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Promoting User Well-being in Central Business District: The Role of Sustainable Open Spaces

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ABSTRACT

Sustainable Open spaces are the heart of every community. They play a great role in connecting people with places. This connection should be considered by every urban designer and architect, especially in the Central Business District (CBD), which is the core of this study. CBDs often face several challenges such as high-density usage and limited open spaces that can serve people. This research aims to define how the design of sustainable open spaces can contribute to the physical, social, and environmental well-being of users and achieve Sustainable Development Goals (SDGs): 3 – "Good Health and Well-being" and 11 – "Sustainable Cities and Communities". In addition to highlighting the main aspects of sustainable urban design elements and user needs for enhancing well-being. Exploring the relation between these two domains as well as identifying their elements and indicators to define the most suitable sustainable design considerations exclusively for open spaces in CBD. The research's methodology adopts a detailed analysis of both international and national case studies, which offers a comparative and contextual understanding of open spaces in different urban settings. In addition to validating the effectiveness of this strategy through urban analysis and questionnaire for users of CBD. Together, they are all used to develop an evaluation matrix to identify the relationship between design elements and their role in transforming open spaces in CBDs to places that can enhance users' well-being and achieve sustainability goals. The research proves that well-designed sustainable open spaces can serve as vital components in healthy urban environments, significantly contributing to the overall quality of life and satisfaction of individuals in CBDs.

Index-words: *User Well-being, Sustainable Open Spaces, SGDs, Urban Design, Central Business Districts.*

I. INTRODUCTION

The Central Business District (CBD) is the vital core of any urban context, which operates as a dynamic hub where business, urban life, and the decision-making process intersect. Cities are rapidly changing, and CBDs continue to evolve into more complex and vibrant spaces. Yet as retail, office, and commercial land uses generate high land values and activity density, the design of sustainable open spaces is often given minimal attention although they form a high percentage of every land which sometimes exceeds the percentage of buildings' footprint. These sustainable open spaces within the CBD have the potential to contribute to the overall well-being of individuals by providing opportunities for physical activity, relaxation, social interaction, and connection with the urban context [1].

The insightful quote from Gehl (2013), "First we shape the cities – then they shape us," highlights the profound impact urban environments can have on its users, which urges the crucial need for thoughtfully designed open spaces. The implications of the oversight of these open spaces are extensive for the overall social, physical, and environmental health of urban citizens.

According to Sustainable Development Goal no. 3 (SDG 3), "Good Health and Well-being" and no. 11, "Sustainable Cities and Communities" together they emphasize the need for creating urban areas that are inclusive, safe, resilient, and sustainable. In these new urban precincts, open spaces have a lead role that supports user well-being, serves a diversity of users, and enhances community interaction, physical health and environmental sustainability which are deemed pivotal. The importance of open spaces in urban areas has been recognized in various studies, highlighting their role in promoting physical activity, reducing stress, fostering social interactions, and enhancing well-being [2]. As urban

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cores continue to grow and evolve, prioritizing the well-being of individuals within these areas becomes increasingly paramount, making this an important area of study.

This research investigates the urban design aspects of these sustainable open spaces that are vital in fulfilling users' well-being needs and seeks to address a significant void in urban design literature. The study aims to articulate the sustainable design of open spaces within the CBD in Egypt which will fulfill the users' well-being needs and constitute its urban form and function. In addition, the significance of this study lies in establishing for the first time the direct links of the relationship between users' well-being and the design of sustainable open spaces within CBDs. It therefore broadens the urban design literature by describing the users' well-being and their spatial and functional needs for sustainable open spaces in CBDs.

Following this manner, analysis for international and national case studies was proposed to develop an evaluation matrix consisting of the two main domains: the urban design aspects of sustainable open spaces and the users' well-being needs. This matrix will not only enhance one's understanding of the critical role of sustainable open spaces in CBDs but also guide future urban design efforts to create healthier, more vibrant, and more sustainable urban environments.

II. CENTRALBUSINESS DISTRICT 'CBD'

CBD, short for Central Business District, serves as the core of a city and is commonly known as downtown or the city center. Originally proposed by E. W. Burgess, an American urban geographer, in 1923, the concept was introduced within his well-known model featuring concentric circles outlining the regional structure of a city [3]. The CBD represents the core of the city, providing optimal accessibility, extensive commercial and banking sectors, as well as governmental establishments. Positioned at the central hub of the city, the CBD is strategically situated for easy access via major rail and road routes, making it the primary focal point for both pedestrian and vehicular traffic. CBD is the hub for offices, banks, shops, and culture and entertainment activities [3].

Characteristics of the city center or CBD make it the most important zone of the city influencing and controlling the morphological form of the city and its expansion [4]. CBD is typically located in the heart of the city' near its oldest part and at the convergence of major road and railway networks, epitomizes urban accessibility and prime location. Its strategic position ensures easy reach from all city areas, making it a magnet for retail outlets and a focal point of the public transport system. This prime location fosters intense competition for space, resulting in exceptionally high land and rent values. Consequently, the CBD is marked by its high-rise architecture, with the tallest buildings often found here due to the premium on land use. However, the CBD is not a monolithic urban space; it boasts a diversity of activities and recreational areas. This internal specialization means that different functions, such as shopping districts, theaters, cinema halls, and entertainment venues, develop their concentrated areas, benefiting from proximity to similar establishments and the ability to attract a large customer base [5] [4].

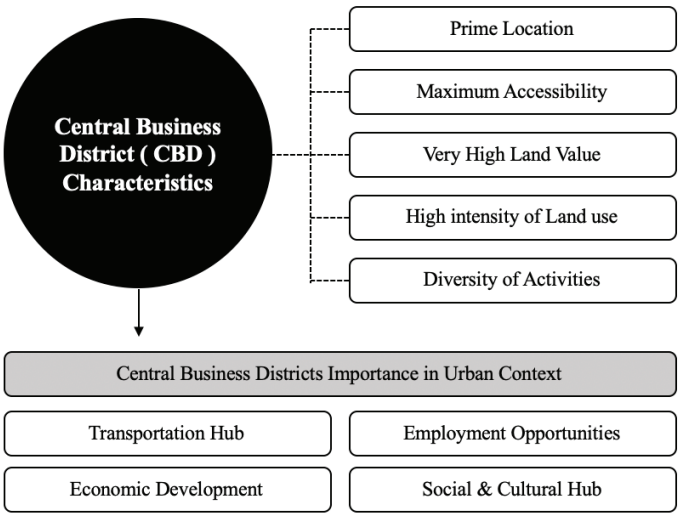

Fig. 1: CBD characteristics and importance
Source: Author

A. Evolution of CBD in Egypt

The evolution of Egypt's CBD reflects the dynamic growth and the changing urban design of the country. Historically centered around downtown Cairo, characterized by its bustling streets and iconic landmarks, the CBD has undergone a transformative shift towards a multi-core model shown in Figure 3. The emergence of west and east Cairo as prominent business hubs signifies a departure from the traditional single-city in Figure 2. This new prototype of the CBD admits the need for decentralization and accommodates the expanding business activities in different regions of the capital. The decentralization trend aims to alleviate congestion, enhance accessibility, and foster economic development across diverse areas, contributing to a more balanced and resilient urban environment. As multiple cores continue to develop, Egypt's CBD is evolving into a networked system that strategically distributes economic activities, thereby shaping a more sustainable and inclusive urban design.

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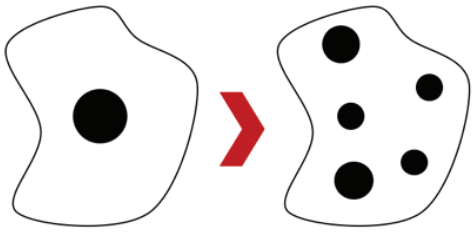
Fig. 2. Egypt Layout



The sketch above illustrates the evolution of central business districts (CBDs) in a city, from a single CBD to a city with multiple, diverse CBDs

Fig. 3. New Pattern Of CBDs

2.2 Challenges Facing CBDs

The challenges facing the CBD urban design include:

- Traffic Congestion: CBDs often tackle high levels of traffic congestion due to a concentrated number of users, leading to inefficiencies and lost economic productivity [6].
- Air Quality: The high density of vehicles and urban activities in CBDs can lead to poor air quality, posing health risks and reducing the quality of life [7].
- Crime and Security: Perception of crime and actual safety concerns can deter people from visiting or working in CBDs, impacting businesses and property values [8].
- Parking Availability: Limited parking due to high land use can result in a scarcity of convenient parking, further exacerbating traffic congestion [9].
- High Land Values Elevated land prices in CBDs can limit the development of open spaces, contributing to social inequality [10].
- Noise Pollution: The concentration of commercial activity and traffic in CBDs leads to high levels of noise, impacting the well-being of residents and workers [11].
- Social Inequality: The focus on commercial development in CBDs can overshadow the needs of users, leading to improvement and displacement [12].
- Lack of Open Spaces: In many CBDs, the emphasis on building development has come at the cost of open spaces, which are crucial for social interaction and recreation [13].

III. SUSTAINABLE OPEN SPACES 'MORE THAN JUST A SPACE'

Urban sustainable open spaces are vital components of the urban environment, providing areas for social interaction, recreation, and ecological functions within cities. These spaces include a variety of public areas such as parks, gardens, plazas, green belts, and natural landscapes integrated within urban settings. The definition of urban open spaces is multifaceted, reflecting their diverse functions and forms. They are often characterized by their accessibility to the public, their contribution to the aesthetic and cultural aspects of urban life, and their role in improving environmental quality. Urban sustainable open spaces serve as crucial elements for urban planning and development, offering benefits such as enhancing the quality of life and contributing to the well-being of urban users [14]. Considered the living room of any city, these spaces serve as places where people gather to enrich their social lives, contributing to a higher quality of life in the city.

A. Open Spaces within CBDs

In the context of CBDs, urban open spaces such as parks, plazas, squares, and pedestrian walkways are essential for creating a balance between the built environment and natural elements. These spaces in CBDs serve as crucial green lungs, providing residents, workers, and visitors with areas for relaxation, socialization, and engagement with nature within the urban hustle [15]. The integration of such open spaces is vital for enhancing the livability and sustainability of CBDs, offering benefits like improved air quality, reduced urban heat island effect, and increased biodiversity [16]. Furthermore, these areas have been recognized for their role in improving well-being and fostering community interaction in urban settings [17].

B. Urban Design Elements of Sustainable Open Spaces

This section explores urban design elements of sustainable open spaces supported by many experts, it outlines key design elements such as accessibility, safety, comfort, and engagement with nature, which are essential in cultivating open spaces that serve as catalysts for healthy urban living. The characteristics identified in this section are not merely theoretical ideals but are grounded in a growing body of research that underscores the tangible benefits of well-conceived open spaces.

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Table I
Open Space Characteristics. (Source: Author)

Characteristics	Reference 01: Smith 2020	Reference 02: Johnson 2019	Reference 03: Lee 2021	Reference 04: Davis 2018	Reference 05: Patel 2022
Accessibility	Easy access for all	Wheelchair accessibility	Proximity to public transit	Well-defined entry points	Safe pedestrian pathways
Connectivity	Network with other public spaces	Links to urban amenities	Bicycle friendly paths	Access to public transportation	Integration with the neighborhood
Usability	Flexible space for events	Suitable for all age groups	Areas for both active & passive use	Durable materials for high-use	Technology integration for convenience
Safety	Good lighting	Emergency services access	Visible security presence	Low crime rate areas	Well-maintained facilities
Comfort	Adequate & art	Shade & shelter	Clean restrooms	Quiet zones for relaxation	Temperature control features
Aesthetic	Landscaping & art	Natural elements integration	Harmonious design with surroundings	Seasonal decorations	Unique architectural features
Amenities	Water fountains	Food & beverage options	Restrooms and first aid stations	Children's play area	Fitness equipment
Green spaces	Native plant species	Eco-friendly maintenance	Community garden areas	Biodiversity support	Sustainable water features
Sustainability	Renewable energy sources	Waste recycling facilities	Eco-friendly materials	Water conservation practices	Energy-efficient lighting
Sociability	Spaces for social gatherings	Community event hosting	Areas for group activities	Welcoming layout for meeting friends	Family-friendly environment

The unique methodology of Jan Gehl Architects is based on the principle that people are the most important priority of public space in the process of planning cities. Public space should be a place for everyone that includes unique qualities and benefits of a particular urban environment, open to a variety of activities and opportunities [13].In his books, such as "Life Between Buildings" and "Cities for People," Gehl emphasizes the following characteristics as essential for good open spaces:

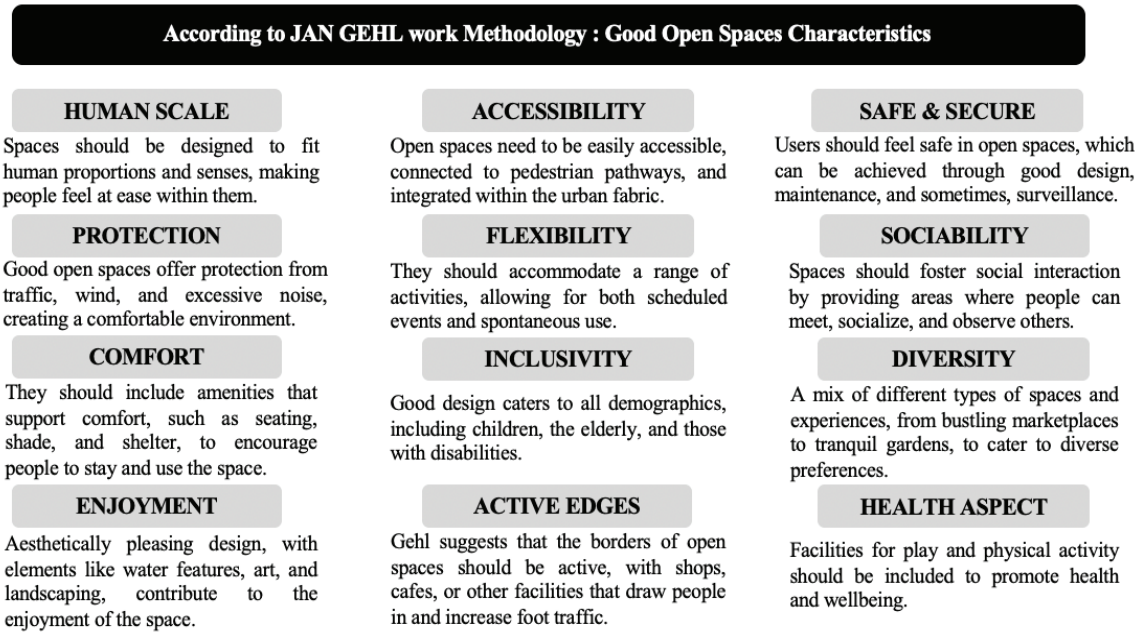

Fig. 4. Open spaces design elements according to Jan Gehl

Gehl's approach to urban design is user-centric, focusing on enhancing the quality of life by making cities more livable, sustainable, and healthy through well-designed open spaces.

IV. WELL-BEING

Well-being, a multifaceted concept allowing for diverse interpretive approaches, is generally defined as a state of happiness, health, or prosperity [18]. It is a valuable aspect of life, often influenced by living conditions and circumstances. Various fields of study, including philosophy [19], social sciences [20] and psychology, have explored the concept of well-being. In psychology, a notable framework is Maslow's Hierarchy of Needs (1981) which suggests that people satisfy a series of needs in a specific order, from basic survival needs at the bottom of the hierarchy to self-actualization needs at the top. Maslow theorized that a person cannot pursue a higher need until the current one is met. In the context of urban design, Mehan and Soflaei equate human needs with those in Maslow's hierarchy, translating these needs into spatial qualities projected into space design.

A. User's Well-being Needs

The wellness wheel illustrates a wellness model with eight dimensions: social, physical, emotional, occupational, spiritual, intellectual, environmental, and financial. All of the dimensions are interconnected and important to a well-rounded and balanced lifestyle [21]. This research focuses on three dimensions of the Well-being Wheel Physical, Social, and Environmental Well-being that can be achieved through the good design of open spaces within CBD.

- ***Social Well-being Needs***

The social dimension encourages connecting with others and contributing to one's community, with the understanding that satisfying relationships are basic to physical and emotional health [22]. Enhancing social well-being in open spaces involves creating environments that facilitate positive social interactions, community engagement, and a sense of belonging. Here are key considerations to meet user needs and promote social well-being in open spaces: seating arrangements, gathering spaces, plazas and community squares, cultural & art installations, outdoor cafes, and event spaces.

- ***Physical Well-being Needs***

Physical well-being is the ability to maintain a healthy and balanced life without physical limitations, physical stress, and excessive fatigue [22]. The World Health Organization [7] defines physical well-being as being a key factor when it comes to one's overall health. Meeting user needs in open spaces to enhance physical well-being involves thoughtful planning, design, and maintenance of these spaces. Here are key considerations to ensure open spaces effectively contribute to the physical well-being of users: Accessibility, safety and security, diversity of activities, greenery and natural elements, seating areas, landscape, and fitness facilities.

- ***Environmental Well-being Needs***

The environmental dimension encompasses a healthy relationship with the earth and its resources, as well as fostering a positive connection with one's immediate surroundings. It entails grasping the interactive link between the environment and individuals and acknowledging one's accountability for the quality of the air, water, and land that envelops man. Simultaneously, it recognizes the impact of social, natural, and constructed environments on one's health and overall well-being. One's environment and one's sentiments towards it significantly influence one's lifestyle and engaging with natural settings can contribute to enhancing one's overall well-being [22].

A. Importance of Well-being & Sustainable Development

The nexus of well-being, urban design, and sustainable development in open spaces within CBD is increasingly recognized as vital for the holistic health of individuals and communities. Sustainable urban design is pivotal in crafting spaces that support physical, social, and environmental needs for enhancing well-being, aligning with the broader goals of sustainable development to foster resilient, inclusive, and environmentally responsible urban environments [23]. Well-designed open spaces encourage physical activity, provide opportunities for social interaction, and facilitate a connection with nature, all of which are crucial components of well-being [24]. Furthermore, these sustainable open spaces offer ecosystem services such as improved air quality and natural cooling, contributing to the environmental dimension of sustainability. By integrating sustainability principles, urban design can address the needs of present and future generations, promoting well-being through the creation of livable cities that balance ecological integrity with human health and happiness [25].

V. RESEARCH METHODOLOGY

This study consists of a two-part methodology to explore the impact of open spaces on user well-being in CBDs.

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A. Theoretical Framework

- **Literature Review**

CBDs: Research the characteristics, challenges, and dynamics of CBDs. Focus on aspects of economic activities and urban design. Sustainable Open Spaces: Define open spaces in the context of urban environments, especially in CBDs. Explore characteristics and their roles in urban ecology and social interactions. User Well-Being: Investigate how well-being is defined and should have more attention in urban studies. Include physical, social, and environmental needs. Impact of Sustainable Open Spaces on Well-Being: Synthesize existing research on how open spaces influence well-being in urban settings, focusing on CBDs.

- **Evaluation Matrix**

Matrix Creation: Develop an evaluation matrix from the literature review and analysis of international cases. This matrix should outline key design elements of sustainable open spaces and their potential impacts on user well-being.

B. Empirical Research

- **Analysis of International Case Study**

International Case Study: Select exemplary CBDs where open spaces have been integrated effectively. Analyze the design, usage, and impact on physical, social and environmental well-being.

- **Analysis of National Case Study**

Selection of a National Case Study: Choose one of the new prototypes of CBD with notable open spaces for an in-depth case study. This should ideally be a location where substantial changes in open space design have been implemented.

Data collection tools used employed both primary and secondary tools. The primary tools included: On-site observations through twenty field trips to selected CBDs to indicate the design of open spaces using the well-being indicators deduced from stage one. Eight trips were made on weekends (Four trips in the day and four trips at night). The other twelve trips were done on the weekdays (six trips a day and six trips at night).

The secondary tools included a questionnaire distributed for the National Case Study Arkan Plaza.

- **Filling the Matrix**

Application of Findings: Use the literature review data, the empirical data from the case study, Observation, and results of the questionnaire to fill the evaluation matrix. This should help in identifying which design elements are most effective in enhancing well-being.

Comparative Analysis: Compare these findings with the initial literature review to validate or challenge existing theories to set the most important design elements for sustainable open spaces based on user well-being.

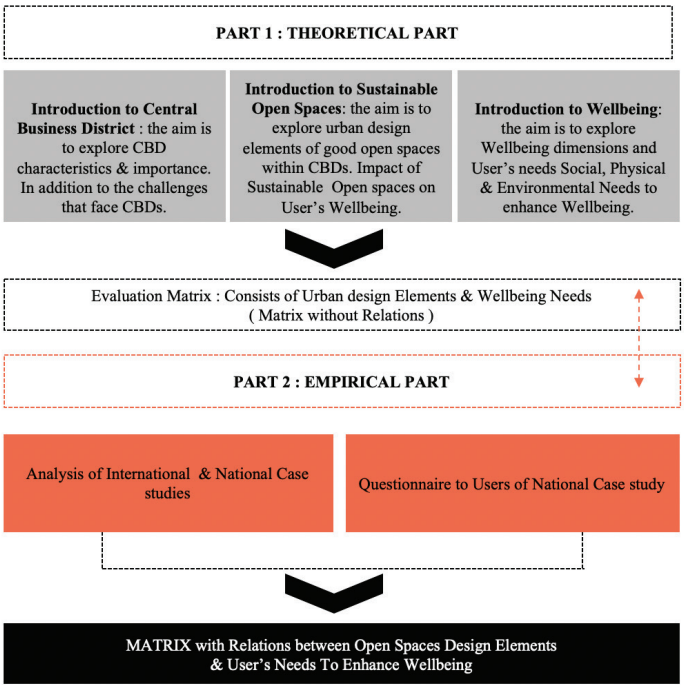

Fig. 5. Research methodology
Source: Author

VI. EVALUATION MATRIX AS A TOOL: RELATIONSHIPS BETWEEN OPEN SPACES AND USER'S WELL_BEING

As mentioned before, stage one of this study is concerned with identifying indicators for measuring the impact of open space design and user well-being especially in CBD, According to the literature review, open space can be classified in terms of space characteristics as compatibility to surroundings, location, comfort, legibility, flexibility, continuity and enclosure, active façade, diversity of activities, landscape elements, accessibility, circulation, services, safety and security and sociability, while the well-being indicators and user needs within the open spaces of the following categories: Physical Well-being, Social Well-being, and Environmental well-being are shown in table II.

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TABLE II
MATRIX (Source: Author)

Evaluation Matrix ; Relationships between CBD Design and the User Needs & Wellbeing

● Strong Relation
◐ Moderate Relation
○ Weak Relation

WELLBEING INDICATORS		URBAN DESIGN ELEMENTS										Landscape Elements						Space Accessibility				Circulation & Legibility			Amenities				Safety & Security		
		Compatibility to Surroundings	location	Comfort	Flexibility	Continuity & Enclosure	Inclusivity	Human Scale	Active Edges	Active Building facades	Diversity of Activities	Green Spaces	Outdoor Furniture	Shaded Areas	Lighting Arrangement	Landmarks	Water Features	Vehicles	Public Transportation	Pedestrian	Cycling	Connected Pedestrian Paths	Cycling Lanes	Entry & Exist Nodes	Public Toilets	Parking	Cafes & Restaurants	Management & Maintenance	Signs for ease movement	Suitable Lighting	surveillance
Physical Needs	Promote safe Walking																														
	Promote Sport Activity																														
	Promote Cyclying																														
	Access to green spaces																														
	Access to recreational facilities																														
	Access to Eat & Drink																														
Social Needs	promote Safety & security																														
	Access to Gathering Events																														
	Promote Social interaction																														
	promote a sense of attachment to place																														
	Easy access to resources																														
Environmental Needs	Protect biodiversity																														
	promote shading areas																														
	Keep space clean																														
	Reduce Noise pollution																														
	Availability of green spaces																														

VII. CASE STUDIES

Two case studies were selected: An international case study and a national case study provided that each case study meets the criteria for designing open spaces within CBD. Certainly, the requirements and needs of the user within the open space are carefully considered in general and indicators for better well-being. The study is analyzed through the observation and documentation of the open spaces within CBD using the concluded criteria of analysis from the matrix review in terms of the open spaces' design elements. Besides, the study analysis of the user needs to enhance physical, social, and environmental well-being. Later, this helps identify the nature and components of the open spaces and the requirements to be considered when dealing with or designing an open space with the help of urban design elements.

The selection criteria for urban open spaces in CBDs, aimed at enhancing user well-being, prioritize spaces that are integral to the health, happiness, and vitality of the urban spaces. These criteria include:

1. Accessibility: Open spaces must be easily reachable by pedestrian, cycle, and public transportation, ensuring that all user types can access these spaces.
2. Diversity of Use: They should offer a variety of functions and facilities to cater for different activities, such as leisure, exercise, social gatherings, and cultural events, encouraging varied and regular use.
3. Safety and Security: The area should be designed to feel safe at all hours, with adequate lighting, visibility, and potentially, surveillance measures.
4. Environmental Quality: The space should contribute to environmental health, incorporating greenery to mitigate air pollution and urban heat island effects, and providing the feeling of comfort.
5. Social Interaction: Design elements should facilitate social behavior, with seating arrangements and open areas that encourage gatherings and community-building activities.
6. Aesthetic Appeal: The design should include elements that enhance the beauty and character of the CBD, making the space inviting and uplifting for users.

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A. International Case Study: Exchange Square, Broadgate CBD in London

CATEGORIES: **URBAN & LANDSCAPE**
DESIGNER: **DSDHA**
CLIENTS: **British Land**
SIZE: **6,000 sqm**

Introduction for Broadgate CBD
Broadgate is a 32-acre pedestrianized estate, formerly the site of Broad Street Railway Station, featuring office buildings, shops, and facilities. Conveniently located next to Liverpool Street station and within walking distance to Shoreditch, Old Street, and Spitalfields, it is a preferred location for many businesses. The estate is planning a 6,000-square-meter park that will feature a water element, a new restaurant, and an event space.

Broadgate is a 32-acre pedestrianized estate, formerly the site of Broad Street Railway Station, featuring office buildings, shops, and facilities. Conveniently located next to Liverpool Street station and within walking distance to Shoreditch, Old Street, and Spitalfields, it is a preferred location for many businesses. The estate is planning a 6,000-square-meter park that will feature a water element, a new restaurant, and an event space.

Fig. 6. Master plan
Source: DSDHA

Fig. 7. Exchange Square
Source: DSDHA

Project Aim:

HEALTH AND WELL-BEING form a vital part of the investment in Broadgate to create an environment that brings people together to work, shop, drink, and dine.

The Broadgate development serves as a compelling case study in the successful application of urban design principles to enhance user well-being. The project's success can be attributed to its emphasis on key open space indicators such as accessibility, character, diversity, legibility, safety, and comfort. Broadgate's strategic location adjacent to Liverpool Street station and within walking distance to Shoreditch, Old Street, and Spitalfields, ensures high accessibility as shown in Figure 8, making it a preferred choice for many businesses. The character of the space is defined by its unique blend of office buildings, shops, and facilities within a pedestrianized estate as shown in Figure 9 that was once the site of the Broad Street Railway Station.

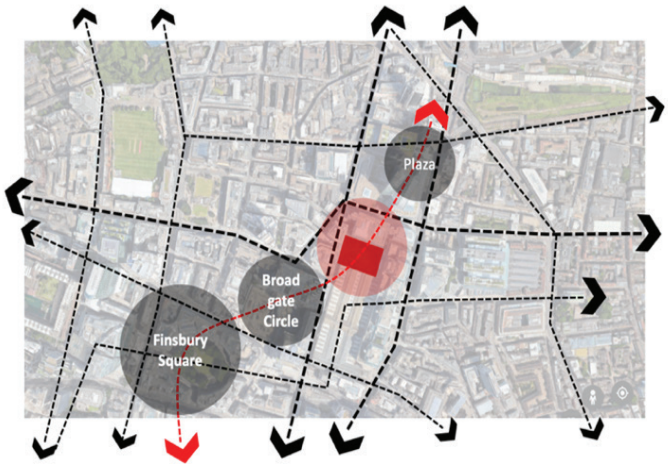

Fig. 8. Accessibility layout
Source: Author

Fig. 9. Main Plaza in Exchange Square
Source: DSDHA

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Physical Needs: The square provides pedestrian-friendly pathways, promoting safe walking and potentially dedicated lanes that encourage cycling, contributing to active transportation. It may feature open areas or equipment for physical activities, fostering sport and exercise in an urban setting. Providing a diversity of amenities such as cafes, restaurants, and restrooms within the space, as well, the square is near Broadgate Circle as shown in Figure 8 which has commercial and retail activities around the square that can offer convenient access to food and drink, serving user needs.

Fig. 10. Main Plaza at night
Source: DSDHA

Fig. 11. Liverpool station
Source: DSDHA

Social Needs: The design of Exchange Square probably includes seating arrangements and gathering spaces that promote social interaction and facilitate community events, which are crucial for social well-being as shown in Figure 10. The square includes features like public art, water features, and performance spaces, which can enhance the social environment, fostering engagement and a sense of attachment to the place. The layout design provides easy accessibility, legibility, and safety feelings for users as shown in Figure 11.

Environmental Needs: The inclusion of greenery through landscaping or the presence of trees can help protect biodiversity and offer shading areas as shown in Figure 12, enhancing environmental quality and user comfort. Maintenance protocols aim to keep the space clean, contributing to both environmental stewardship and the users' sense of well-being. Measures to reduce noise pollution, such as the strategic placement of vegetation and water features as illustrated in Figures 13 and 12, create a more tranquil urban atmosphere. The availability of green spaces within Exchange Square can offer users a connection to nature, which is known to have several benefits for mental health and overall well-being.

Fig. 12. Main Plaza at night
Source: DSDHA

Fig. 13. Liverpool station
Source: DSDHA

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Exchange Square stands as a good model of how urban open spaces within CBDs can significantly contribute to enhancing user well-being. Its strategic design links accessibility, safety, and a connection to nature, addressing the physical, social, and environmental needs of its users. Through its commitment to inclusivity and quality of space, Exchange Square does not only support the vitality of the CBD, but also elevates the urban experience, affirming the essential role of well-designed open spaces in the health and happiness of city residents.

B. National Case Study: Arkan Plaza in Cairo

LOCATION: AL SHEIKH ZAYED, GIZA, EGYPT.
SCOPE: URBAN & LANDSCAPE
SCALE: 260,000 m2.
OWNER: BADER ELDEIN DEVELOPMENT

INTRODUCTION FOR ARKAN CBD

Arkan was Established by El Badr Commercial Development in 2012. Arkan Plaza is a prominent mixed-use commercial project encompassing offices, clinics, retail establishments, and restaurants. Over time, Arkan has transformed into the principal commercial and social hub in West Cairo, centrally located in the heart of Sheikh Zayed.

Fig. 14. Arkan Plaza
Source: Author

Fig. 15. Arkan Main Plaza
Source: Savills

Arkan Plaza, located in the heart of Sheikh Zayed, Egypt, serves as a model of a CBD that prioritizes user well-being through thoughtful design of open spaces. Arkan Plaza has quickly become a significant commercial and social destination in the city. Arkan Plaza is a highly accessible location, it is surrounded by Main Streets from all three sides, and one side is attached to another project. The Main Highway (26th of July Corridor), El Bostan Road & El Zouhor Road as shown in Figure 16.

Fig. 16. Arkan location
Source: Author

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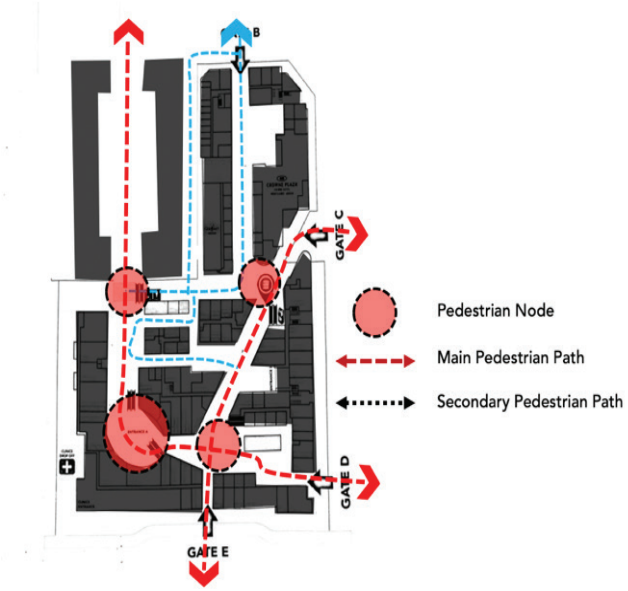

Fig. 17. Circulation at Arkan
Source: Author

Physical Needs: The design of the Plaza emphasizes accessibility by continuity of pedestrian paths and nodes as shown in Figure 17, with a variety of shops, kiosks, and restaurants catering to diverse needs of users from food, beverage, clothing, and fashion to gifts, and antiques, making it a convenient one-stop destination for visitors. The character of Arkan Plaza is defined by its architectural design, which strikes a balance between modernity and timeless elegance. Lighting arrangement in open spaces and high-quality materials creates a visually stunning environment that enhances the overall user experience and promotes safe walking at night as shown in Figures 18 and 19.

Fig. 18. Main plaza at night
Source: Author

Fig. 19. Lighting at night
Source: Author

Social Needs: The Plaza provides diversity. It houses a mix of commercial and office spaces, and its culinary offerings range from high-end restaurants to coffee shops as shown in Figure 18. This diversity does not only cater for a broad variety of tastes but also contributes to the vibrant and dynamic atmosphere of the Plaza. Providing gathering spaces, common areas, and seating encourages socialization, allowing for meetings and community bonding as manifested in Figure 20. As for the event venues, the Plaza may host event spaces for cultural, entertainment, leisure, or market activities that bring people together as shown in Figure 21.

Fig. 20. Main Plaza at night
Source: Author

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Fig. 21. Night events at Arkan
Source: Author

Environmental Needs: Arkan Plaza prioritizes safety and comfort. The Plaza is designed to be a welcoming and secure environment where visitors can relax and enjoy their time. As for the sustainable practices, the Plaza incorporates sustainable design elements such as energy-efficient lighting and design features likely to address the hot Egyptian climate with shading devices, water features, and environment-friendly material to cool the environment as shown in Figures 21 and 23.

Fig. 22. Shading device for main pathway
Source: Author

Fig. 23. Comfort shaded pathways
Source: Author

VIII. QUESTIONNAIRE RESULTS

A comprehensive questionnaire was distributed to users of Arkan Plaza in Egypt, to evaluate their well-being in the open spaces within the mixed-use complex. The survey, which was conducted over five months from October 2023 to February 2024, garnered a total of 100 responses. The distribution of the questionnaire at different times ensured a diverse range of insights reflective of various user experiences. Before the full-scale survey, a pilot study was executed to refine the questionnaire, ensuring that the questions effectively seized the relevant aspects of well-being as experienced by the users of Arkan Plaza. The primary objective of this questionnaire was to assess how these open spaces contribute to the physical, social, and environmental well-being of the individuals who frequent them, thus providing a data-driven foundation for further enhancements to the urban design of Arkan Plaza.

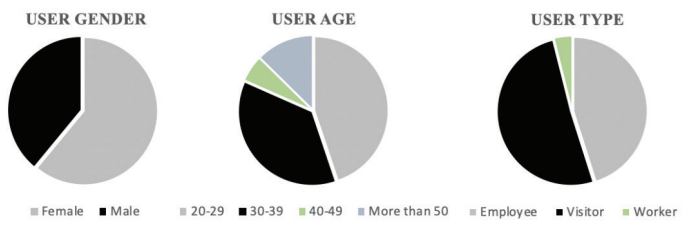

Fig. 24. User Gender, User Age & User Type
Source: Author

User Gender: This chart is split into two categories, showing the distribution between Female and Male users. The chart indicates a larger segment for females 61% of users compared to Male users.

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User Age: The largest portion of users falls within the 30-39 age group, followed by the 20-29 age group. The 40-49 and more than 50 age groups make up a smaller portion of the users.

User Type: The final chart categorizes users into three types: Employee, Visitor, and Worker. The Visitor segment appears to be the most significant 52%, followed by Employees 46%, with Workers being the smallest group.

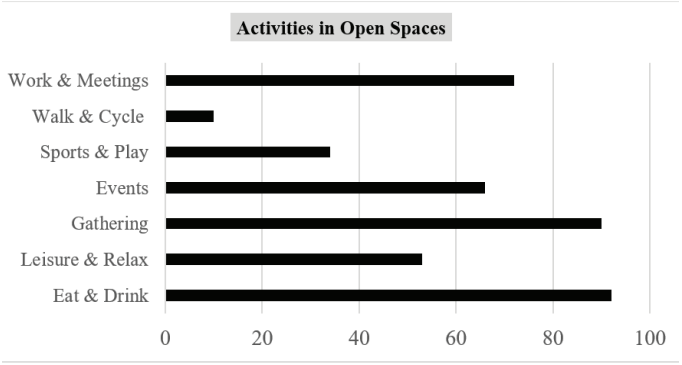

Fig. 25. User Gender, User Age & User Type.
Source: Author

'Eat & Drink' activities emerge as the most popular, suggesting that open spaces serve not only as places of leisure but also as social hubs where food and beverages play a significant role in the user experience. Following closely is 'Gathering', which indicates these areas are vital for community engagement and social events. 'Work & Meetings' also scored notably, revealing that open spaces are increasingly to have formal interactions and professional exchanges. 'Leisure & Relax' activities are surprisingly less common than one might expect, possibly due to the multi-use nature of these spaces that prioritize more active and social uses. Meanwhile, 'Walk & Cycle' activities are the least engaged in, perhaps reflecting a need for better infrastructure to support these modes of movement or a user preference for more stationary activities in such environments as shown in Figure 23.

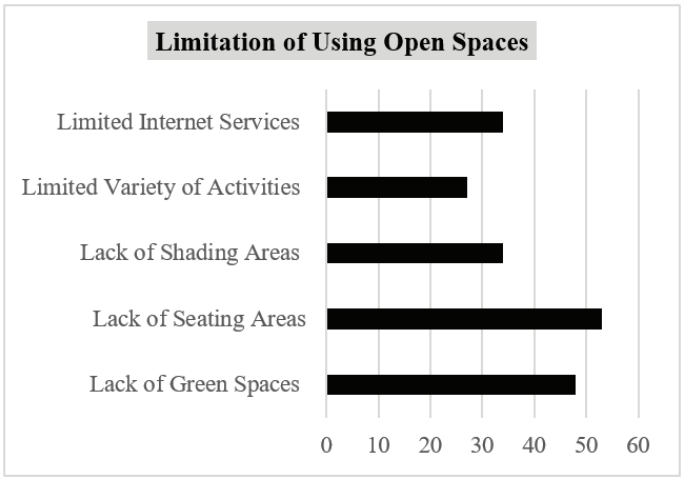

Fig. 26. Limitations of open spaces
Source: Author

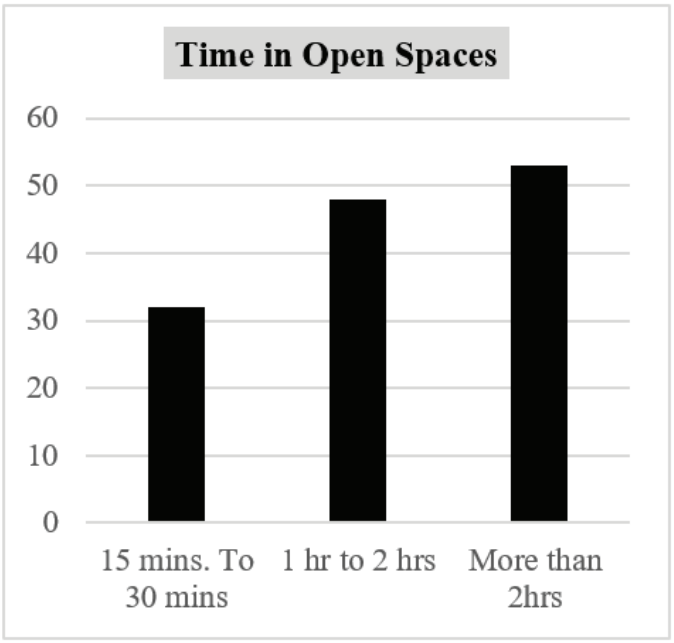

Fig. 27. Time in open spaces
Source: Author

The first graph, "Limitations of Open Spaces," Figure 24, lists factors that limit the duration of stay in these areas. Each factor has a bar associated with it, indicating the relative impact it has on limiting user stay. It appears that the lack of seating areas is the most significant limitation, followed by the lack of shading areas, and a limited variety of activities. The second graph, "Time in Open Spaces," Figure 25, illustrates the duration that users typically spend in these open spaces, the longest duration of more than two hours has the highest bar, suggesting that a significant number of users tend to spend extended periods in these spaces, provided the conditions are right.

Together, these graphs suggest that while users are inclined to spend substantial time in open spaces,

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certain limitations, particularly related to comfort and amenities, can significantly shorten their visits. Enhancements in seating, shading, and a variety of activities could potentially increase the time users spend in open spaces, maximizing their benefits for user well-being.

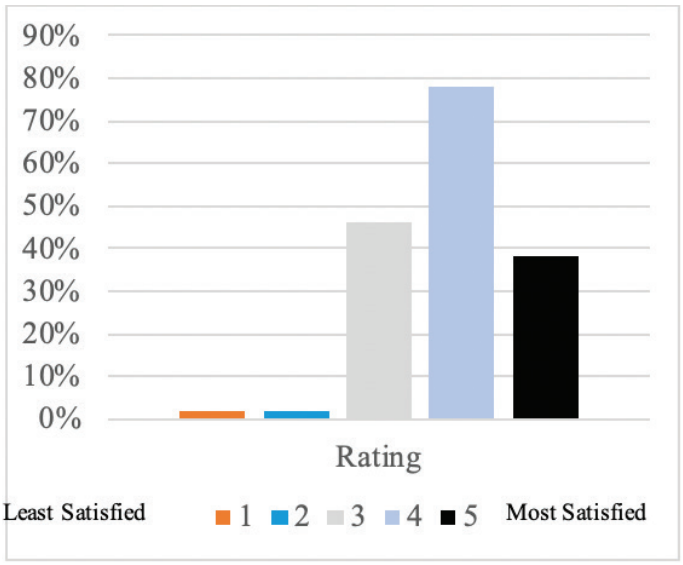

Fig. 28. Limitations of open spaces
Source: Author

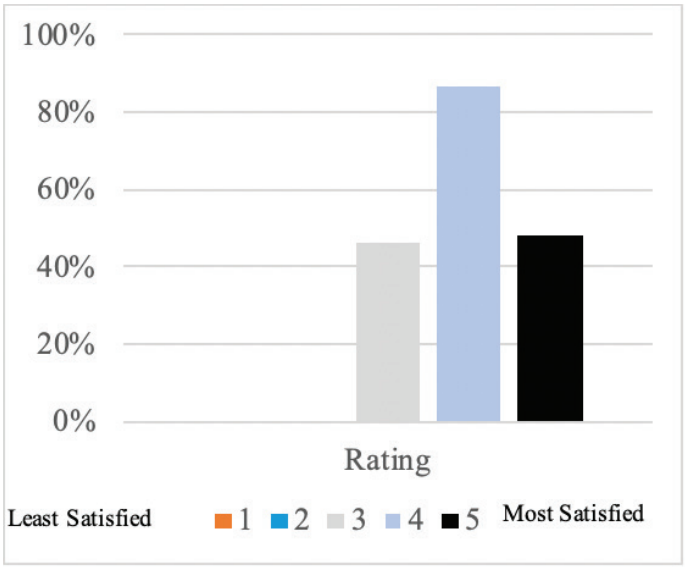

Fig. 29. Time in open spaces
Source: Author

In Figure 26, which represents user comfort, respondents rated their satisfaction on a scale from 1 (least satisfied) to 5 (most satisfied). The majority of users appear to report high levels of comfort, with the highest percentage of responses in category 4, followed closely by ratings of 5, indicating that most users find open spaces quite comfortable. The second chart, Figure 27, evaluates how effectively these open spaces help users reduce stress, using the same satisfaction scale. Here, users mainly rate the quality of open spaces with a 4, suggesting a strong positive impact on stress reduction, while the second-highest group of responses falls in the category 5. This demonstrates that the majority of users consider open spaces beneficial for their mental well-being. Both charts together reveal that users generally find open spaces to be comfortable and beneficial to their stress levels, which is indicative of the success of these spaces in fulfilling some of their core objectives in urban design.

IX. EVALUATION MATRIX AS A TOOL: RELATIONSHIPS BETWEEN OPEN SPACES AND USER'S WELL-BEING

The matrix serves as an analytical tool for assessing the impact of various characteristics of open spaces within a CBD on well-being indicators, which are categorized under Physical, Social, and Environmental dimensions. Each row represents a well-being indicator, such as "Promote safe walking" or "Protect biodiversity". Each column represents a characteristic of open spaces, grouped into broader categories like Landscape, Accessibility, Circulation, Services, Safety and Security, and Sociability. Each characteristic is detailed with specific attributes like "Lighting Arrangement", "Public Transportation", "Connected Paths", "Public Toilets", and "Events". The cells of the matrix are filled with symbols indicating the strength of the relationship between each characteristic and the well-being indicator:

- solid circle (●) indicates a "Strong Relation" suggesting that the characteristic significantly impacts the well-being indicator.
- A half-filled circle (◑) signifies a "Moderate Relation" implying a noticeable but less significant impact on the well-being indicator.
- An empty circle (○) denotes "No Relation", indicating no substantial impact on the well-being indicator from the characteristic.

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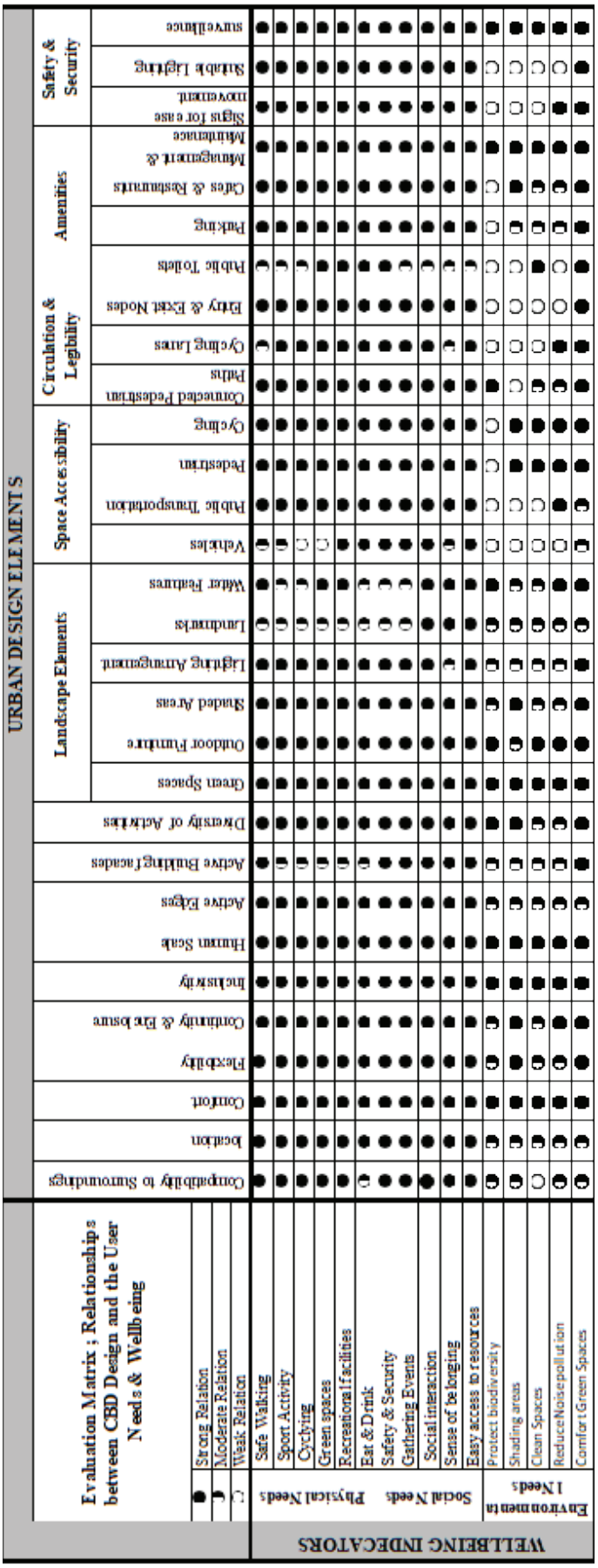
Table (03): MATRIX wit Relations Between Urban Design Elements & Well-being
Source: Author



X. CONCLUSION

The critical exploration of literature on the CBD and the design of sustainable open spaces demonstrates a significant link to user's well-being. The research indicates a clear and important relationship between the urban design of sustainable open spaces and the enhancement of social, physical, and environmental aspects of well-being. This connection is essential and must be a central consideration for urban designers, experts, and academics who are key in shaping the sustainable communities and urban spaces of the future.

The research contributes an evaluation matrix that serves as a tool to define the relationships between the urban design elements of sustainable open spaces within CBDs in Egypt and user needs to enhance well-being. By identifying the impact of each design element on specific user needs, this matrix provides a structured approach to assess and guide the development of open spaces.

A. Findings

1. Well-designed sustainable open spaces have a strong impact on enhancing the user's well-being.
2. Elements of successful sustainable open spaces can be concluded in comfort, accessibility, diversity of activities, flexibility and safety.
3. Design of sustainable open spaces within CBDs in Egypt can be neglected due to the need of developers to build more to maximize the profit.
4. Environmental aspect should be highly considered when designing sustainable open spaces within CBDs in Egypt to achieve user's comfort.
5. User's well-being should be a primary design aspect not a secondary one.

XI. FUTURE STUDIES

Future studies may look to expand beyond quantitative methods, incorporating qualitative approaches to capture the nuanced human experiences and perceptions of open spaces. Additionally, the impact of policy changes, economic fluctuations, and technological advancements on the use and design of these spaces permits ongoing investigation. Recognizing the diversity within urban populations, subsequent research should also

examine the differential impacts of open spaces across various socio-economic groups, aiming to ensure equitable access and benefits. Given the complexity of urban ecosystems, interdisciplinary research drawing from environmental science, urban sociology, and public health is recommended to construct a more holistic understanding of how sustainable open spaces contribute to well-being in CBDs. This comprehensive approach can help to refine urban design practices, creating more inclusive, resilient, and healthy urban spaces for all community members.

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