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Analysis of Built Environment Related Sustainable Urbanism Definitions, Theoretical and Practice Approaches

Yapılı Çevre ile İlgili Sürdürülebilir Şehircilik Tanımlarının, Teorik ve Pratik Yaklaşımların Analizi

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Abstract:

Various views of sustainable urbanism principles and global perspectives have been proposed over recent decades. The common aim is to acknowledge the age of the Anthropocene and provide substantial outcomes on how sustainable urbanism can make built environments more desirable, healthy, resilient, and livable. Despite these principles, many environmental problems persist due to denial of global warming and its consequences, continued urban sprawl, overconsumption, and lack of emphasis on livable settings in urban areas at the local, regional, and global levels. However, sustainable urbanism can be operational when a balance is established among economic, social, and ecological features by considering those significant outcomes. Hence, this paper targets identifying the propositions of diverse authors and designers for built environment-related sustainable principles, theories, and elements by assessing various perspectives and empirical studies in addition to emphasizing the importance of sustainability for both humans and natural systems and habitats. Accordingly, surveying numerous resources brings the opportunity to explore the critical assessment of particular phenomena.

Keywords: Sustainable Urbanism, Built Environment, Green Buildings, Equity, Anthropocene

Özet:

Son on yılın üstünde bir süredir sürdürülebilir kent ilkelerine ve küresel perspektiflere ilişkin çeşitli görüşler ortaya atılmıştır. Ortak amaç, Antroposen çağını kabul etmek ve sürdürülebilir kentleşmenin yapılı çevreleri nasıl daha tercih edilir, sağlıklı, olanaksızlıklara ve handikaplara karşı esneklik ve dayanıklılık gösteren ve yaşanabilir hale getirdiğine dair önemli sonuçlar sağlamaktır. Bu ilkelere rağmen, küresel ısınmanın ve sonuçlarının inkar edilmesi, devam eden kentsel yayılma, aşırı tüketim ve yerel, bölgesel ve küresel düzeylerde kentsel alanlarda yaşanabilir ortamlara vurgu yapılmaması nedeniyle birçok çevre sorunu devam etmektedir. Ancak sürdürülebilir kentleşme, bu önemli sonuçlar dikkate alınarak ekonomik, sosyal ve ekolojik özellikler arasında bir denge kurulduğunda

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işlerlik kazanabilir. Bu nedenle, bu makale, sürdürülebilirliğin hem insanlar hem de doğal sistemler ve habitatlar için önemini vurgulamanın yanı sıra, çeşitli bakış açılarını ve ampirik çalışmaları değerlendirerek yapılı çevre ile ilgili sürdürülebilir ilkeler, teoriler ve unsurlar için farklı yazar ve tasarımcıların önerilerini tanımlamayı amaçlamaktadır. Buna göre, çok sayıda kaynağı araştırmak, belirli fenomenlerin eleştirel değerlendirmesini keşfetme olanağı sunmaktadır.

Anahtar Kelimeler: Sürdürülebilir Kent, Yapılı Çevre, Yeşil Binalar, Ekolojik Kent, Eşitlik, Antroposen.

1. INTRODUCTION

Today, the intention on urban sustainability (Beatley, 2012; Bovill, 2014; Cuello Nieto & Society for Philosophy and Technology, 1997; Farr, 2008; Farr, 2018; Gibberd, 2015; Marans, 2015; Newman & Jennings, 2008; Rapoport, 2015; Vanegas, 2003; Agyeman, et.al., 2003; Ferrão & Fernández, 2013) has become even more crucial and inevitable by forces of rapidly increasing population in urban areas and needs for more construction through this population growth. Hence, sustainability principles, predominantly for the built environment, need to be evolved and defined explicitly for practical solutions at various scales. As globalization has posed challenges to sustainable urban projects worldwide, Rapoport (2015) has raised a critical question if the global intelligence corps (GIC) was contributing to the emergence of a standardized model of sustainable urbanism. According to findings of the research, masterplans produced by GIC firms comprise a moderately uniform and consistent set of concepts, which have a similar menu of alternatives such as bicycle lanes, bus rapid transit, sustainable urban drainage systems, combined heat and power systems, and renewable energy, for improving the sustainability of urban development (Rapoport, 2015). Human beings interact with their physical and social environment at a certain level. Respect for the integrity of nature and for the needs and rights of present and future generations is signified by sustainable development (Cuello Nieto & Society for Philosophy and Technology, 1997). However, current environmental problems are not properly understood to support this approach. In the scope of sustainability, there are some other questions that are needed to be asked such as: What is the global view of the importance of sustainable development? Why are we in danger of overconsumption? Is it based on past and future predictions of resource consumption?

According to the United States Census Bureau (2022), current world population is almost 8 billion, and 56 percent of this population inhabits in urban areas, which is projected to double by 2050 (The World Bank, 2020). This uncontrolled increase has brought many economic, social, and environmental issues. In particular, consumption increases spurred by this population growth, and urban sprawl which exceeds the limits of the urbanized environment.

Another related environmental issue is the earth's annual temperature, which has increased at an average rate of 0.08 degrees Celsius (0.14 degrees Fahrenheit) per decade since 1880, but this rate has increased more than twice (0.18 degrees Celsius / 0.32 degrees Fahrenheit) since 1981 (NOAA National Centers for Environmental Information, 2022). This issue occurs because of increasing atmospheric carbon dioxide level, and according to NOAA Annual report, global temperature is expected to be at least 5 degrees Fahrenheit warmer compared today's temperature that the 1901-1960 if this rapid carbon emission continues rising. In response to global warming, in an article published in the Journal Nature, scientist Paul Crutzen (2002) coined the term "Anthropocene", stating, "It seems appropriate to assign the term 'Anthropocene' to the present, in many ways human-dominated, geological epoch." Though Crutzen cites other sources recognizing human influence on the earth's geology and atmosphere which date back as far as the late 1800s at the beginning of the Industrial Age.

For these reasons, the last several decades the built environment related studies aim to define sustainability comprehensively and discover its extent by evaluating performance of buildings, climate change, urban heat island effect (Carpio et al., 2020), overconsumption, waste, and water management systems, and so on. On the other hand, the economic situation of all countries has been affected by the Coronavirus (COVID-19) pandemic. Moreover, almost all countries are dealing with increasing inflation rates at different levels. According to news published at Le Monde ("Europe Struggles to Find Consistent Approach to Cutting Energy Consumption," 2022), European Union (EU) aims to take steps to prevent high energy consumption, and only countries such as Germany and Spain have taken tangible action to save gas and electricity.

Green urbanism, ecological urbanism, green architecture, urban metabolism, and sustainable urbanism are compared to draw a comprehensive path for redevelopment strategies in the built environment. Overall, this paper surveys a wide range of sustainable strategies by evaluating the unique ideas and decisions that have assisted to shape the built environment.

2. REVIEW OF VARIOUS APPROACHES TO MAKE THE BUILT ENVIRONMENT SUSTAINABLE

As Anderson (2000) defines, the built environment is composed of "the structures and facilities that we build in urban and suburban areas, as part of the physical pattern we use in our current civilization." It is the combination of "natural," "built," "social," and "economic" environments. This statement also refers to human settlements regarding sustainable urban design standpoint. In this case, two important criteria emerge, which are significant for "urban

morphology", and need to be mentioned: "the understanding of urban change and evolution", and "the conceptual framework for designing for change" (Scheer, 2008). Since the built environment contains buildings for varieties of functions, open spaces, circulation paths for motorized and non-motorized transportation, those can also be private, semi-private, public, and semi-public where people can fulfill their needs. Throughout history people have settled in places to sustain their life, they have created their own environment to survive. In general, these places have been established depending on their culture, belief, identity, needs and other important values. Kostof and Tobias (1999, p. 10) states, "we "read" form correctly only to the extent that we are familiar with the precise cultural conditions that are generated." Perhaps, in the beginning, most of the places where people maintain their life were smaller, more walkable, and manageable than the current urban areas, which hold chaotic and complex conditions. Comprehensive Report and Best Practice Guide (*New Urbanism*, 2003) states that neighborhoods and communities comprise different features that need to work together, which makes them "complex organisms".

2.1. Green Urbanism View

Beatley, in his book Green Urbanism Learning from European Cities (2000), provides a sustainable urban model for American cities. The author examines the problems of sustainable urbanism, offers criteria for development, and criticizes conditions contributing to these problems. Some of the problems facing the world's populations are overconsumption, population growth, a lack of environmental equity, and resulting poverty. Beatley (2000) also points out that these problems are valid for American cities and trigger carbon dioxide emissions, increase in waste and energy use, and deplete resources. These environmental conditions are multifaceted and difficult to resolve and grasp. In this case, the answers need to include smart technologies and reduced expectations of consumption. Solutions that are offered contain the creation of smart cities, innovative ideas, and green cities. Since technology offers a variety of options, concepts of smart public transportation, district heating and green building design have become more popular. Although most of the projects are not established, there are numerous examples related to green technologies, green materials and technologies, and smart materials are constructed. For instance, Bodurow (2017) describes the design technique that requires a Net Zero Energy (NZE) prototype to be part of a larger, long-term vision as well as achieve aesthetic, performative, and equity goals. Green building rating systems that have developed because of increasing concerns in the building industry and management, in topics

such as sustainability, building performance, environmental impact, energy, cost efficiency, and maintenance (Attmann, 2010).

Furthermore, Beatley (2000) organized the principles of urban sustainability in four topics: urban management, policy integration, ecosystems thinking, and regional and local cooperation as well as partnerships. From this sense, programs, activities, and strategies should be progressed based upon sustainable approaches by the local government. Having sustainable development, sustainable communities, and sustainable cities decreases negative environmental effects that reduce the occupants' standards of living. These affect resident lifestyles and provide opportunities for walking, bicycling, and reduced fuel consumption. According to Pasalar et.al. (2021), modes of transportation, frequency, the closeness of transportation nodes, available routes, cost of a ticket, and safety and security need to be evaluated before suggesting locations for affordable housing projects.

Beatley (2000) offers a "new urbanism" approach to control both urbanization and environmental form. The old view of urbanization was not complete, because it did not include ecological planning. The impacts of new urbanization are now recognized in cities that are more ecologically based than suburban models. The following description summarizes the qualities and characteristics of green urbanism:

- Green urbanism requires both a decrease in the ecological footprints of a city and good transportation to link different places.
- A traditional perspective of the polarity of cities and nature needs to be changed within green urbanism. Cities include non-natural forms, such as gray-field infrastructure. Natural places (forests, green spaces, and green roofs) should be conditioned in cities for their benefits; clean air and water, along with a refreshed-soul, benefit both the residents and the ecosystem.
- Natural systems are symbiotic, and each system supports and depends on other systems. They can be transformed into a city system of green urbanism instead of linear structure. The benefit of this approach is to eliminate waste.
- Local or regional food production must be considered before importing food. Each city or region can be self-supporting with local food production, economic development, and other activities.
- Sustainable urbanism and green urbanism provide opportunities for alternative— non-fossil-fuel—commuting (e.g., walking and biking).

- Green urbanism requires cities to be more centralized to make neighborhoods livable. It also needs to be supported by natural systems.

2.2. Sustainable Architecture and Urbanism View

Farr (2008), in his book Sustainable Urbanism, proposes the creation of a bridge between urbanism and environmentalism. Environmentalists focus on nature, and urbanists focus on dense human settlements. He also mentions five sustainable categories used to create the best model of a city: The first is density, which is also a major element of sustainable urbanism. It is an important category that is developed within local, regional, and global profit centers. The common motto of the planner is "Think Globally, Act Locally" as suggested by Farr. The aim of increased density is to provide benefits to both the human and natural systems. Density stimulates residents of walkable communities to cherish, celebrate, and protect their neighborhoods (Farr, 2008). A walkable place, according to Farr, is lively, physically, and financially healthy, fashionable, affordable, sustainable, sociable, and safe (2008). It is, in other words, a crystal-clear sign of a high quality of life. Almost by definition, an attractive community is walkable, and an unpleasant community is not. Even though the typical American mentality sees density as a risk for privacy and quality of life, it is a requirement for sustainability.

The second category is the development of sustainable corridors that exist in two types: transportation and biodiversity. In this case, both provide connections between neighborhoods. These corridors must be easily accessible. The aim of transportation is to provide a "transit-oriented development." Thus, high density land use and pedestrian-oriented design can maximize access to public transportation and often incorporate features to encourage transit ridership. Sustainable transit systems create automobile-free neighborhoods. Tonkiss (2013, p. 40) emphases that association "between density and diversity is key to claims around social sustainability, as these 'thicker' social spaces create geographies of opportunity that serve the needs and the preferences of a range of users.' In addition, recent studies show that residential density and car use are often negatively associated as exposed by urban places (Kitamura et al., 1997). People who live in the central areas prefer to use public transportation and non-motorized modes of travel; on the other hand, suburbanites are inclined to live an auto-centric lifestyle. Kitamura et al. (1997) conclude that attitudes – compared to the land use characteristics – are definitely more strongly associated with travel. Therefore, recommendation is to promote higher densities and mixtures may not change travel demand

substantially through land use policies if residents' attitudes also are not formed. Furthermore, Ewing (1994), cited in Cervero and Kockelman (1997), has claimed that since density and mixed land uses mostly exist at the same time, most of the benefits of density may refer to mixed uses as well. In this sense, one purpose of the biodiversity corridors is to protect local natural habitats.

The third category is the sustainable neighborhood unit. Not only does each neighborhood need to have accessible workplaces, shopping centers, and schools, but the idea of sustainability also requires neighborhoods to share this opportunity. So, sustainability can be developed by connecting and completing neighborhoods.

The fourth category is open space that is supported by outdoor activities and connected by a network of neighborhood parks and plazas. Humans interacting with nature receive health and environmental benefits such as walkable open spaces, neighborhood stormwater systems and waste treatment, and local food production.

The impact of building energy usage as fifth category aims to create high-performance buildings and neighborhood-scale infrastructure systems, which proposes less fossil-fuel energy usage and the promotion of energy-saving systems, containing sustainable (alternative) energy systems. For instance, Demir and Mirianhosseinabadi (2017) states that solar, wind, geothermal, small-scale, or micro hydroelectric, and biomass are encouraged on-site energy sources.

On the other hand, Kelbaugh (2002), in his book 'Repairing the American Metropolis: Common Place Revisited,' looked at the structure of American cities at different scales within historical, philosophical, and ideological movements. The scope of modernism, postmodernism, deconstructionism, and phenomenological environments has been created. Moreover, Kelbaugh highlights green buildings and solar architecture as well as urban design perspectives incorporating utopian visions of new urbanism (2002). New urbanism, for many reasons, is a better choice than traditional suburbs because it includes more sustainable functions (Kelbaugh, 2002). Community planning, healthy and sustainable ecology, economic and social diversity, and good governance all exist in new urbanism.

While Kelbaugh omits environmental issues that include urban sprawl and open space, he does discuss technological development risks. His argument is that neighborhoods and urban regions have more advantages than single-use mega-zoned suburban sprawls. The author's solution is to reduce sprawl, support suburban areas, and design open spaces. The author strongly

advocates the need for open space. This element adds to the quality of life enjoyed by citizens living in the urban areas. Open space plays an important role because of the increased density in cities.

Very few Americans live in true neighborhoods; most prefer to be in an urban region. Kelbaugh does not refer to other countries; the ideas involve how the structure of American cities should be managed and how the integration from buildings to neighborhoods and from neighborhoods to regions should occur. The author suggests policies that help to create sustainable cities, towns, and regions for America. This policy framework includes seven main topics (Kelbaugh, 2002):

1. Get development priorities right: advocating old city development instead of new suburban development. Existing cities have more opportunities for expansion and density because of their settled social, physical, and institutional infrastructure.
2. Get automobiles under control: against financial support to promote the use of automobiles.
3. Get transit on track: developing a general transportation network system that enables people to walk, use transit, and ride bikes.
4. Get planning: explaining how important it is to plan each part of a region. Municipalities must have plans at every scale, such as specific area plans, subarea plans, zoning plans, and neighborhood plans. Sustainable charrettes are especially important to developing a neighborhood plan, as citizens need to have an active role in the process.
5. Get more granny flats and live-work units to support work/life integration. The aim of this policy is to use less building space and increase population density. The idea is that people prefer to have their workplaces closer to their homes and that this must be a priority of planning American neighborhoods.
6. Get funding and taxing right: suggesting governments use funding for smart growth. Public money must support smart-growth elements, such as transit systems and neighborhood plans.
7. Get governance right: requiring the government to be effective and consistently support sustainable planning on every scale, from the regional level to the neighborhood.

All the policies defined above provide perspectives on how to make the built environment sustainable. Designing, planning, and decision making are key steps in the process of sustainable urbanism. Another important point is that existing urban areas need to have higher

priority than new suburban areas. Besides, not only urban designers are responsible to provide sustainable solutions, but also political, social, and economic entities should be involved.

McGeough et al. (2004) offer a number of approaches for sustainable urbanism and foster more livable communities worldwide because of overpopulation in large cities and unsustainable practices, providing percentages of growth in population and energy usage. The authors' view of sustainable urbanism is "the state a metropolitan community reaches once it is able to meet the needs of the present generation without compromising the ability of future generations to meet their own needs." In this statement, sustainable urbanism is explained as being respectful to the needs of current and future generations.

The report, 'Our Common Future' published in 1987 by the United Nations World Commission on the Environment and Development, focuses on urban development in America, highlighting major trends such as demographics and land usage, climate change, globalization, and technology. It examines a competition among top urban designers, architects, and planners: the International Competition for Sustainable Urban Design (IC-SUSD). The aim of this competition was to stimulate new alternatives of sustainable urbanism. In the competition, designers were expected to create successful investments over a one-hundred-year period with economic, sociopolitical, and environmental sustainability. The principles for urban sustainability are collected in five main topics: sustainable energy resources and practices, ecological urban form and function, community-based resource management, land-use optimization, and social and economic equity. Seven elements support these topics: natural systems, land-use systems, mobility systems, energy systems, environmental-management systems, building-design systems, and governance systems. More recently, the UN Department of Economic and Social Affairs established seventeen (17) Sustainable Development Goals (Sustainable Development, n.d.) focusing, in part, on issues of reducing inequalities and engendering justice through sustainable development.

2.3. Ecological Urbanism View

Mostafavi and Doherty (2015), in their book called Ecological Urbanism, focus on how the city can be protected within ecological and urban integration and on the benefits of ecological urbanism. The authors discuss the problem of overpopulation in urban areas, noting that resources are not unlimited. There is an anxiety that "one planet living'' is still a dream. The Brundtland Report, the Kyoto Protocol, and the Copenhagen Summit are in agreement that this dream should come to life. Within ecological urbanism, there are some components such as the

affordability of ecological planning and sustainability, scale in terms of sustainability, economic, political, social, and cultural structures of the cities should be defined. Current problems for which urban designers must find solutions are global warming, rapid growth, congestion, water shortage, drought, population explosion, urban sprawl, and pollution. Ecological urbanism guides professional disciplines in making policies or designing urban areas for a sustainable and livable future.

The distribution of services is part of the underground system. Mobility and functionality include both underground and ground-level systems. All types of transportation systems and mass-transit networks are part of this system. Public space is a ground-level structure provided for people. The relationship between parameters and symbiosis creates a complete urban form in the ecosystem. This provides the opportunity to create strategies and to manage models for sustainable development. In this case, urban planning requires projects to take place on all three levels—underground, ground, and upper—to create a strong foundation for sustainability.

Biodiversity is one of the upper-level structures represented by green roofs. The green capacity of cities is generally lower because of the lack of open space and buildings with green roofs (Attmann, 2010; Mostafavi & Doherty, 2015). Mostafavi and Doherty (2015) also touch on density and how it is perceived in the urban environment. There is no exact description for urban density in the twenty-first century, even though urban areas are growing at a rapid pace. According to Mostafavi and Doherty (2015), increasing density is unavoidable and therefore must be planned for. Sustainability has been described with integrated ecological and urban systems to provide more desirable and sustainable urban places.

In Cities as Sustainable Ecosystems: Principles and Practices, Newman and Jennings have described threats on cities and their effects on the environment (2008). The book starts with two examples. The first is Perth in Australia, a city with blue rivers, clean air, and good sanitation. It is an example of how urbanity and environment survive together without disruption. The second example is of larger cities displaying a variety of problems, such as lack of water, climate change, urban decay, car dependence, and health problems. Cities have always been the center of economic growth and housing and are growing faster than ever. This continued globalization has negative effects on natural resources. Every day, resource usage increases around the world, creating an ever-increasing impact on the natural environment. Newman and Jennings seek to explain human- environment relationship through ten principles (2008):

Vision: Sustainability is provided by social, economic, and political involvement for long-term strategy: “The vision needs to reflect the distinctive nature and characteristic of each city” (p. 7). The vision reflects the people’s hope to have sustainable cities. Also, equity comes into prominence for the protection of “future generations.” A few sectors that have common futures are encouraged to have a strategy, an action program, and a process to be successful. In addition, McLaren and Agyeman (2015) argue that communal models of sharing, which are the systems that are shaped around equity and justice, that build solidarity and spread trust are essential to be supported and emphasized by city leaders.

Economy and Society: This principle advocates that “environmentally sound, sustainable development” helps long-term economic and social security. Newman and Jennings emphasize that to achieve triple bottom-line sustainability, economic strategies need to increase the value and vitality of human and natural systems and renew human, financial, and natural resources. Inhabitants and government in each city need to be aware of its economic capacity and understand that increased demand for resources will be a problem. Economic strategies need to be local and bioregional in order to be sustainable.

Biodiversity: People and nature cohabit the earth and that nature is a more valuable commodity than we currently view it as. A city has an important position within the natural ecosystem and bioregion. There is a beneficial relationship between the city and the environment, especially for humans. Thus, people need to understand nature. Healthy ecosystems provide services and benefits to enhance sustainability within the physical, psychological, and spiritual realms.

Ecological Footprints: Cities have negative effects on resources and the environment. Overconsumption by urban residents is the primary cause of limited resources. This unsustainable situation needs to be replaced with sustainable habits. It is possible to determine the impact of a city by calculating its ecological footprint. Materials, water, and energy are resources that people should use within their needs. The purpose of the “metabolism of the city” is to decrease the ecological footprint of the city.

Modeling Cities on Ecosystems: By this principle, practical modeling of cities is based on the functionality of ecosystems. Newman and Jennings state: “The characteristics of ecosystems include diversity, adaptiveness, interconnectedness, resilience, regenerative capacity, and symbiosis.” These characteristics can be incorporated together for more beneficial objectives, such as “productivity and regeneration” within ecological, social, and economical solutions.

Cities are formed within strategies of sustainable natural ecosystems and traditional urban settlement.

Sense of Place: This principle is a reflection of cities' differing cultural, characteristic, and historical structures. In this view, people should accept and match their values, traditions, institutions, and ecological realities within sustainability. Newman and Jennings write that the shape of a city provides mobilization and motivation of "the human and physical resources of cities" (p. 144). When cities are formed, location and historical characteristics affect their profiles. Cities encompass what Newman and Jennings call "human elements of building, infrastructure, and gardens" (p. 144). Cities are also places where human, political, social, economic, and ecological interactivity takes place.

For instance, Barcelona and Berlin are all historically and architecturally rich cities that have maintained a great sense of place with their distinctive urban forms and contexts. Balch (2011) defines Barcelona as a city that has a historic core, wide city blocks, high density of the built form, a distinctive architectural character, a strong pattern of streets and squares (with local character), and active street frontages, which contribute to a sense of place and belonging. Berlin, too, contributes to a sense of security and self-surveillance with the established walkways, pedestrian oriented major public spaces and streets, the intensity of pedestrian and cycle activity, and medium to high density residential districts (Balch, 2011). Considering all this evidence, it seems that enhancing physical characteristics of an urban environment generates a greater sense of place.

Empowerment and Participation: It is necessary to "empower people and foster participation." Newman and Jennings (2008) point out that some people's opinions are not taken into consideration (e.g., the poor). People are equal and should therefore take responsibility to ensure that their opinions are heard. They describe empowerment as encouraging people who do not have the chance to share their opinions, such as "women, indigenous, populations of the poor, the disabled, and illiterate" (p. 156). Citizens can bring new ideas, which help with development and increase awareness of issues and processes. When citizens participate without obstacles, they take responsibility for their environment.

Partnerships: This topic requires a "common and sustainable future" so it can occur within a clear and open relationship between cities. Therefore, sustainability requires cooperation, connection, and a strong network. Newman and Jennings emphasize networks and systems in nature. Scientists believe that a natural network does not work hierarchically but functions like

a mutually beneficial partnership. For example, association, establishment of links, cooperation, and maintained symbiotic relationships are observed within a partnership. Another benefit of a natural network is that all waste is eliminated. The natural circle provides a symbiotic relationship in which organisms use all elements of the process. This concept has become a model for sustainable urban systems. Newman and Jennings describe this partnership as a requirement of urban development that includes a "sharing of power, trusting of each other, effective communication, shared or complementary vision and goals, symbiosis (mutual benefits), and adequate resources." It also includes cooperation between different places in a bioregion and beyond. Moreover, a partnership does not just occur city-to-city; it can also be between a city and a government, business, or community.

Sustainable Production and Consumption: Sustainability is examined within production and consumption. Newman and Jennings describe sustainable production and consumption as "a range of approaches and tools that can be used to promote sustainable practices. Demand management, which includes accurate valuations of natural resources and increasing public awareness, is a valuable strategy to support sustainable consumption" (p. 187). Eco-friendly technologies can help an environment to develop. For example, they can be used for protection, increased performance, lower pollution, and recycling. Sustainable consumption requires limitations to usage that is appropriate to human needs. Thus, people need to change their culture within the economic, political, and social realm.

Governance and Hope: This principle refers to political strategies and decision making for the sustainable future of the city. "Good urban governance," according to Newman and Jennings, requires three important objectives that provide sustainability: to transform the city to sustainability; to create new strategies, programs, and technologies; and to determine targets and develop a cycle. Transparency, openness, and responsibility in communities, business, and government are important to build hope, because it is the foundation of knowledge.

2.4. Environmental Challenges and Sustainability

Randolph, in his book Environmental Land Use Planning and Management (2004), covers human-environment interactions and explains how the system works at the management standpoint. According to Randolph (2004), human beings isolate themselves from the natural environment and ignore being part of natural systems. In addition, technological development further deteriorates the human-environment interaction. "Environmental management," means to control or direct "human-environment interactions" to improve the environment and develop

the quality of human life (Randolph, 2004). These intersections appear to be based on ecological, social, and environmental criteria (Table 2.1).

1. Natural hazards affect society, which are defined as natural hazards such as flooding and other weather-related damages, geologic hazards, and natural pests and disease-transmitting organisms
2. Pollution (which society creates) affects the environment and human health.
3. People take advantage of economically significant natural resources at untenable rates.
4. Natural systems and ecosystems are demolished by pollution and overuse.
Table 2.1: Relationships among ecological, social, and environmental criteria (Randolph, 2004)

The author addresses the participants and their roles in environment management for the United States. There are many sectors that engage in environmental management, such as private markets and civil society in the United States. Political, technical, and scientific fields also have a role in the environmental-management lead process.

Some business sectors' diversity affects the environment; these are industrial firms, developers, and farmers. Thus, they have a responsibility to standardize, program, and build original technologies to control the environment. For instance, according to Randolph, besides financial institutions, private services include designers and real estate agents in land use and development. "Growth machine" is the general name that some environmental groups give to private services because of their influence on development projects. However, they are still responsible for creating and preserving the environment.

On the other hand, the government plays a central role in mediating the effects of "private activity" on the environment. Therefore, Randolph writes, the government holds responsibility at the federal, state, and local levels. These provide executive, legislative, and judicial oversight:

- Executive branch refers to agencies that develop plans and administer programs.

- Legislative branch refers to laws, programs, and policies.

- Judicial brunch refers to courts that evaluate laws.

Public groups are involved in government planning and decision making in many different ways. Those groups might be nongovernmental organizations, environmental and residential groups, land trusts, land holders, and so on.

The relationship between human society and the environment provides different types of environmental management, depending on social culture, values, and ethics. These determine the characteristics of human behavior on the environment. Randolph emphasizes Beatley's (2000) suggestions about the value of natural objects, which are "instrumental value, intrinsic

value, and inherent worth" (Randolph, 2004). The author also looks at contemporary American values and perspectives and how they influence environmental management. There are also numerous scientifically proven truths about "controversial environmental issues." This scientific knowledge is filtered by people's attitudes and values to analysis. Therefore, environmental issues depend on society's thoughts and morals. In this case, Randolph came up with five viewpoints in the scope of "visions of paradise.": "optimist, concerned optimist, hopeful pessimist, pessimist, and self- absorbed." These describe people's attitudes in the face of environmental issues.

Randolph points out similarities between Colby's eco-development (ED) model and sustainable development (2004). Sustainable development is supposed to provide for current needs and protect resources for future generations on social, economic, environmental, and political paths. Randolph adds "Engagement" and "Eternity" to the "three E's"— Economy, Environment, and (social) Equity—to expound on sustainability. Adding engagement and eternity, Randolph says, is necessary for political participation to be successful in society's future.

Environmental management has evolved over the decades. Societal progress in the United States is an incomplete process, and it involves the incremental growth of ethical and official rights over time. Randolph mentions Bernard and Young's (1997) three evaluation gestures for environmental values. First is the conservation movement in the nineteenth and twentieth centuries. Many conservation organizations were created to provide functions of vital movement such as the National Park Service, the Fish and Wildlife Service, and the Forest Service. These are conservation and management organizations for public natural resources and development. Second is the public and environmental health and the protection of commonly held resources. Laws and watchdog environmental groups that are focused on the protection of the environment from humans' noxious impact appeared in the twentieth century to define the connection between our environmental condition and human health. Third is what Randolph calls the "ecological way." It includes the first and second waves to search for the best way to regulate "human habitation" and "use of resources" with the protection of natural systems over long periods of time.

In Randolph's book, Chapter 13, "Land Use, Stream Flow, and Runoff Pollution," addresses water activity in land use. The author argues that developed land uses cause "stream flows, water quality, and stream integrity" to change. Those changes cause problems such as storm flows and flooding. In the system, every movement affects another aspect. Therefore, "storm flows and flooding" are the reasons "natural hazard" and "aquatic ecology" are affected by

"baseflows and low flows"; "natural waters and sources of community supplies" are affected by the resulting "runoff pollution" (Randolph, 2004).

Both rain and snow occur in a natural process called the hydrologic cycle. Some phases connect with one another: evaporation, precipitation, and infiltration. This process takes time from the first step of precipitation to evaporation and finally transpiration. After it snows or a rain, water has two ways to complete the cycle. First, according to Randolph, it infiltrates into soil and contributes to soil moisture, subsurface flow, and groundwater recharge. Second, it contributes to water surface area by increasing the volume of lakes, rivers, oceans, and streams.

Many urban structures (hard surfaces) block water from infiltrating into the soil as the negative effects of urbanization on the hydrologic cycle. This causes drainage and flooding problems and channel erosion downstream (Figure 2.1). Rivers, lakes, and estuaries are at risk in many urban places, because runoff from industries and municipalities pollutes them.

Figure 2.1: (a) The scene of surface runoff after heavy rain in İzmir, Turkey (by authors, 2022); (b) The scene of flooded highways in Detroit, MI, USA after an extreme rain event (Time Magazine Photo, August 12, 2014 3:16 PM EDT, URL-1).

Models of precipitation depend on water division on and under the land. The United States has rainfall data from more than one hundred fifty years. Analytical data help us to predict future possibilities. However, global warming and other conditions also affect the climate; therefore, it will not be possible to predict the future correctly. The water balance among precipitation, infiltration, and runoff depends on the soil texture. If there is no runoff on the ground, it means that the infiltration rate is either in balance with the rainfall rate or is under the capacity. If runoff shows up on the ground, then the rainfall rate is over the capacity of the soil to absorb it.

Surface-water draining depends on the topographic condition, which involves what Randolph calls drainage basins. Topographic maps show perennial streams, intermittent streams, and

watershed delineation. Randolph writes: “Topography affects drainage; drainage also affects topography through the process of geomorphology, the formation of landforms, water erosion and deposition.” The other important point is water quality and pollutants. Land use indirectly affects water quality. Basically, surface runoff carries pollutants in addition to useful materials for aquatic life, such as organic materials and inorganic nutrients. Therefore, 60 to 70 percent of the nation’s waters do not meet the average water-quality standard (Randolph, 2004).

3. FINDINGS

This paper is intended to provide insightful evaluation of published approaches to urban sustainability at various scales. Moreover, the social, economic, technological, and environmental components of human settlements are highlighted to explain how the elements and principles are measured. The tables below were created to explore similarities and differences between the diverse sustainable urban design principles and elements. Key perspectives are categorized to determine common themes in identifying detrimental development patterns (e.g., urban sprawl) and other crucial issues defined within this paper. Successful sustainability can be achieved when a city exists in harmony with the surrounding ecology. Many cities across the globe have tried and are attempting to accomplish this, but often do not follow proven principles and practices. Newman and Jennings claim that “the best innovations in human history have arisen by learning from and modeling natural systems” (2008). Likewise, there is a relationship between the environment and humans, and matters of justice and equity are also a critical part of the socio-ecological system and the attainment of urban sustainability.

	PRINCIPLES AND ELEMENTS OF AUTHORS (ELABORATION)
Beatley, 2000	**Compact City** High density, usage of each piece of land, mix urban villages, existing building and new uses, walking distance, urban neighborhoods **Transportation/High-Mobility Transit City** Car-free center, environmentally friendly cars, underground car parking at edge of center, cycling paths, pedestrian and bicycle mobility, close stations, reduced usage of cars, environmentally friendly traffic, public transportation, mobility smart-card system for all transit **Regional and National Spatial Planning** • City-specific local plan, city-detailed development plan, viability-ascertained and enhanced, development of urbanization, existing interrelated natural/rural, important energy efficiency • Green belts/agricultural preservation policies, level of land-use control, citywide plan **Green and Organic Cities (Ecological)** Natural environment (forests, wetlands, prairies), diversity of plant and animal life, natural systems accessibility, public recreational areas, clean water, ecological

	networks (restore diversity), natural policy plan, green roofs and buildings, green streets, farms and ecological parks, natural drainage strategies (vegetation), climate condition, quality air and water and soil, storm-water systems, urban wildlife, and habitat conservation **Governance and Economy** Techniques, specific actions to reduce environmental impacts, programs, policies, management, develop sustainability indicators, provide environmental budgets and charters, balance the amount of pollution, plan and control, decision making
Farr, 2008	**Density** **Walkable Community** Cherish, celebrate and protect, lively, physically and financially healthy, affordable, sustainable, sociable, safe, car-free cities **Sustainable Corridor** Transportation, biodiversity (protect local habitat), accessibility, TOD, pedestrian oriented, close stations, accessibility to public transport, auto-free neighborhood **Sustainable Neighborhood** Accessibility of working places and shopping center and schools, shared opportunity, connected and completed neighborhood **Open Spaces** Outdoor activities, parks, plazas, walkable open space, storm-water systems, waste treatment, food production **Energy Usage system** High-performance building, infrastructure for energy saving
Kelbaugh, 2002	**Design and Community Planning** Old city development/new uses, different scale, and type of plan for municipalities, reducing automobile usage **Transportation Network System** General transportation, walk and bicycle path **Healthy and Sustainable Ecology** Green building, environmental and solar architecture, open space **Live-Work Units (Mixed Use)** **Good Governance** Smart usage of funds, management, development, policy, being effective on every scale (Region and neighborhood)
McGeough, Newman, and Wrobel, 2004	**Natural Systems** Reduce material and energy consumption, minimize impact on environment, observation of land and water and climate and habitat, analyze environmentally sensitive areas **Land-Use Systems** Existing/proposed development, sustainable land-use planning, ecological and mutually compatible urban land uses, land-use analysis (carrying capacity, topological slopes, access to roads), designation of uses (urban, agricultural, forests, wetlands, barren lands), sustainable urban form (existing central cities and suburban, urban land classification and zoning) **Mobility Systems** Discouraging automobile-dependent urban development, nonmotorized local mobility and public transportation systems, reduce fossil-fueled auto usage, use of existing rail systems **Energy Systems** Clean energy technologies, systems planning, encouraging natural-gas-fired combined-cycle turbines, distributed energy resources (generation tech, combined heating, power, district energy systems, demand response, side management controls, energy efficiency mechanisms) **Environmental Management Systems**

	Control pollution of water and urban solid waste and air, recovered, recycled, composed, municipal wastewater treatment facilities **Building System** Uses of natural light, power, hot water, passive solar heat, uses of solar energy, reducing energy consumption **Governance System** Strong leadership, participatory process, urban form (supported by development, designing, defining), policy, urban form, community development, node by node, district by district
Mostafavi and Doherty, 2010	**Biodiversity** Green roofs, connected green areas **Urban Metabolism** Energy saving, capture and storage of rainwater system, no energy wasted (reducing, reusing, recycling) **Services and Logistics** Distribution of water and gas pipes, electricity, telecommunication, and platform of merchandise, reduce, reuse, recycle **Ecological Footprints** Social, environmental, and economical impact on environment, carbon emission, sewage treatment, energy **Mobility and Functionality** Transportation systems, mass-transit network **Public Space** Open space, pedestrian path **Urban Design and Planning (Ground, underground, Upper)** Compact, complexity, efficient, socially cohesive city model **Density** Land use, more efficient land use, transport, infrastructure, urban analysis
Newman, and Jennings, 2008	**Vision** Social, economic, and political involvement, strong strategy and action program and process **Economy and Society** Develop long-term economic and social security, value and vitality of human and natural system, conserve and renew human, financial, and natural resources, knowledge of economic capacity B**iodiversity** Natural system, bioregion, biosphere **Ecological Footprints** Metabolism of city (material, water, energy) Overconsumption affects limited sources **Modeling Cities on Ecosystem** Includes diversity, adaptiveness, interconnectedness, resilience, regenerative, capacity and symbiosis, productivity and regenerative (social, economic, ecological), strategies of sustainable natural ecosystems and traditional human agreement **Sense of Place** City cultural and historical characteristics structure, people's values, traditions, institutions, and ecological realities, provide mobilization and motivation for human and physical resources of cities, interactive human, political, social, economic, ecological city **Empowerment Participation** Equality and responsibility, increase citizens' awareness of their environment, involvement in development process **Partnership** Require common and sustainable future, clear and open relationship, sharing

	experiences and perspectives and power, require cooperation, connection, and strong network systems (model), cover cities, government, business, community, bioregions **Sustainable Production and Consumption** Eco-friendly technologies, protection and increase in performance, less pollution, recycling, limited usage of resources, changing habits, involvement in process of reenvisioning **Governance and Hope** Political strategies, decision making, transform city to sustainability, new strategies, programs, technologies, determine target, develop cycle, clear, open, and responsible government, built knowledge

Table 3.1: Summary of various sustainability approaches

This study finds that transportation is the most common, and ecological footprint is one of the less common elements (Table 3.2). On the other hand, "vision and partnership" and "modeling cities on ecosystem" are addressed only by Newman and Jennings (2008), and "services and logistics" are covered only by Mostafavi and Doherty (2015). Urban metabolism represents the methods of energy efficiency within a city. The system for capturing and storing rainwater is an example of urban metabolism. Any system that does not allow energy to be wasted, such as reducing, recycling, and reusing energy, would be considered an urban metabolism. Urban complexity and a knowledge of society cause different uses and functions to work together at all three levels (underground, ground, and upper) of urban planning.

According to findings, sustainability for the built environment in terms of settings requires connected and walkable high-performance structures. Therefore, complete streets, stormwater management systems, safe and clean energy sources, and solar and green-roof constructions are required to bring sustainable, contemporary features to the built environment. Looking at the bigger picture, the development strategy, partnerships, organized design, and planning, and described set of proper goals are strengths of successful procedures.

This study also found that surface runoff is one of the important issues needed to be thought carefully for the built environment. If there is no effective drainage system in an urban area, runoff can cause fatality and capital for maintenance. As a result, water-flow changes, landforms, and land-use decisions all affect surface water. Therefore, there needs to be a solution for water management. Moreover, urban designers need to be aware of the effects of surface flow and surface runoff. They need to analyze the precipitation ratio of their study areas. In this case, decision making also includes hydrological knowledge that helps designers to calculate channel capacity and to make strong decisions for stormwater management. In this way, the effects of surface runoff can be reduced.

COMMON	ECONOMICAL/ENVIRONMENTAL/SOCIAL	NON-COMMON
TRANSPORTATION - Beatlery, Transportation/High Mobility Transit City - Farr, Sustainable corridor - Kelbaugh, Transportation Network System - McGeough&Newman& Wrobel, Mobility Systems - Mostafavi&Doherty, Mobility&Functionality	ENVIRONMENTAL FRIENDLY DEVELOPMENT ENVIRONMENTAL	
GOVERNANCE - Beatley, Governance and Ecology - Kelbaugh, Good Governance - McGeough&Newman& Wrobel, Governance System - Newman- Good Governance and Hope	PROVIDE CITY DEVELOPMENT WITHIN SOCIAL & ECONOMICAL & ENVIRONMENTAL	
SUSTAINABLE PLANNING&DESIGN - Beatley, Regional&National Spatial Planning - Kelbaugh, Design&CommuniEty Planning - McGeough&Newman& Wrobel, Land Use Systems - Mostafavi&Doherty, Urban Design&Planning	FOCUS ON SOCIAL& ENVIRONMENTAL DEVELOPMENT	**Newman & Jennings** **- Vision&Partnership** **- Modeling cities on ecosystem**
ENERGY SYSTEMS - Kelbaugh, Energy Usage Systems - McGeough&Newman&Wrobel, Energy Systems - Mostafavi&Doherty, Urban Metabolism - Newman&Jennings, Sustainable Production&Consumption	PRIMARILY SOLUTION FOR ENVIRONMENTAL ISUES, ECO-FRIENDLY ENVIRONMENTAL	
OPEN SPACE - Beatley, Green&Organic Cities - Farr, Open Spaces - Kelbaugh, Healthy&Sustainable Ecology - McGeough&Newman&Wrobel, Natural Systems - Mostafavi&Doherty, Public Space - Newman & Jennings, Modeling Cities on Ecosystem	NATURAL ENVIRONMENT ORIENTED - PROVIDE SOCIAL ACTIVITIES ENVIRONMENTAL& SOCIAL	
NATURAL SYSTEMS - Kelbaugh, Healthy&Sustainable Ecology - McGeough&Newman&Wrobel, Natural systems - Newman & Jennings - Economy&Society	ENVIRONMENTAL PROTECTION ENVIRONMENTAL	
DENSITY - Beatley, Compact City - Farr, Density - Mostafavi&Doherty, Density	EFFICIENT LAND-USE ENVIRONMENTAL	
MIX-USE - Beatley, Compact City - Farr, Sustainable Neighborhood - Kelbaugh, Live-Work units(Mix-use)	CONSCIOUS LAND USE DESIGN&PLANNING ENVIRONMENTAL & SOCIAL	
SENSE OF PLACE - Farr, Walkable Community - Newman & Jennings, Sense of Place	SOCIAL & ENVIRONMENTAL& ECONOMICAL	
ENERGY SAVING -Farr, Energy usage system - McGeough&Newman&Wrobel, Building system	ECONOMICAL&ENVIRONMENTAL	**Mostafavi&Doherty** **- Services&Logistic**
BIODIVERSITY Beatley, Green roof Building - Mostafavi&Doherty, Biodiversity - Newman&Jennings, Biodiversity	PROTECTION OF NATURAL ECOSYSTEM ENVIRONMENTAL	
PARTICIPATION - McGeough&Newman&Wrobel, Governance System - Newman, Empowement&Participation	BASED ON PEOPLE INVOLVEMENT TO PROCESS SOCIAL	
ECOLOGICAL FOOTPRINTS - Mostafavi&Doherty, Ecological Footprints - Newman, Ecological Footprints	PRESERVE THE NATURAL RESOURCES FROM HUMAN ACTIONS ENVIRONMENTAL	

Table 3.2: Comparison of sustainability approaches

4. CONCLUSION

The world is now more focused on sustainability, and due to population, cultural, economic, and technological concentrations, cities are increasingly the laboratories for new theory and practice. From the UN to the neighborhood, governmental, NGO, and business entities are focusing on identifying successful approaches to achieve urban sustainability. This paper aims to analyze and evaluate various approaches and determine common and uncommon parameters

of sustainable urbanism as they relate to the built environment. Approaches provided in this paper also focus on dissimilar cities around the world, with attempts to identify those experiences theories, and practices which prove applicable as shared paradigms. While diverse solutions can be produced for the built environment in terms of form, sustainable urbanism requires determining a comprehensive and holistic approach which addresses complexity and all the elements (contains all the principles). Findings show that even one missing parameter could still be enough to impede the goal. In addition, constructing one single energy efficient building is not an adequate solution to creating healthy and livable environments - protagonists must go "beyond the building" to achieve urban sustainability. The built environment must (should) be part of a mixed-use, biodiverse, dense (including public realm), transit-oriented settlement by providing connectivity, walkability, and accessibility through a universal design approach. Different knowledge bases can provide advantages in order to solve, design, manage, preserve, maintain, and evaluate urban characteristics and elements. Consequently, a successful sustainable urbanism (urban design proposal) relies on the integration of all components and their effect on the city to form a desirable, dynamic, and sustainable environment for present and future generations.

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