

Original Research Article

Analyzing the Concept of Continuous Productive Urban Landscapes (CPULs)* Based on a Systematic Review

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Abstract | Natural disasters, economic and environmental crises, and pandemic diseases have highlighted the need to revise urban development models to anticipate new development strategies. Cities have been historically associated with production, trade, and consumption processes. However, the role of production has been eliminated in the contemporary world, and trade and consumption have dominated this cycle. This is one of the issues that has been fueling urban crises. Therefore, it is necessary to create an urban resilience matrix by integrating productivity and urban landscape as a planning tool and also the development of sustainable infrastructure. Given that continuous productive urban landscape (CPUL) is a novel concept in the theoretical field of urban landscape, this systematic review was conducted based on a four-stage model by formulating the study searching strategy using the following keywords: productive landscape, urban landscape, integrated productive urban landscape, dynamic landscape, and productive urban landscape in top citation databases. In the initial search, 377 papers published from 2000 to 2021 were found, 56 of which were selected as qualified papers for in-depth analysis and finding answers to research questions. Then, the screened papers were analyzed in terms of content and synthesis. The existing views and definitions were extracted and classified chronologically to redefine the concept of integrated productive urban landscapes by examining and comparing the definitions. Based on the analysis and classification of definitions, the integrated productive urban landscape strategy is a network of green and open multi-purpose structures. These structures connect the landscape and social centers through productive spaces, with the priority of walking while passing through the built environments. An integrated productive urban landscape, as a new typology of the landscape, considers the landscape as an integrated structure from a holistic and ecological perspective and integrates urban agriculture in green and open public spaces. It defines a new layer of the landscape in cities in addition to redefining open urban spaces. Also, this strategy proposes a new way of life and production-based spatial organization that is socially inclusive and environmentally sustainable by emphasizing local production as a forgotten opportunity. Implementing the integrated productive urban landscape strategy based on the identified structural and functional features can create an interaction between social, economic, and environmental environments. Moreover, this is considered a consistent and flexible strategy that contributes to the urban development and resilience of the urban ecosystem by providing a model for land use management and planning. Therefore, this approach provides an appropriate response to the challenges of contemporary urban development.

Keywords | *Productive landscape; Integrated landscape; Green and open networks; Sustainable infrastructure; Ecological infrastructure; Systematic review.*

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Introduction | Urban environments as a dynamic and growing system with economic, political, social, and cultural relations, need a wide and complex range of approaches and solutions to respond to the current conditions and future outcomes of development. As the uneven expansion of cities without exploiting the ability of the natural environment has disturbed the city-nature balance, and since the use of cities has changed into a consumer-oriented one, cities are faced with a severe economic crisis. Therefore, modifying urban metabolism and changing this process is indispensable for achieving sustainable development, which is the vision and strategy for the 21st century. In this regard, the important role of nature and landscape in cities is becoming more salient as they help with adaptation and reduction of climate change while also increasing biodiversity and the quality of urban life. Evidence shows that urban agriculture as an ecological infrastructure can provide a means to achieve many such goals (Viljoen & Bohn, 2020). Cities have historically supported production, trade, and consumption, all of which play a major role in urban life. In the contemporary city, however, production is hidden or eliminated, while trade and consumption predominate (Davis, 2019). Meanwhile, the gap between the functions of landscape production, on the one hand, and its ecological and social functions, on the other hand, has dominated landscape architecture and urban planning thinking (Specht et al., 2014). Hence, cities worldwide are looking for successful strategies, policies, and examples of urban agriculture as an ecological infrastructure. In Europe, CPULs with potential environmental and socio-cultural benefits are widely accepted as successful examples (Bohn & Viljoen, 2012a). In this regard, the current study raised the following main question: How can CPULs be a good answer to the challenges facing contemporary cities in terms of potential synergy between urban agricultural activities and sustainable development? To answer this question, it seems necessary to understand the concept and capacities of CPULs. Therefore, the concept of CPULs in the landscape literature is examined, and the existing definitions (in terms of what dimensions they refer to and what features are involved in shaping the concept of CPUL) are explored.

Research Method

The present article reviews the recent literature on CPULs according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) (Moher et al., 2015; Moher, Liberati, Tetzlaff, Altman & Prisma Group, 2009). This method consists of 4 steps: 1) Searching online databases, 2) Screening process, 3) Accessing the selected articles, and 4) Collating the relevant articles. In the first step, to obtain the relevant articles, four comprehensive databases were used as the main sources of literature: Google Scholar, Web of Science, ScienceDirect, and Scopus. These databases were searched via keywords (“Cpuls city” OR “urban

landscape” OR “landscape” OR “Cpuls) AND (“productive” OR “dynamic”) in the titles and keywords. In addition to the articles identified through database search, the Google search engine was used as a source to define specific terms related to this topic as well as to access organizations that work in this field. Gray literature was also used as another source of information. It includes conference proceedings, reports, websites, and policy documents. Terms such as (Food and Agriculture Organization (FAO); the Edible Cities Network (EDICITNET) and (productive landscape; continuous productive landscape; productive) were used as keywords, which resulted in 377 articles. Although the purpose of this article is to discuss the concept of CPULs, examples are very rare. Therefore, studies conducted on productive urban landscapes (PULs) (provided that their information is in line with this study) were also added. In the second stage (article screening), to identify a manageable subset of these articles, among the results obtained, the most relevant articles that included the term “CPULs” and its derivatives, 214 articles and research sources in English, Italian, Spanish, and German published from 2001 (beginning of CPUL idea) to 2021 were selected. A wide range of information expresses the definition of this word and the identification of its features. In other words, the characteristics of CPULs must be identified to achieve a precise definition of CPULs as a new concept in urban planning knowledge. Thus, by reviewing the term “CPULs”, a wide range of their features are identified with the general goal of accessing the concept of CPULs. In addition, resources classified in thematic areas other than those studied are excluded. In the next step, after obtaining the full text of the papers, by reading the keywords, abstracts, and conclusions of each article and scanning its content, the process continued to ensure their relevance. Of these, 45 articles, the titles of which included the intended words, were removed from the list of sources due to the inconsistency between their content and other articles in this study and since they belonged to other fields of science. Eventually, 108 articles on the productive landscape and CPUL were explored via meta-analysis as case studies. Finally, to categorize the content of each article, the following items were analyzed: 1) Is the nature of CPUL discussed in the article? 2) What kind of landscape production is discussed? 3) Does the article mention the potential of PULs? Herein, 56 sources are mentioned. Figure 1 shows the systematic process of selecting the articles.

Literature Review

Following the theories of contemporary urban agriculture (Fig. 2), the first research on the concept of CPULs was commenced in 1998 by Katherine Bohn and Viljoen, who expanded on it in 2005 (Holdsworth, 2005). The first article on a CPUL was published in 2000 by Viljoen and Bohn, who referred to CPUL as an environmental strategy (Viljoen &

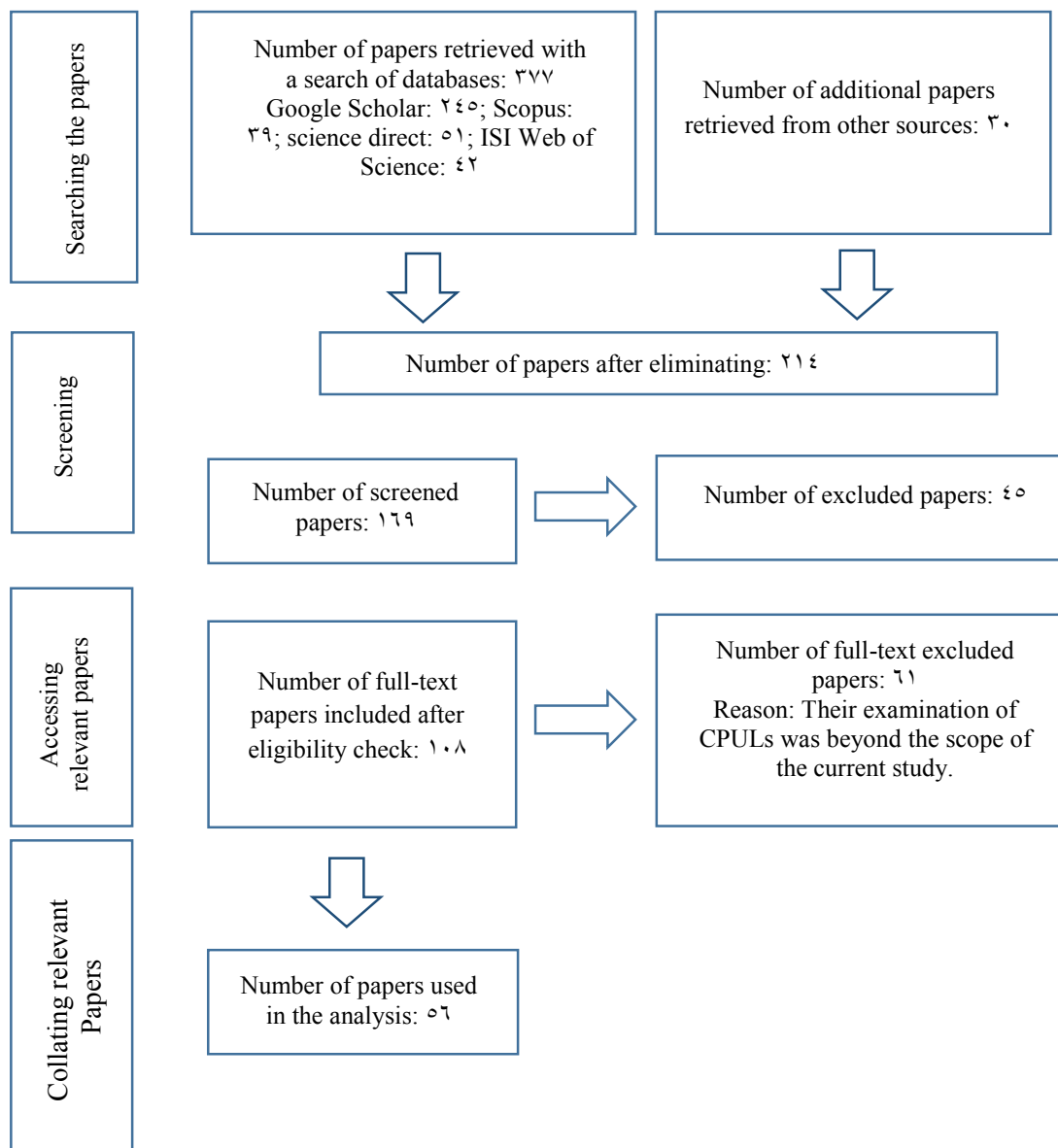


Fig. 1. Selection process and results based on PRISMA guidelines. Source: Authors.

Bohn, 2000). Following this research, in 2001, an exhibition entitled Urban Nature was held in the United Kingdom, which was the first conference to address this issue. Then, in 2005, with the publication of “Continuous Productive Urban Landscapes: Designing Urban Agriculture for Sustainable Cities” by Bohn and Viljoen, this concept entered the discourse of contemporary urban design. In addition to their numerous studies (Fig. 3), they held several exhibitions, including Edible City Exhibition, to implement a CPUL in the Netherlands in 2007, which marked a turning point in the development of the CPULs concept (Bohn & Viljoen, 2011). Further research by Bohn and Viljoen emphasized the role of productive urban landscapes in providing urban food (Bohn & Viljoen, 2008). In another article, they pointed to the importance of CPULs as a strategy to enhance the qualitative benefits of the landscape (Viljoen & Bohn, 2009).

In another study, CPULs were introduced as a capability to redefine urban spaces (Viljoen & Bohn, 2010). Following the expansion of the concept of CPULs, McDonnell (2011) also explained the concept of CPULs and their relationship with urban agriculture. To continue their research, Bohn and Viljoen (2011) completed their definition of a productive landscape. With a broader view of CPULs, they regarded them as a landscape network and sustainable landscape strategy. Bohn and Viljoen (2012) conducted several studies which, while addressing different dimensions of a CPUL, examined it in terms of a physical and environmental design strategy (Bohn & Viljoen, 2012a, b, c). Studies have also addressed the potential for multi-purpose CPULs in integrated urban environments (Narvaez, 2012; Viljoen & Bohn, 2012). In addition to research on the concept of productive urban landscapes, a number of studies have dealt

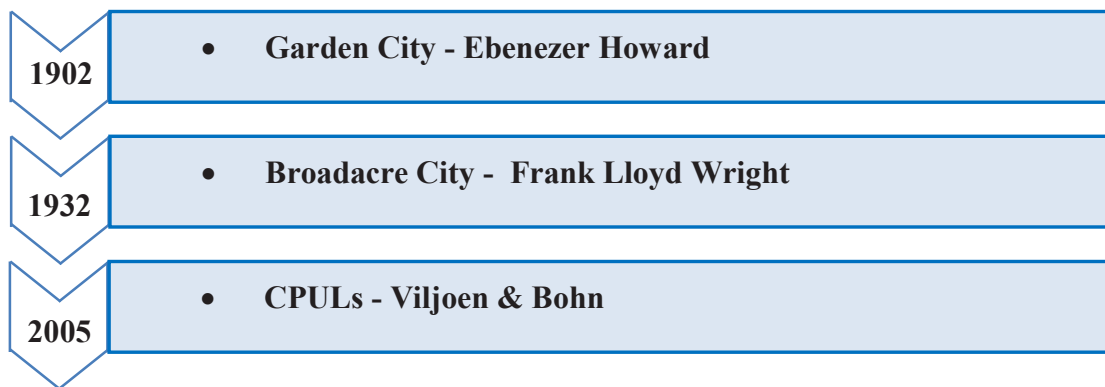


Fig. 2. Contemporary Urban Agriculture Theories. Source: Authors.

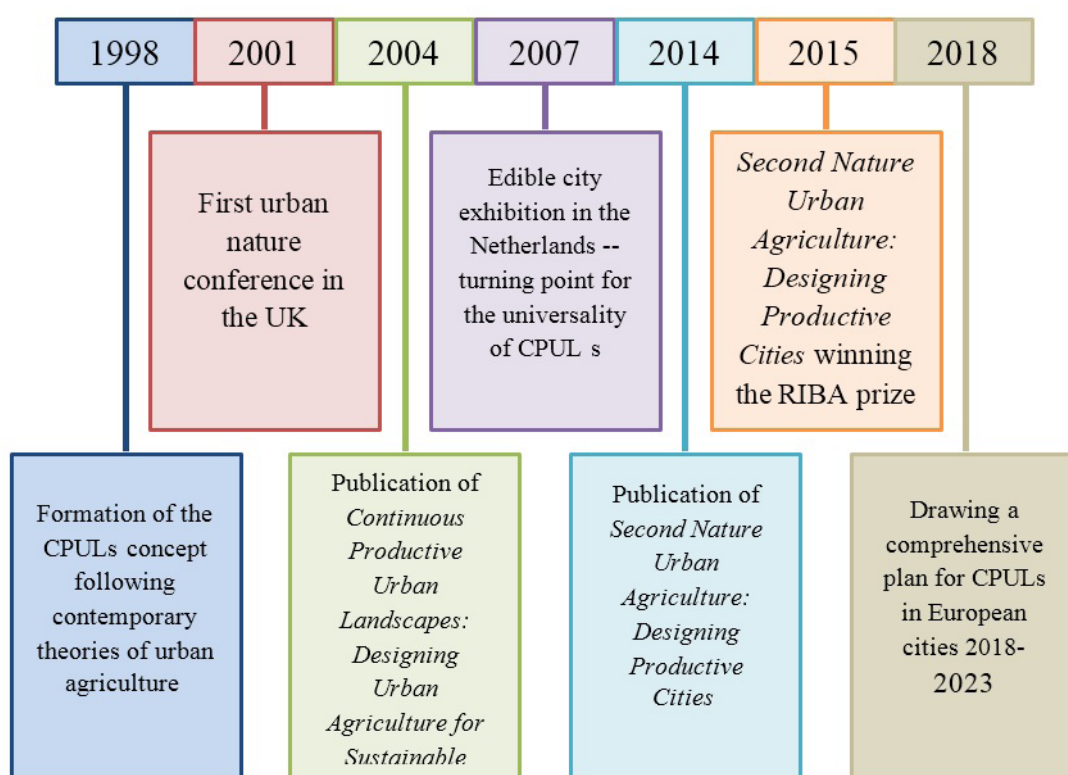


Fig. 3. Timeline of the theory of CPULs. Source: Authors.

with this concept via the approach of resilience, enabling, and regenerating urban textures (Akyol & Tunçay, 2013; Türkyılmaz, Pellitero, Türkyılmaz, & Da Silva Eliziario, 2013). In some of these studies, the authors point to the potential of a productive landscape in creating an integrated and sustainable structure in cities (Sousa & Batista, 2013; Breetzke & Breed, 2013). In “Second Nature: Urban agriculture, Designing productive cities” was published by Viljoen and Bohn (2014), which explored the role of the productive urban landscape in creating productive cities (Viljoen, & Bohn, 2014). Moreover, Zeldis emphasized the network structure of CPULs and integrated it with urban agriculture (Zeldis, 2014). In the study by Morgan in the

same year, the concept of a city with CPULs was compared with the garden city - Ebenezer Howard (Morgan, 2014). In 2015, Viljoen and Bohn (2015) published an article on achieving productive landscape executive policies. In another article published in the same year by other colleagues, they pointed to the need to integrate productive urban landscapes and integrate agriculture into urban and regional land use planning (Viljoen, Schlesinger, Bohn & Drescher, 2015). In a separate article, they also discussed the impact of CPULs on improving the quality of urban spaces (Viljoen & Bohn, 2015). In another study by Viljoen, Rich, and Rich (2015), various dimensions of a CPUL were discussed, and its commercial

and recreational performance was addressed (Viljoen et al., 2015). In the same year, a report was published to explore the impact of CPULs in the form of a green network with urban sustainability (Braude, 2015). According to the research conducted by Bohn and Viljoen between 2005 and 2015 as well as the publication of two books on CPULs, research was conducted on the development and implementation of CPULs from 2015 to 2021. Several studies have been conducted in other countries on the productive urban landscape, including the strategic plan carried out in 2015 entitled *Productive Dublin* (Ross O 'Ceallaigh, 2015). In 2016, an article discussed the evolution of the role of urban agriculture in achieving resilient cities (Bohn & Viljoen, 2016). In the same year, another article was published by these two authors that introduced CPULs as a movement and land use area (ibid.). In another report by James Shore entitled "The third landscape", a manifesto was put forward for landscape theory based on the concept of CPULs (Shore, 2016). Bohn identified CPULs as an urban movement and typology (Bohn & Viljoen, 2016). To create new urban spaces, Bohn & Viljoen (2017) wrote an article emphasizing the productive role of the urban landscape and addressed complex cultural, environmental, and spatial goals.

Moreover, Kleszcz dealt with the environmental and economic benefits of a productive urban landscape (Kleszcz, 2018). Pablo De la Cal (2018) considered the productive landscape as green infrastructure in urban planning policies. Tornaghi proposed a model in the form of a productive urban landscape to redefine present and future urban development (Tornaghi, 2018). In another study, a productive urban landscape was regarded as a basic and multifunctional infrastructure of urban life (Mesquita, 2019). The productive landscape was also viewed as a tool to expand ecological capacity with the approach of food production and urban food supply (Chu & Bohn, 2019). The productive landscape was also described as a way to integrate urban and rural areas and adapt agriculture to the city by creating a productive urban landscape (Wiskerke, 2020). Another paper addressed the economic dimensions of a productive landscape (Ramandhani, Budiarti, & Makalew, 2020). A report by the London School of Architecture also pointed out that, in the COVID-19 era, there was a greater need to strike a balance between work and life, and a productive urban landscape was a proper strategy for this end (A.A. School, 2020). In the study by Mitchell, the productive urban landscape was described as a true picture of integrating nature and agriculture into urban life (Mitchell & Iglesias, 2020). Marat-Mendes, Borges, and Lopes regarded productive urban landscape as a new perspective of the urban landscape and referred to the combination of ecological and cultural values of landscape (Marat-Mendes, Borges & Lopes, 2020). The productive urban landscape was also mentioned as a synergistic

factor between the city and the environment in the form of a new urban movement (Bojan & Pusco, 2020; Skar et al., 2020). The integration of productive urban landscape and urban agriculture is introduced as an approach to the development of existing and future cities (Skar et al., 2020). In another study, the productive urban landscape is viewed as a strategy for urban planning that acts as an integrating system in urban systems (Ola, 2020). A productive urban landscape is defined as a synergistic factor in enhancing urban productivity (Olofsson & Nilsson Öhrn, 2020). The productive urban landscape is viewed as a new type of public space (Letterio, 2021). Shao (2021) proposed an integrated urban plan for St. Paul, Minnesota, based on the CPUL. Rizzo defined a productive urban landscape as a new urban strategy for transforming cities towards naturalism (Rizzo, 2021). Yang et al. expressed a productive urban landscape as a planning theory dealing with the reconstruction of urban metabolism (Yang, Zhang & Huang, 2020). In another study, the productive urban landscape was noted as a model for future cities that connected urban agriculture with other layers of the urban landscape (Chen, 2021). A 2020 paper by Viljoen and Bohn pointed to the important role that nature and the productive landscape played in cities by helping with adaptation, reducing climate change, enhancing biodiversity, and improving the quality of urban life. Accordingly, it is essential to focus on design concepts that support CPUL as an inseparable element of urban design (Viljoen & Bohn, 2020). Viljoen and Boh¹ in their latest research highlighted the concept of the productive urban landscape and discussed the proper use of land and spatial planning to achieve and maintain green infrastructure following the call for "smart and sustainable cities" with "innovative measures" with nature-based solutions that pointed to edible city networks based on CPULs, which started in 2018 and will continue until 2023. Although little research has been conducted exclusively on CPULs, due to the novelty of the subject and the necessity of forming the concept of CPULs in the urban literature, it is essential to identify and refine the concept of CPULs in line with the objectives of the research.

Theoretical Foundations

• CPULs

As mentioned earlier, the concept of CPULs gained international attention and entered the discourse of contemporary urban design with the expansion of research on urban agriculture and with the publication of Bohn and Viljoen's book. The importance and prevalence of CPUL as a new concept in urban literature have motivated research on this topic. As the first theorists in the field, Viljoen and Bohn considered CPULs as an environmental design strategy that had both physical and social implications. Accordingly, this approach follows a system that, by emphasizing urban agriculture, helps create sustainable

and resilient food sources and adds to the spatial and socio-economic quality of the urban territory (Viljoen & Bohn, 2000). In a book they co-authored with their colleagues in 2005, they described the productive urban landscape as a theory based on the compact city model, stating that the productive urban landscape is an integrated urban (green) infrastructure that links urban agriculture at different scales and types with other green and urban spaces (Viljoen, Bohn & Howe, 2005). They believe that CPULs create a new sustainable urban infrastructure and help redefine the usage of the urban open space. McDonnell defines CPULs as a conceptual framework for urban agriculture in the existing fabric (McDonnell, 2011). Bohn and Viljoen regard CPULs as a new urban design strategy with a naturalistic approach that will include economic, sociological, and environmental concepts. They point out that, in this strategy, the landscapes that will be productive in various ways will form a space for recreational activities and access routes, urban green lungs, etc. (Bohn & Viljoen, 2012b). Aykol introduces “productive landscapes” as an emerging strategy that integrates productivity in cities through landscape and planning tools. The main idea behind this concept is to create multi-purpose urban open space networks that complement and support the built environment (Akyol & Tunçay, 2013). Emphasizing the cultural dimension, Hărmănescu and Popa propose a comprehensive combination of planning and legal framework for the spatial and economic development of productive landscapes (Hărmănescu & Popa, 2013). Türkyılmaz et al. (2013) define a productive landscape as a strategy to achieve a sustainable balance between economy, society, culture, environment, and food production. According to Breetzke, CPULs are a new type of landscape that refers to the ability of CPULs in social dimensions as well as the environmental dimension (Breetzke & Breed, 2013). Viljoen and Bohn regard CPULs as an opportunity to create equitable, resilient, optimal, and beautiful cities made up of a network of productive open spaces with car-free routes. This strategy proposes newly emerging methods of urban life, addresses new ways of creating space and place, and offers a new way of physically and visually accessing nature (Viljoen & Bohn, 2014). The theory of CPULs is a developed form of Howard’s garden city theory, which merges instead of separating the functions of the city and urban agriculture (Zeldis, 2014). According to Viljoen et al., a productive urban landscape is a natural solution that integrates a network of public spaces with agriculture throughout the city (Viljoen et al., 2015). This concept is mainly based on the creation of urban open spaces. Integrated multi-purpose networks are formed to complement and support the environment (Bohn & Viljoen, 2016). A CPUL is an urban design strategy emphasizing urban agriculture that can combine complex cultural, environmental, spatial, and functional goals (Bohn & Viljoen, 2017). Kleszcz re-establishes the relationship

between life and the processes needed to support it and views productive urban landscapes as planted and managed urban open spaces that are both environmentally and economically productive (Kleszcz, 2018). CPULs are introduced as green infrastructure in urban planning policies and urban open space design (De la Cal, 2018). According to Tornaghi, the productive urban landscape is a conceptual model for redefining the present and future development of cities (Tornaghi, 2018). In Chu’s definition, a CPUL is a strategy to achieve a livable city. Chu et al. regard the CPUL as a tool to extend the ecological capacity and change the usage of traditional recreational spaces to provide a sustainable urban food system while emphasizing productivity and social features of the landscape (Chu & Bohn, 2019). CPULs are a new perspective of the urban landscape that integrates ecological and cultural values (Marat-Mendes et al., 2020). Ola describes the productive urban landscape as a strategy for achieving a sustainable food system in interaction with the urban environment and the cultural and economic systems of the city (Ola, 2020). Yang et al. introduce CPUL as a programming theory that modifies urban metabolism (Yang et al., 2020). The CPUL is also viewed as a factor of synergy between the city and the environment that can promote urban productivity (Olofsson & Nilsson Öhrn, 2020). The role of CPULs is pointed out in the adaptation and reduction of climate change by promoting biodiversity and quality of urban life, and the productive landscape is seen as an integral element of urban design (Viljoen & Bohn, 2020). The CPUL that is strategically designed can create a new form of public space that can benefit society as a social infrastructure (Letterio, 2021). The CPULs is defined as a novel urban strategy to transform cities towards naturalism (Rizzo, 2021). In another study, CPULs are mentioned as a model for future cities that link urban agriculture with other layers of the urban landscape (Chen, 2021). According to the presentation of the concept of CPULs by experts, it is possible to delineate its nature by examining its definitions. Table 1 lists the most important tenets presented on CPULs.

Discussion

By reviewing the theoretical foundations and definitions provided by landscape researchers, it is concluded that the CPULs as a novel strategy in urban planning and design includes various aspects and dimensions, and the concept will suffer if these features are neglected. Therefore, addressing the dimensions and features with a holistic view to provide a comprehensive definition of CPULs seems necessary. As mentioned in the theoretical foundations and Table 1, experts have examined the dimensions of the concept from their point of view, but the existence of common approaches and features in all these definitions is undeniable. A review of the literature shows that each definition delineates certain aspects of the concept of CPULs. Therefore, by analyzing the

Table 1. The most important tenets presented on the nature of CPULs. Source: Authors.

Theoretician	Basic principles of the theory	Source
Viljoen, Bohn & Howe	CPUL is a theory based on the compact city model that, as a (green) urban infrastructure, connects urban agriculture of different scales and types to other urban green and open spaces.	Viljoen et al. (2005)
Viljoen & Bohn	CPUL proposes an integrated strategy for introducing productive and continuous urban landscapes in cities that highlights the re-definition of the use of urban open space.	Viljoen & Bohn (2010)
Viljoen & Bohn	A novel urban design strategy with a naturalistic approach that will be productive in different ways while dealing with economic, sociological, and environmental concepts, and will form a space for recreational activities, access paths, urban green lungs, etc.	Bohn & Viljoen (2012b)
Akyol	Multi-purpose urban open space networks that complement and support the built environment	Akyol & Tunçay (2013)
Türkyılmaz	It defines the productive landscape to achieve a sustainable balance between economy, society, culture, environment, and food production.	Türkyılmaz et al. (2013)
Viljoen & Boh	They regard the CPUL as an opportunity for creating equity-based, resilient, optimal, and beautiful cities formed of CPULs with car-free routes. This strategy deals with new methods of space and place formation and proposes a novel way for physical and visual access to nature.	Viljoen & Bohn (2014)
Zeldis	CPUL is viewed as a developed form of Howard's garden city model, such that agriculture is extended to public spaces and streets.	Zeldis (2014)
Bohn & Viljoen	This concept is mainly based on the creation of urban open spaces. Integrated multi-purpose networks aim to complement and support the environment.	Bohn & Viljoen (2016)
De la Cal	It views the CPUL as part of the green infrastructure in urban planning and urban open space design policies.	De la Cal (2018)
Chu	A tool to extend the ecological capacity and change the usage of traditional recreational spaces to provide a sustainable urban food system while emphasizing productivity and social features of the landscape.	Chu & Bohn (2019)
Olofsson	The CPUL as a factor of synergy between the city and the environment can promote urban productivity.	Olofsson & Nilsson Öhrn (2020)
Yang	The CPUL is expressed as a programming theory that modifies urban metabolism.	Yang et al. (2020)
Bohn & Viljoen	They point to the adaptation of the CPUL to the environment and its potential to promote the biodiversity and quality of urban life, and regard the CPUL as an indispensable element of urban design.	Viljoen & Bohn (2020)
Letterio	The CPUL that is strategically designed can create a new form of public space that can benefit society as a social infrastructure.	Letterio (2021)
Rizzo	The CPUL is defined as a novel urban strategy to transform cities towards naturalism.	Rizzo (2021)
Chen	The CPUL is mentioned as a model for future cities that links urban agriculture to other urban landscape layers.	Chen (2021)

CPULs concept, a relative definition can be achieved and the features and emphases used by experts can be categorized based on similarities and in line with the research objectives, as Table 2.

A review and classification of the definitions provided indicate that the definitions have commonalities such as emphasizing a sustainable food system, integration of agriculture within the city, green infrastructure, promotion of environmental and economic dimensions, etc. (Table 2). In other words, Table 2 shows that although there are similarities and common features in the definitions provided by experts, most of these definitions lack a holistic view.

Meanwhile, the strategy of CPULs as a new strategy includes various aspects and dimensions that, as an intertwined concept, needs deeper analysis and exploration. To this end, to reach a consensus on CPUL's features, we examine the distribution of features considered in some of the most important studies conducted on CPUL (Fig. 4).

Based on Fig. 4, these features are the most frequent in the domain of economic and environmental quality improvement and an emphasis on the integration of agriculture with the public, green, and open spaces (highlighted in > 10 studies). Continuity ranks second and the promotion of social and cultural quality ranks

Table 2. The most important terms used to express the concept of CPULs in the definitions of experts. Source: Authors.

Features	Researchers
Creating a sustainable food system	Viljoen & Bohn (2000); Chu & Bohn (2019); Ola (2020); Türkyılmaz et al. (2013); Braude (2015)
Urban resilience	Viljoen & Bohn (2016); Viljoen & Bohn (2014); Viljoen & Bohn (2000)
Promoting spatial quality	Viljoen & Bohn (2000); Härmănescu & Popa (2013); Viljoen & Bohn (2014); Bohn & Viljoen (2017)
Promoting social quality	Viljoen & Bohn (2000); Bohn & Viljoen (2012); Breetzke & Breed (2013); Türkyılmaz et al. (2013); Chu & Bohn (2019); Letterio (2021)
Promoting economic quality	Viljoen & Bohn (2000); Bohn & Viljoen (2012); Härmănescu & Popa (2013); Türkyılmaz et al. (2013); Bohn & Viljoen (2017); Kleszcz (2018); Chu & Bohn (2019); Olofsson & Nilsson Öhrn (2020); Skar et al. (2020); Ramandhani et al. (2020)
Promoting environmental quality	Bohn & Viljoen (2012); Breetzke & Breed (2013); Viljoen & Bohn (2014); Bohn & Viljoen (2017); Kleszcz (2018); Chu & Bohn (2019); Marat-Mendes et al. (2020); Bojan & Pusco (2020); Skar et al. (2020)
Cultural promotion	Härmănescu & Popa (2013); Bohn & Viljoen (2017); Türkyılmaz et al. (2013); Marat-Mendes et al. (2020); Bojan & Pusco (2020); Skar et al. (2020)
Green urban infrastructure	Viljoen et al. (2005); Viljoen & Bohn (2010); Viljoen & Bohn (2016); de la Cal, (2018)
With urban agriculture at different scales	Viljoen et al. (2005)
Integrating agriculture with public spaces and other urban spaces	Viljoen et al. (2005); McDonnell (2011); Zeldis (2014); Morgan (2014); Viljoen et al. (2015); De la Cal (2018); Mitchell & Iglesias (2020); Skar et al. (2020); Zeldis (2014); Ola, (2020); Chen (2021)
Integrity	Viljoen & Bohn (2010); Viljoen & Bohn (2016); Viljoen & Bohn (2014)
Multi-functionality	Bohn & Viljoen (2012); Akyol & Tunçay (2013); Viljoen & Bohn (2014); Zeldis (2014); Viljoen & Bohn (2016)
Continuation	Viljoen & Bohn (2010); Bohn & Viljoen (2012); Akyol & Tunçay (2013); Viljoen & Bohn (2014); Viljoen & Bohn (2016); Braude (2015); Morgan (2014)
Diversity	Viljoen & Bohn (2020)
Re-defining the use of urban open space (a new type of space)	Viljoen & Bohn (2010); Viljoen & Bohn (2014); Chu & Bohn (2019); Letterio (2021); Breetzke & Breed (2013); Viljoen et al. (2015)
Naturalism	Bohn & Viljoen (2012b); Viljoen et al. (2015); Rizzo (2021)
Supporting the built environment	Akyol & Tunçay (2013); Bohn & Viljoen (2016); Viljoen & Bohn (2014).
Increasing productivity	Härmănescu & Popa (2013); Akyol & Tunçay (2013); Chu & Bohn (2019); Olofsson & Nilsson Öhrn (2020)
Balance	Türkyılmaz et al. (2013); Yang et al. (2020)
Synergy	Olofsson & Nilsson Öhrn (2020); Skar et al. (2020)
Car-free movement	Viljoen & Bohn (2014)
Complexity	Bohn & Viljoen (2017)

third in terms of frequency. Based on this table, most of the sources attach significance to concepts such as economy and environment and features such as continuity and integration to examine and identify the concept of CPULs. The statistics indicate that the features of CPULs can be divided into two general categories (Fig. 5).

Based on the literature, the concept of CPULs involves various dimensions that address the productivity of the landscape and consider both the functional and structural dimensions of the landscape. These dimensions also stress economic, environmental, social, cultural, and

spatial perspectives, and highlight structural concepts such as cohesion, integration, continuity, diversity, and complexity in the form of an integrated structure in the urban system.

Conclusion

This paper analyzed and identified the concept of CPULs, a novel concept in urban planning, based on a systematic review of most reputable scientific sources. In this regard, the following conceptual definition was formed based on the definitions presented in the literature, with

Property \ Researcher	Viljoen & Bohn (2000)	Viljoen et al. (2005)	Viljoen & Bohn (2010)	McDonnell (2011)	Viljoen & Bohn (2012)	Türkyilmaz et al. (2013)	Hărămbășescu & Popa (2013)	Breutzke & Bredt (2013)	Alyol & Tunçay (2013)	Viljoen & Bohn (2014)	Zeldin (2014)	Morgan (2014)	Viljoen et al. (2015)	Brande (2015)	Viljoen & Bohn (2016)	Bohn & Viljoen (2017)	Kleszcz (2018)	de la Cal (2018)	Chu & Bohn (2019)	Olofinson & Nilsson (2020)	Bohn et al. (2020)	Skar et al. (2020)	Mitchell & Iglesias (2020)	Ramandhani et al. (2020)	Marat-Mendes et al. (2020)	Bojan & Jusco (2020)	Ola, (2020)	Yang et al. (2020)	Rizzo (2021)	Letterio (2021)	Chen (2021)	number of repetitions				
Sustainable food system	*					*							*						*														5			
Urban resilience	*									*					*													*						3		
Improvement of spatial quality	*						*			*						*																		4		
Improvement of social quality	*				*	*		*								*				*										*				6		
Improvement of economic quality	*				*	*	*									*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*		10		
Improvement of environmental quality	*				*	*		*		*						*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		10	
Cultural improvement						*	*									*						*			*	*	*	*	*	*	*	*		6		
Urban green infrastructure		*	*												*			*																4		
With urban agriculture at different scales		*																*																1		
Integrating agriculture with public spaces and other urban spaces	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	10	
Integrity		*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3	
Multi-functionality			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	5	
Continuity		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	7	
Diversity								*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1	
Re-defining the use of urban open spaces (a new type of space)		*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6	
Naturalism					*							*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	4	
Supporting the built environment									*	*									*	*															2	
Promoting productivity						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	4
Balance						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2
Synergy																			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2	
Car-free movement									*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1
Complexity															*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1	

Fig. 4. Distribution of features used by various experts in explaining the concept of CPUL. Source: Authors.

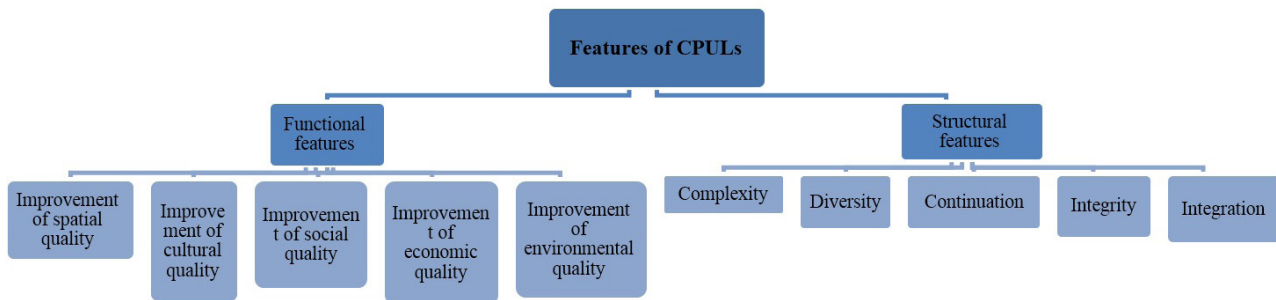


Fig. 5. Classification of features used by different experts in expressing the concept of CPULs; Source: Authors.

an emphasis on the views of thinkers such as Bohn, Viljoen, Türkyilmaz, Letterio, and Chen. With respect to functional characteristics, the CPULs strategy consists of a green and open multi-purpose network that connects the landscape and social centers through productive spaces with the priority of walking while passing through built environments. The goal is to improve environmental, economic, social, cultural, and spatial quality, and to include features such as integration, cohesion, continuity, diversity, and complexity (Fig. 5). In fact, CPULs, as a new typology, consider the landscape as an integrated structure with a holistic and ecological point of view (Fig. 6). By integrating urban agriculture in green and open public spaces, it redefines urban open spaces and defines a new layer of landscape in cities. This layer emphasizes local production as a neglected opportunity, a new lifestyle, and spatial organization based on production that is socially

inclusive and environmentally sustainable. In fact, CPULs are environmentally friendly areas that stress urban agriculture as a key component, promote urban flexibility through social cohesion resulting from social interactions of agricultural activities and consumption pattern modification, and change the ecology paradigm towards an organic and resilient model. With the development of green and open spaces, this strategy presents and produces urban and suburban food and, in so doing, not only adds significant spatial quality to the city but also has positive socio-economic and environmental outcomes. Food production in the place where the citizen resides, or food consumption in the place where it is recently cultivated decreases energy consumption to create a healthy and stable balance in the cycle of growth to processing, distribution to consumption, and recycling to growth. Therefore, in interaction with the metabolism of

natural ecosystems and by reducing social, economic, and environmental burdens, CPULs will be a good strategy for better preparedness for future crises. This strategy reviews new forms of production to adapt to the sustainable vision for future cities. It also highlights local production and food supply, thereby reducing the negative environmental impact of current urban food systems, creating food security and social capital, promoting circular economy, strengthening local identity, social capital, self-sufficiency, and economic growth. In this way, it leads to social regeneration, helps promote economic durability and

ecological sustainability, and increases cities' resilience to a wide range of acute pressures and shocks (Fig. 7). It seems that implementing a CPULs strategy creates an interaction between the social, economic, and biological environment as an adaptive and flexible strategy, thereby serving as a model for land use management and planning in urban development, helping with self-sufficiency and improving the resilience of the urban ecosystem. In this way, it can be an appropriate response to development challenges and environmental, economic, and social concerns of contemporary cities.

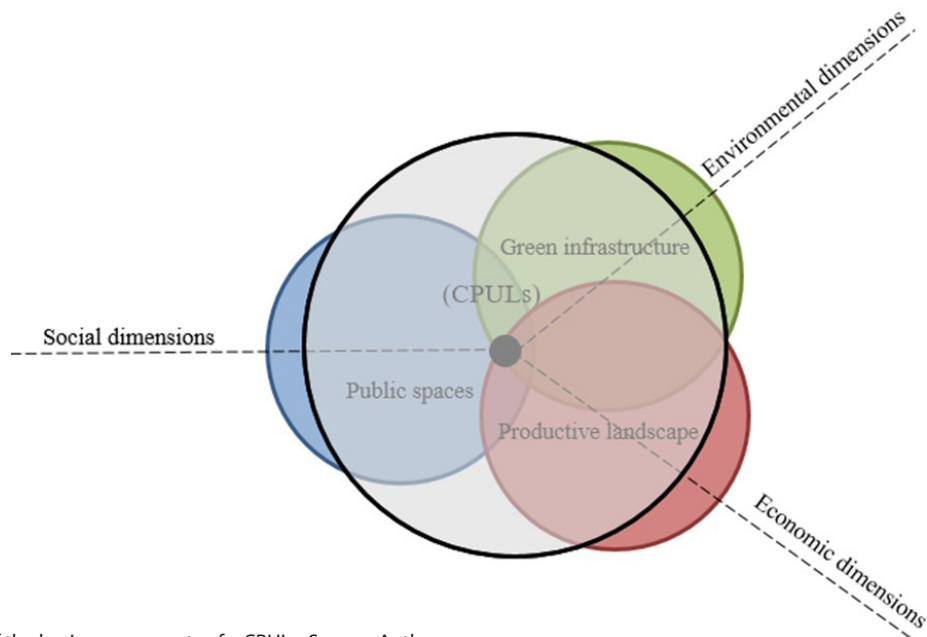


Fig. 6. Interaction of the basic components of a CPULs. Source: Authors.

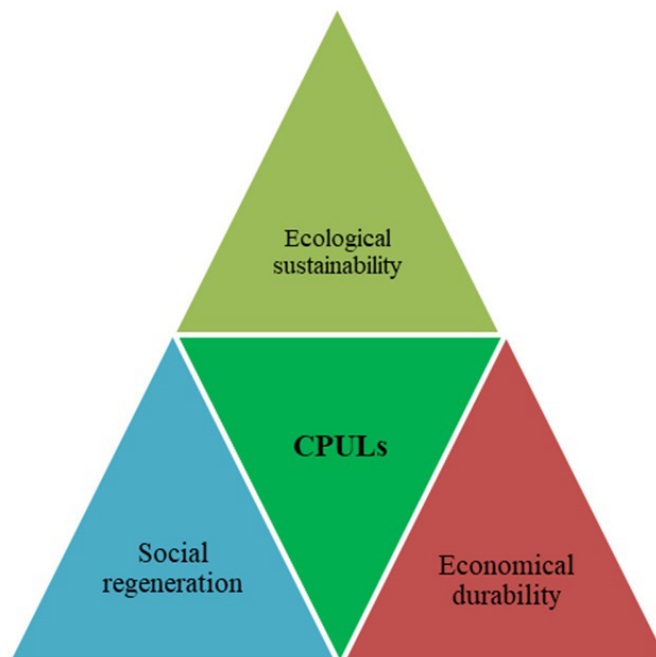


Fig. 7. Outcomes of CPUL to improve urban resilience; Source: Authors.

Endnote

*This study was derived from doctoral dissertation of Sepideh Sanjari entitled "Presenting the pattern of productive city by creating green and open urban ecological networks (CPULs)" with the guidance of Dr. "Zahra Sadat Saeideh Zarabadi " and advice Dr. "Mostafa Behzadfar" at

Islamic Azad University of Tehran Science and Research Branch.

1. These studies commenced in 2018 and continue until 2023; they are mentioned in the reference list with year of publication of 2021: Viljoen & Bohn (2021).

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