultural equity, community and volunteering to participatory in nature based activities, such as; tree planting, pollinator and birds protection, institutional activities, such as: guidelines and bylaws of conservatory and awareness of nature importance in public and private properties(Desha & Baghdadi,2017, Beatley,2013).

-Chicago

Chicago, followed the biophilic urbanism through the reclaiming unused industrial infrastructure and developing new urban public green spaces (Desha & Baghdadi,2017).remarkable projects, such as;2.7 mile, community-centric bike trail and park system, designed as a lush green playground, the trail acts as a community connector between the neighborhoods. It provides convenient and an uninterrupted commute through the city. The program includes a poplar grove, a shrub grove, a learning garden, a shade grove, a poetry garden, a picnic

lawn, hanging bridge gardens, a sumac tunnel, a spire garden, a pine grove, and what the designers call an "urban savannah." Integrated within the parks and trail, there is now space for skateboarding, a farmer's market, and live music. The elevation of the trail creates a separation between the city and the trail, bringing visitors to a more quiet space to appreciate the landscape around them (Beatley & Newman,2013).

- Berlin

Berlin, has pioneered the concept of Biotop Area Factor(BAF),is a program that requires 60 per cent of ecological area on applicable new residential structures, and 30 per cent on new commercial structures. With such programs and widespread support from the community approximately one third of Greater Berlin is natural habitat. farsighted plans and continuous cultural support of urban ecology, accompanied the city of Berlin through the ring of parks, allotments, extensive forests and agricultural areas in and around city proximity (UN Habitat,2012). Hence, biophilic elements such as green roofs and living walls have been supported by a complex collection ofpolitical requirements at multiple levels of government. With four levels of political pressure(International, European, National and local), the city of Berlin is fully committed to protecting the natural environment with the strong sensitivity amongst the citizens (Desha, Baghdadi et al,2017).

Table 1shows the attributes of successful practical experiences in cities through the Biophilic Urban Development.

Table 1
Practical attributes in successful cities through the Biophilic Urban Development.

City	Biophilic Urban Development Attributes
Singapore	Green commuter network and corridors, green public spaces,extensive streetscape and roadside greenery, green buildings, biodiversity conservations, botanical and horticultural gardens, aesthetic landscape, natural forms, institutional training for urban living green environment and landscapes, community participatory for promoting the green spaces in the city, sustainable strategies.
Portland	Walkability, bikeability, urban agriculture, public parks, conserving natural areas and farmlands of the city boundaries, green streets, eco roofs, managing storm waters and run off, vast tree canopy, green landscapes.
Toronto	Biodiversity, urban forestry, natural parklands, vast urban ravine network, bird friendly bylaws, vast tree canopy urban public spaces, city wide strategies to enhance and protect the natural elements and pollinators, community and volunteering for local ecology activities and outdoor learning destinations, resilient strategies toward the climate change, green transportation.
Chicago	reuse and revitalizing industrial infares into the urban public green spaces, bike trail, parks, picnic and recreational gardens, learning gardens, urban farms, green landscapes.
Berlin	widespread natural habitat, sociocultural support planning of urban ecology, urban forestry, parks, urban agriculture, green roofs, green walls, scales of political and government to enhance the biophilic goals, sensitive citizens to protect the natural environment.

Considering the expert thoughts of Biophilic urbanism paradigm in theory and practice, it is possible to achieve its essence and quiddity, viainvestigating the definitions and substantive contents presented in Table 2, the most imperative concerns presented in the expression of Biophilic concept in urban planning and design, are discussed.

Table 2
The most imperative important considerations presented in the expression of Biophilic urbanism concept. Source: Authors.

Theorist	Basic considerations
Kellert(2008)	Biophilic approach is a necessity in human-nature connection. It deals with environmental facilities, natural shapes and forms, natural patterns & processes, light, space&place,the evolutionary man -nature bonding and the pyramid of nature.
Beatley(2011)	The Biophilc city is abundant with nature. People experience a rich nature in all work, life and play spaces. He introduces city spatial scales (Building, Block, Street, neighborhood, Community and Region) and dimensions of biophilic city (Conditions and Infrastructures, Activities, Attitudes and Knowledge, Institutions and Governance)
Beatley &Newman(2013)	Biophilic city is a sustainable and resilient city which respondingthe climate change,throughrenewable energies, urban agriculture ,local materials and recycling.
Browning(2014)	Biophilic design is considered as the result of bioscience of human-nature connection and has positively evaluated its use in ensuring the individual and public health and well-being. The elements are; nature in space, nature of space and nature simulation.
Kellert &Calbrese(2015)	Biophilic design is an ecological mechanism that demands optimal accommodation for people in modern environments.Biophilic city advantagesincludes; contact with nature, proportion, health and well-being.

Salingaros(2015)	Biophilic design requires understanding of nature processes. Visual and non-visual connection with nature aspects is important toward creating biophilic spaces, such as; green roof, green wall, gardens and plant landscapes.
Reeve (2015)	Building, street and city are key spatial scales in biophilic urbanism, in which meaningful and direct experience of nature is effective in spatial preferences of individuals,hence effective in improving concentration, physical and mental health while increasing social interactions of citizens.
Kellert(2016)	Biophilic design is an approach based on direct and indirect experience of nature that strengthens the sense of commitment, trust, emotional bonding and place attachment in people.
Littke(2016)	Biophilic urbanism is a comprehensive approach in design and planning, associated with knowledge about nature and the city physics, green spaces, lifestyle, attitudes and experiences of citizens through their multisensory, intuitive and emotional relation with nature.
Birkland(2016)	Biophilic urbanism is corresponding to positive development, leads topromote; ecosystem, human life and social capital.
Beatley(2016)	Biophilic urban planning and design provide access to nature, at anywhere-anytime in all urban spaces. It should be conceived as a global movement among urban experts.
Baghdadi &Desha(2017)	Biophilic urbanism is considered as an ecological approach,meanwhile addresses the direct and indirect economic, social, cultural, environmental and urban management advantages of biophilic urban planning.
Xue(2019)	Biophilic urbanism is the city management, inwhichmixed use of work, life and entertainment spaces, light traffic ,green transportation network and people's participation in green spaces placemaking are impliedto make the sense of life through experiencingthe nature elements, hence the intimate relation of people with the place has been revealed. Biophilic infrastructure, sensorial design, green space place-making.
Totaforty(2020)	The Biophilic city considers as sustainable city, in which the human scales andneedsare the basic regards.Whilst the priority of urban planning is to preserve urban landuse to green spaces, parks and gardens,residents enjoy high quality of life, peace,physicalwell-beingand mental health.
Taylor(2021)	The importance of biophilic design is in visual, aesthetic experiences thou positive psychologicalissues, results in terms of nature patterns and forms, order and complexity of biophilic shapes, which impressive onreducing stress,meanwhile improving cognitive functions.
Tirri(2021)	The importance of biophilic urbanism is in its intangible emotional values, including urban green spaces in which thoughtful design, quality, diversity, size andland use are practicalto create positive feelings among citizens.
Panlasigui(2021)	Biophilic city is a city of environmental justice,fulfills a pervasivelinkage of; nature, naturalsettings and resources conservation and green network connections, through local government and public participation conclude the citizens welfare and well-being.
Lee &Kim(2021)	The Biophilic urbanism has Three spatial scales; macro (region, city), meso (neighborhood, street) micro (building).Likewise, three methods; natural, technical and functional.
Geakwad(2022)	Biophilic approach is aligned with the sense of place attachment and ecopsychology. Biophilc spaces areenriched with positiveemotionalunderstandings in which nature experience occurs through the human's five senses.
Hung(2022)	Biophilic urban spaces are full of life vibes whichpeople's spiritual, emotional, mental and physical health improves. There would be four landscapes categories;cityscape, waterscape, meadows and treescape.

5. Results

By reviewing the theories and definitions presented by Biophilic scholars, it is obvious that Biophilic Urbanism, as a new approach in the field of urban planning and design, includes various attributes. To obtain a comprehensive understanding toward the definition of the Biophilic urbanism concept, addressing the dimensions and characteristics with a holistic view seems necessary. As mentioned in the Table 2, each of the experts has examined the consideration of Biophilic urbanism paradigm from their point of view. Conversely, the common approaches and characteristics in all of these definitions are undeniable. Study of the literature and the practical experience of Biophilic urban development, shows that in each of the definitions presented, some aspects of Biophilic urbanism concept have been discussed. Consequently, relative definitions of biophilic urbanism can be achieved by analyzing the characteristics emphasized by theorists through categorizing basis on similarities according to the research objectives in the form of Table 3.Studying and classifying the proposed definitions on biophilic urbanism paradigm, indicates commonalities such as; emphasis on sustainable city, green city, nature elements, natural processes, spatial scales, green spaces, green infrastructure, climatic comfort& climate change ability, development of environmental, social, cultural, economic and institutional conditions, according to Table 2, some attributes are engaged Biophilic urban planning while others embodied by the Biophilic urban design.. Although there are common similarities in the definitions presented by experts, most of these lack a holistic view, while the biophilic urbanism approach as a new strategy includes

various aspects and dimensions require a deeper analysis and scrutiny in the form of an intertwined concept.in order to reach consensus toward the characteristics of biophilic city, the distribution of the noteworthy features, in the most important studies on biophilic urbanism has been investigated in the following Figure 3.Study on the distribution of characteristics used by different experts in expressing the concept of biophilic urban planning, shows that the most frequent use of these features, such as, environmental components, biodiversity, green city and social components are the most noticeable attributes in the studies and practical Biophilic Urban paradigm experiences, embraced with the Biophilic urban planning. Whilst, city spatial scales. Nature in space, urban forests, parks, gardens, green roofs, green walls, green yards are the most attribute of Biophilic Urban development, defined by the theatricians in theory and practice, which included the urban design strategies of Biophilic Urbanism.

Reviewing Table 4 and its summation shows that; concepts such as urban environment promotion, green city, sustainable and resilient city, empowering sociocultural and economic qualifications, green and blue infrastructures, integrated ecological network, city spatial scales, multisensory design, besides features, such as; nature elements (water, light, plant, animals, sounds, fragrances, texture, color, natural materials) natural processes (complexity, order, landscape, shelter, seduction, risk, peril) and natural patterns and forms are essential to identify and scrutinize the concept of biophilic in urban planning, addressed in most sources, obtained from the data analyzing of related scientific studies by deep tracing the most frequent keywords, concerns and noticeable matters in Biophilic Urban development paradigm in urban design and planning, in theory, hence through the practical experiences of successful Biophilic urban development which have been investigated and implicated by the experts.

Table 3
The most important attributes used in expressing the concept of Biophilic Urbanism, in the theorist's definitions.

Theorists	Attributes	Biophilic Urbanism
Beatley(2011),Beatley & Newman(2013),Browning(2014),Reeve(2015), Birkland(2016), Xue(2019), Hung(2021), Panlashigui(2021), Lee & Kim(2021).	**Sustainable & Resilient city**	Biophilic Urban Planning
Beatley(2011),Beatley & Newman(2013), Reeve(2015), Littke (2016), Birkland(2016),Desha & Baghdadi (2017),Xue(2019),Totaforty(2020),Taylor(2021), Tiri(2021),Panlashigui (2021),Geakwad, Lee & Kim(2021) ,(2022), Hung(2022)	**Green city**	
Birkland(2016)	**Positive development**	
Kellert(2008),Beatley(2011),Beatley & Newman(2013),Browning(2014),Reeve(2015),Salingaros (2015), Littke (2016), Birkland(2016),Desha & Baghdadi(2017),Xue(2019), Totaforty(2020), Taylor(2021), Tiri (2021),Panlashigui(2021), Lee & Kim(2021),Geakwad(2022),Hung(2022).	**Environmental components**	
Beatley(2011), Desha &Baghdadi(2017),Littke(2016), Birkland(2016), Xue(2019),Totaforty(2020), Taylor(2021), Tiri(2021),Panlashigui (2021),Lee & Kim(2021),Geakwad(2022),Hung(2022),	**Social components**	
Beatley(2011),Beatley & Newman(2013),Littke(2016), Birkland(2016), Desha &Baghdadi(2017),Totaforty(2020),Taylor(2021	**Cultural components**	
Beatley(2011),Beatley & Newman(2013),Reeve(2015),Xue(2019),Desha & Baghdadi(2017), Tiri(2021), ,Panlashigui(2021),Lee & Kim(2021)	**Economic components**	
Beatley(2011),Beatley & Newman(2013), Reeve(2015),Desha & Baghdadi(2017),Xue(2019),Lee & Kim(2021)	**Institutional components**	
Beatley(2011),Beatley & Newman(2013),Desha & Baghdadi (2017),Xue(2019),Lee & Kim(2021)	**Climate Comfort & Climate Change Adaptibility**	
Beatley(2010),Beatley & Newman(2013), Reeve(2015), Birkland(2016),Desha & Baghdadi(2017), Xue(2019) , Totaforty(2020),Lee & Kim(2021),Tirri((2021)	**Blue & Green Infrastructure**	
Beatley &Newman(2013),Xue(2019),Panlashigui(2021)	**Green transportation**	
Beatley(2011),Beatley & Newman(2013), Reeve(2015),Desha & Baghdadi(2017), Xue(2019),Lee & Kim(2021), Panlashigui(2021),	**Integrated Ecological Network**	
Kellert(2008),Beatley(2011),Beatley & Newman(2013),Browning(2014),Reeve(2015),Salingaros (2015), Littke (2016), Birkland(2016),Desha & Baghdadi(2017),Xue(2019), Totaforty(2020), Taylor(2021), Tiri (2021),Panlashigui(2021), Lee & Kim(2021),Geakwad(2022), Hung(2022).	**Biodiversity**	
Beatley &Newman(2013),Desha & Baghdadi(2017)	**Clean and Renewable Energies**	
Beatley &Newman(2013),Desha &Baghdadi(2017), Tiri (2021),	**Urban Agriculture**	
Kellert(2008),Beatley(2011),Beatley &Newman(2013),Browning(2014),Reeve(2015),	**City Spatial Quality**	Biop

Salingaros(2015),Littke (2016), Birkland(2016),Desha &Baghdadi(2017),Xue(2019),Totaforty(2020), Taylor(2021), Tiri (2021),Panlashigui(2021), Lee & Kim(2021),Geakwad (2022),Hung(2022)		
Kellert(2008),Beatley(2011), Browning(2014), Littke (2016), Birkland(2016),Xue(2019),Tataforty(2020), Lee & Kim(2021).	**City Spatial Scales**	
Kellert(2008),Beatley(2010)	**Nature Pyramid**	
Kellert(2008),Beatley(2011),Beatley & Newman(2013),Browning(2014),Reeve(2015), Salingaros(2015),Littke (2016), Birkland(2016),Desha & Baghdadi(2017),Xue(2019),Totaforty (2020), Taylor(2021), Tiri (2021),Panlashigui(2021), Lee & Kim(2021),Geakwad (2022),Hung(2022).	**Nature in Space**	
Kellert(2008),Beatley(2011), Browning(2014), Salingaros(2015), Xue(2019), Totaforty(2020),Lee & Kim(2021),Taylor(2021).	**Nature simulation**	
Kellert(2008),Beatley(2011), Browning(2014), Salingaros(2015), Xue(2019), Totaforty(2020), Lee & Kim(2021),	**Nature of Space**	
Kellert(2008),Browning(2014),Xue(2019),Lee & Kim(2021),Tirri(2021), Hung(2022),Geakwad(2022)	**Space & Place relation**	
Kellert(2008),Browning(2014),Salingaros(2015),), Littke(2016),Xue(2019), Totaforty(2020),),Lee & Kim(2021),Geakwad(2022),Hung(2022)	**Multisensory Design**	
Beatley(2011),Beatley & Newman(2013),Reeve(2015),Xue(2019), Lee & Kim(2021)	**Shared Spaces**	
Xue(2019),	**Mixed Use**	
Beatley(2011),Beatley & Newman(2013), Reeve(2015),Xue(2019)	**Walkability**	
Beatley(2011),Beatley & Newman(2013),Xue(2019),	**Bikeability**	
Kellert(2008),Beatley(2011),Beatley &Newman(2013),Browning(2014),Reeve(2015), Salingaros(2015),Littke (2016), Birkland(2016),Desha &Baghdadi(2017),Xue(2019),Totaforty (2020), Taylor(2021),Hung(2022),Tiri (2021),Panlashigui(2021), Lee & Kim(2021),Geakwad	**Green spaces, Parks, Urban forests, Gardens, Green Roofs, Green Walls**	
Kellert(2008),Beatley & Newman(2013), Xue(2019), Lee & Kim(2021)	**Local Materials**	

Table 4

Distribution of attributes used by theorist in expressing the concept of Biophilic Urbanism.

Biophilic Urbanism	Theorist / Attributes	Kellert(2008)	Beatley(2011)	Beatley & Newman(2013)	Browning(2014)	Reeve(2015)	Salingaros (2015)	Littke (2016)	Birkland(2016)	Desha & Baghdadi(2017)	Xue(2019)	Totaforty(2020)	Taylor(2021)	Tiri (2021)	Panlashigui(2021)	Lee & Kim(2021)	Geakwad(2022)	Hung(2022)	Number of Attributes
Biophilic Urban Planning	Sustainable & Resilient city		*	*	*	*			*		*				*	*		*	**9**
	Green city		*	*		*		*	*	*	*	*	*	*	*	*	*	*	**14**
	Positive development								*										**1**
	Environmental components	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**17**
	Social components		*					*	*	*	*	*	*	*	*	*	*	*	**12**
	Cultural components		*	*				*	*	*		*	*					*	**7**
	Economic components		*	*		*				*	*			*	*	*			**8**
	Institutional components		*	*		*				*	*					*			**6**
	Climate Comfort & Climate Change Ability		*	*						*	*					*			**5**
	Blue & Green		*	*		*			*	*	*	*		*		*			**9**

	Infrastructures																		
	Green Transportation			*							*				*				**3**
	Integrated Ecological Network		*	*		*				*	*				*	*			**7**
	Biodiversity	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**17**
	Clean & Renewable Energies			*						*									**2**
	Urban Agriculture			*						*				*					**3**
Biophilic Urban Planning	City Spatial Quality	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**17**
	City Spatial Scales	*	*		*			*	*		*	*				*			**8**
	Nature Pyramid	*	*																**2**
	Nature in Space	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**17**
	Nature Simulation	*	*		*		*				*	*	*			*			**8**
	Nature of Space	*	*		*		*			*		*			*				**7**
	Space & Place relation	*			*						*			*		*	*	*	**7**
	Multisensory Design	*			*		*	*			*	*				*	*	*	**9**
	Shared Spaces		*	*		*					*					*			**5**
	Mixed Use										*								**1**
	Walkability		*	*		*					*								**4**
	Bikeability		*	*							*								**3**
	Green Spaces, Parks, Gardens, Urban forests, Green Roofs, Green Walls	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	**17**
	Local Materials	*		*							*					*			**4**

5. Conclusion

This paper tries to analyze and identify the concept of Biophilic as an exquisite concept in the field of urbanism based on content analysis technique regarding PRISMA method, from the most prestigious scientific sources of urban design and planning. The following conceptual definitions were formed from the results of the presented definitions through emphasis on the ideas of theorists, their most concerns in theory and practical experiences. Thus, the achievement of this study concerns The Biophilic Urban Development (Biophilic urban design and planning), as a paradigm of human nature reconnection approach led to physical and mental health of the citizens, byinteraction of three basic dimensions, includes; Structural, Functional and Meaning, as presented in the figure 3.

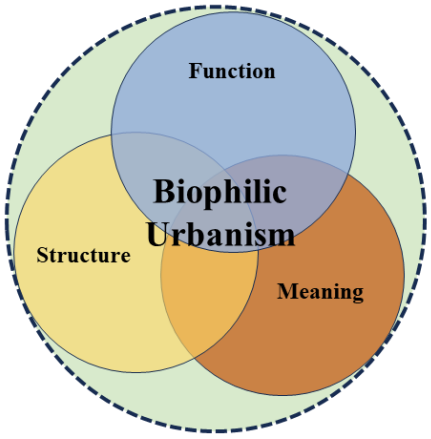

Fig. 3. Interaction of the basic Biophilic Urbanism paradigmdimensions.

These dimensions can be operationalized in the hierarchy of urban spatial spaces and duration of time.

Structural dimensions have four components, as; environmental, sociocultural, economic and institutional.
In other words, in order to achieve the leading objective of Biophilic urbanism, nature accessible to all; cities full of facilities to connect people with nature at all times and places,citizens should be able to attain a rich experience of nature in living, working and leisure environments, through the micro, me so and micro city spatial scales which are the components of the Biophilic Urbanism Functional dimension, regarding, criterias, as ;building, block, street, neighborhood, community and region. Green roofs, green walls, vertical gardens, green courtyards, green streets, local parks, rain gardens, urban farms, community gardens, ecological parks, preserved rivers, green pedestrian and vehicle corridors , urban forests and urban ecological network, consider as the most significant Biophilic facilities in multi scales of the city. This spatial hierarchy provides citizens'ease of access to nature in different time domains which in this study, sets as the duration scales components, including; daily, weekly, monthly, semiannually and yearly, known as the Nature pyramid. Conversely, the biophilic approach in urban planning and design trying to afford direct and indirect people's nature experience, through applying the meaning dimension of Biophilc Urbanism concept in this study , which includes components sensorial design , embodied criteria ; 1- nature in space (water, air, light, temperature, color, texture, natural materials, plant and animal species…).2 -nature simulation (natural patterns and shapes; images of nature, biomimicry, …) .3- nature of space (order, complexity, landscape, refuge, intimacy, seduction, risk and danger,…) and 4-space and place relations (cultural and , historical attachment to place, diversity, legibility, aesthetic,…).

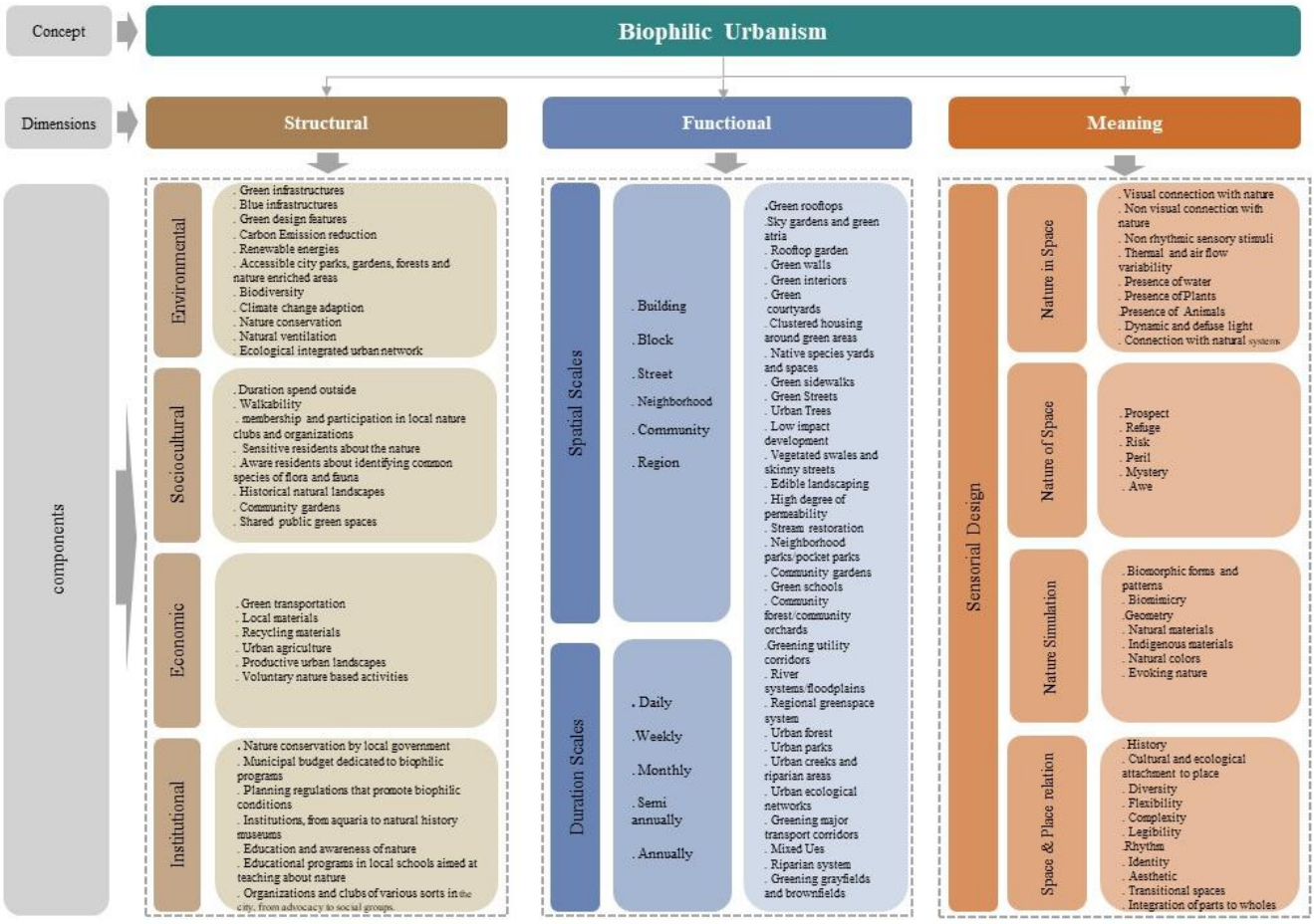

Fig. 4. Expressing the Biophilic Urbanism concept, dimensions, components and criterias .

These aspects plays a fundamental roll in the Biophilc Urbanism paradigm, through converting the space into the place which make the sense of place and attachment to urban spaces as the citizens belongings. Subsequently, they would be more sensitive and aware of conservation and improvement of nature and its features.
Truthfully, Biophilic cities are resilient, sustainable , green cities which not only improve and maintain the environmental settings and natural ecosystem through the recovery and revival of nature elements in multiple city spatial scales, but also through educating and apprising citizens toward nature values, their committed behaviors concerning the urban ecosystem would be strengthened. In Biophilic city, citizens spontaneously participate in biophilic activities and thereby benefited from individual and public advantages of biophilic urbanism ,such as;

physical and mental well-being, social belongings, economic efficiency (reduction in cost of treatment, transportation, food and energy), preservation and promotion of cultural identity (valuing environmental values, indigenous and local knowledge),ecosystem improvement (climate change adaptability, thermal comfort, biodiversity conservation, water resources, soil and air pollution reduction) and developed institutional and governmental conditions (participation in decision-making, bottom-up perspectives and local planning), which expressed as the structural dimension, embodied relating components and criteria in Biophilic Urbanism in this study.

By overlying the three fundamental dimensions of Biophilic Urban development approach, Structural, Functional and Meaning and their aspects, as expressed in the figure 5,Biophilic urban spaces generates environmental justice leads to individual and public prosperity, health, well-being, diversity and happiness. Thus, people perceive a sense of satisfaction and desirability in life through bonding with nature. Subsequently, many challenges of contemporary urbanization would be treated by improving the quality of urban environments toward the Biophilic Urban development accomplishment.

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