Entrepreneurial Circular Ecosystems in the Context of Urban Agriculture

An alternative for food sustainability in cities

Elvia Florencio Torres Ximenes[1,2] *, Paulo Henrique Assis Feitosa[1], Liliane Araújo Pinto[2], Roberta de Castro Souza-Pião[1]

[1]University of Sao Paulo; [2]Federal University of Piaui

*elviaftx@usp.br

Abstract

Amid increasing urbanization and the need for a sustainable food supply chain, Urban Agriculture (UA) emerges as a promising alternative to promote more sustainable and resilient urban communities, especially when implemented under the principles of the circular economy. Additionally, entrepreneurial action and an ecosystem approach involving the cooperation of multiple actors in the urban context play significant roles. Research on this topic is still in its early stages. Thus, this article aims to identify potential actors in the literature to form an Entrepreneurial Circular Ecosystem (ECE) of Urban Agriculture (UA) that provides sustainable development. To achieve this, a systematic literature review was conducted using Scopus and Web of Science databases. The articles were reviewed through content analysis using NVivo 12 software. Among the essential elements for the development of an ECE in UA are the necessity of multidisciplinary partnerships, technological innovation, cultural change, entrepreneurial action, cooperation among diverse ecosystem actors, and engagement of local communities. Additionally, the importance of an orchestrating organization that synergistically unites all stakeholders is emphasized. The study also highlights the need for public policies and initiatives to promote UA and encourage collaboration among different actors in the urban ecosystem to achieve more sustainable and resilient cities in the future.

Keywords

Urban Agriculture, Entrepreneurial Circular Ecosystem, Circular Economy, Entrepreneurship, Sustainable Cities.

1 Introduction

Around 55% of the world's population resides in urban areas, and it is expected that by 2050 this proportion will reach two-thirds. The increase in urbanization makes the quality of life in cities a challenge for decision-makers, and the transition of urban systems to sustainability becomes a primary necessity (Machado and Da Cunha, 2022; Lee, 2020; Deksissa et al., 2021; Bhattarai and Adhikari, 2023). More specifically, the pressures on the current food supply chain, stemming from population growth and increasing socio-environmental concerns, demand the search for alternative methods of food production and consumption (Weidner and Yang, 2020).

In this context, UA is recognized as an important tool to promote more sustainable and resilient urban communities. It has the potential to contribute to the implementation of circular economy strategies at the urban level, promoting the closure of energy and mass cycles. Additionally, UA plays a crucial role in restoring natural cycles and urban ecosystems (Ferreira et al., 2018; Erälinna and Szymoniuk, 2021).

Circularity in food production has been researched but is in its early stages, requiring further investigation (De Boer and van Ittersum, 2018; Zucchella and Previtali, 2019). The principles of circularity in urban agricultural ecosystems can be implemented in the productive sector and involve the integration of multiple actors to provide greater opportunities to maintain resources in circulation (De Boer and Van Ittersum, 2018; Maurya et al., 2023). In this context, the entrepreneur emerges as a relevant agent for social transformation, yet studies on the subject have focused on urban planning and left entrepreneurship out of scope (Der Gaast et al., 2023; Sonnino and Coulson, 2020). A broad view of the urban agricultural ecosystem involving circular economy and entrepreneurial activity becomes relevant. This approach has been little explored by academia despite its high potential for sustainability (Ferreira and Dabic, 2022).

Given these gaps, the question arises: Which actors can be integrated into the ECE of UA in order to provide sustainable development? Therefore, this article aims to identify potential actors in the literature to form an Entrepreneurial Circular Ecosystem (ECE) of UA that provides sustainable development.

This research consists of a literature review and is organized as follows. In section 2, it presents the theoretical framework that supports the concepts of UA and ECE. Section 3

describes the methodological procedures for the development of the research. In section 4, it presents the main findings, followed by the discussion (section 5) and conclusions (section 6).

2 Theoretical Background

2.1 Urban Agriculture (UA) and sustainable cities

Ancient cities considered agriculture a basic element in urban planning, with agricultural production serving local communities. However, the industrial revolution in the 18th century modified this model, directing cities towards global-scale production and resulting in the distancing between urbanization and agriculture, as industries occupied lands previously designated for agriculture due to their greater economic profitability (Dobele and Zvirbule, 2020).

In recent years, there has been a resurgence of interest in UA, driven by concerns about food access in urban areas, sustainability, and food security (Bhattarai and Adhikari, 2023; Mulier et al., 2022).

Due to higher land prices in urban areas compared to rural ones, UA usually occurs in small spaces such as residential yards, rooftops, balconies, community gardens, schools, public parks, and degraded green areas (Bhattarai and Adhikari, 2023; Lee, 2020).

UA plays a multifaceted role, providing various benefits to the urban environment and its inhabitants, including the creation of local sources of fresh food, the promotion of biodiversity, and the revitalization of underutilized urban spaces (Nowysz et al., 2022; Ferreira et al., 2018). Additionally, it contributes to food security, minimizes the effects of urban heat islands, reduces greenhouse gas emissions, and improves the availability and access to perishable foods such as vegetables and dairy products (Bhattarai and Adhikari, 2023; Ferreira et al., 2018).

However, the complexity of the urban system presents challenges for food production in UA, due to the variety of spaces and regulations involved. Achieving circularity in this context may require new approaches (Canet-Martí et al., 2021). In this study, we propose adopting the perspective of ECE, as discussed in detail below.

2.2 Entrepreneurial Circular Ecosystem (ECE)

The literature presents various combinations of business ecosystems. Among them, two typologies stand out in terms of sustainability: entrepreneurial ecosystems focused on social and community development (Cohen, 2006; Sunny and Shu, 2019; Khavul and Bruton,

2013) and circular ecosystems based on the principles of the circular economy (Zucchella and Previtali, 2019; Tate et al., 2019; Hsieh et al., 2017).

In general, the entrepreneurial ecosystem encompasses social, political, economic, and cultural elements that support the growth of innovative startups and encourage entrepreneurs to take risks in creating and financing high-potential companies (Spigel and Harrison, 2017). On the other hand, the circular ecosystem consists of interdependent actors operating businesses applying the principles of the circular economy (Trevisan et al., 2022). The integration of these two typologies forms the ECEs.

In summary, ECEs are composed of different interconnected actors that adopt the circular economy as a fundamental premise to address environmental and social demands, with entrepreneurs playing a significant role as agents of social transformation.

An example of ECE in UA was the Harvesting Sustainability Project: community practices of food security and urban agriculture. The project was carried out in Embu das Artes, a metropolitan region of the city of São Paulo, Brazil, during the period between 2008 and 2011. The initiative involved different actors from the municipal administration, civil society, and a non-governmental organization. The project aimed to promote socioeconomic inclusion, combat hunger, promote nutritional food security, promote socio-environmental education, rescue popular knowledge, stimulate job creation and income, and solidarity economy, with emphasis on organic/agroecological-based UA. During the project's validity, several community gardens were built. These spaces attracted residents from the neighborhoods who started to practice walks, design actions for neighborhood improvements, and socialize with the different groups involved. UA was also pointed out as a therapeutic activity, improving the depression status of some actors involved. Furthermore, the project also improved urban landscapes by making use of some underutilized areas in the city (Ribeiro et al., 2015).

3 Methodology

the article consists of a literature review aimed at identifying critical elements for structuring an ECE in UA. Given the scarcity of research simultaneously addressing ECE and UA, two systematic literature reviews were conducted, one for each concept. In both cases, articles, review articles, and early access articles available on the Web of Science (WOS) and Scopus databases were collected.

In the first review, the aim was to identify analysis dimensions to characterize ECEs related to sustainability. To achieve this, a literature search was conducted in titles, abstracts, and keywords using the following terms: ("entrepreneurial ecosystem*" OR "circular ecosystem*" OR "sustainable ecosystem*" OR "innovation ecosystem*") AND

("sustainab*") AND ("circular economy" OR "circularity").

This search resulted in 62 publications in Scopus and 58 in WOS. Using the Rstudio tool developed by Aria and Cuccurullo (2017) to cross-reference the data, 40 duplicate publications were identified and excluded, resulting in a final sample of 80 articles. Subsequently, the abstracts of the publications were read to select those to be read in full during the research. At this stage, articles that did not focus on circular and/or entrepreneurial ecosystems for sustainability were excluded, resulting in the selection of 38 articles. Later, a content analysis (Snyder, 2019) was conducted on the articles in the sample using NVivo 12 software to identify analysis dimensions for ECEs. This information enabled the development of the framework presented in the next section (Table 1).

The second literature review followed the same research protocol. Initially, articles were searched using the following keywords: ("urban agriculture") AND ("entrepreneurial ecosystem" OR "circular ecosystem" OR "circularity" OR "entrepreneurship" OR "circular economy") AND ("sustainab*"). The search resulted in 52 publications in Scopus and 61 in WOS, of which 45 were duplicates and were removed from the sample, resulting in 68 articles. Subsequently, the abstracts of the publications were examined, and technical articles in the field of agriculture and those without a direct relationship between UA and circular economy and/or entrepreneurship were excluded. This step resulted in the exclusion of 41 articles, leaving 27 publications that were subsequently reviewed through content analysis in NVivo 12 to understand the literature on UA related to circular economy, entrepreneurship, and sustainability.

4. Findings

based on the first systematic literature review, we found that ECEs can be analyzed through the following dimensions, as outlined in Table 1:

Table 1 - Dimensions of Analysis

Dimensions of Analysis	Concepts
Regulations	This refers to the set of laws and mandatory norms for companies operating within a circular economy model. These legal requirements may vary depending on the specificities of each sector and country (Sopelana et al., 2021; Oliveira et al, 2022).
Circular Innovations	These are innovations aimed at fostering the circular economy (Pizzi et al., 2022; Boffa et al., 2023).

Open Culture for Circularity	Among the various elements that constitute a culture, we will consider values, collective interests, actors' knowledge, and the collective spirit of the community (Cohen, 2006; Thakur e Wilson, 2023).
Trust and Cooperation for Circular Value Creation and Capture	This dimension highlights the importance of shared value among the various actors of the ecosystem to promote a sense of trust and belonging (Velter et al., 2020; Moggi and Dameri, 2021).
Circular Entrepreneurship	It is the deliberate and conscious process of aligning all entrepreneurial initiatives and environmental opportunities with the principles of the circular economy (Panait et al., 2022; Rocha et al., 2023).
Local Community Development	This is the social dimension involving the interaction between circular business models and society, focusing on both the social impact and the development potential that circular businesses offer to society (Sopelana et al., 2021; Boldrini e Antheaume, 2021).

Source: Developed by the authors, 2024

Each dimension involves a group of interconnected actors. The second literature review aimed to identify this group of actors in the AU, from which it was possible to characterize ECE in the AU based on the general dimensions of an ECE identified in the first moment.

a) Regulations

The management of a circular food system in sustainable UA is linked to the UN Sustainable Development Goals (SDG 2 - Zero Hunger and Sustainable Agriculture; SDG 11 - Sustainable Cities and Communities; and SDG 12 - Responsible Consumption and Production) (Erälinna and Szymoniuk, 2021). Despite the growing recognition of the benefits of UA, it generally lacks public policies that include it in local urban planning (Gulyas and Edmondson, 2021; Weidner et al., 2020; Ferreira et al., 2018).

In most urban food policies, the reasoning about local food systems is aimed at a physical, symbolic, and economic reconnection between the city and the countryside through a series of actions and tools involving all phases of food chains. This implies the recognition of agroecosystems as integrated phenomena capable of playing a fundamental role in the development of urban systems (Mazzocchi and Marino, 2020).

b) Circular Innovations

Innovation capacity plays a fundamental role in transitioning from a linear to a circular production model within an ecosystem (Zucchella et al., 2022). In the context of UA, the literature highlights several innovations relevant to promoting circularity in urban agricultural production. Regarding the reuse and recycling of wastewater, biofilters stand out, allowing for the passive treatment of potentially contaminated rainwater (Cronin and Halog, 2022). In terms of logistics and distribution, a promising solution to mitigate urban congestion and reduce emissions of polluting gases is the adoption of small electric vehicles; the short distances traveled in UA also decrease the need for environmentally harmful packaging (Weidner et al., 2020). Regarding communication, network technologies are increasingly being incorporated into various applications, connecting different actors in the supply chain (Cronin and Halog, 2022). Such innovations consist of clean technologies that contribute to the circularity of the urban agricultural system.

c) Open Culture for Circularity

Direct experiences of consuming locally grown foods can develop healthy consumption habits, and such habits lead to sustainable consumption and production (Lee, 2020). People are increasingly conscious and seek value in fresh, minimally processed, and sustainably sourced foods (Erälinna and Szymoniuk, 2021), resulting in the development of local agri-food sectors based on short supply chains (Zanzi et al., 2021).

However, while culture drives circularity in UA, it also raises barriers. For example, some consumers are hesitant to accept the use of urban wastewater in irrigation (Mulier et al., 2022). Thus, cultural characteristics must be considered and addressed for the structuring of an ECE in agriculture.

d) Trust and Cooperation for Circular Value Creation and Capture

To conceive UA focused on circularity and sustainability, the cooperation of multiple actors is necessary. Public-private partnerships provide technological and commercial support; educational institutions can offer technical knowledge for the development of agricultural practices (Bhattarai and Adhikari, 2023); the food industry and retail system, when incorporated, bring greater financial returns to producers (Weidner et al., 2020); urban farmers can seize entrepreneurial opportunities that UA provides (Der Gaast et al., 2023; Weidner et al., 2020); consequently, urban residents and the involved communities can enhance social and emotional well-being by enjoying green spaces (Erälinna and Szymoniuk, 2021).

The communication and cooperation of these various actors contribute to the success of UA (Gulyas and Edmondson, 2021) and allow its structuring through an ecosystemic vision. In this sense, some communication platforms are being created to facilitate the cooperation of various actors involved, from production and distribution to

waste composting (Nowysz et al., 2022).

e) Circular Entrepreneurship

Food production in urban areas stands out as a significant opportunity to drive circular entrepreneurship. Shorter food supply chains not only promote food security but also enable a more agile response to consumer demands (Säumel et al., 2020; Canet-Martí et al., 2021). Additionally, they contribute to reducing food waste and fossil fuel emissions, as they decrease the distances traveled in food transportation (Canet-Martí et al., 2021). Regarding organic waste composting, such chains enable the reduction of local costs for community waste management and the exploitation of underutilized urban resources, such as graywater, rainwater, vacant lots, and rooftops (Nowysz et al., 2022).

Despite circular business opportunities, UA carries challenges concerning competition with imported products and the lack of guaranteed stable income for the business (Nowysz et al., 2022). This ability to envision opportunities amidst challenges characterizes the entrepreneurial action of producers.

f) Local Community Development

Another fundamental aspect of UA is its social dimension, as it offers opportunities to address social injustices. For instance, most UA projects involve disadvantaged individuals, such as disabled, elderly, and unemployed people, providing jobs and training opportunities. This stimulates social entrepreneurship for the creation of new business models (Lee, 2020; Weidner et al., 2020). UA can also occur in less privileged areas, enabling the improvement of residents' social situation and promoting awareness of environmental justice, mental and physical health, well-being, social cohesion, and consumption of locally grown fresh and healthy food (Säumel et al., 2020; Lee, 2020).

In UA ecosystems, businesses are characterized by decentralized and small-scale production, as they are aimed at meeting local needs. This approach helps to avoid waste and pollution, contributing to the implementation of a more circular economy (Cronin and Halog, 2022).

5 Discussions

For an ECE model to work in UA, orchestration is required, as the various actors must be aligned (Kanda et al., 2021). A circular ecosystem must include the creation of facilitating organizations responsible for monitoring, regulating, and developing the elements of the ecosystem (Asgari and Asgari, 2021). This is directly related to the level of trust and cooperation, as ecosystem orchestrators must efficiently coordinate business networks, maintaining an environment of trust in which cooperation, resource sharing,

knowledge, and various innovations can take place (Thakur and Wilson, 2023).

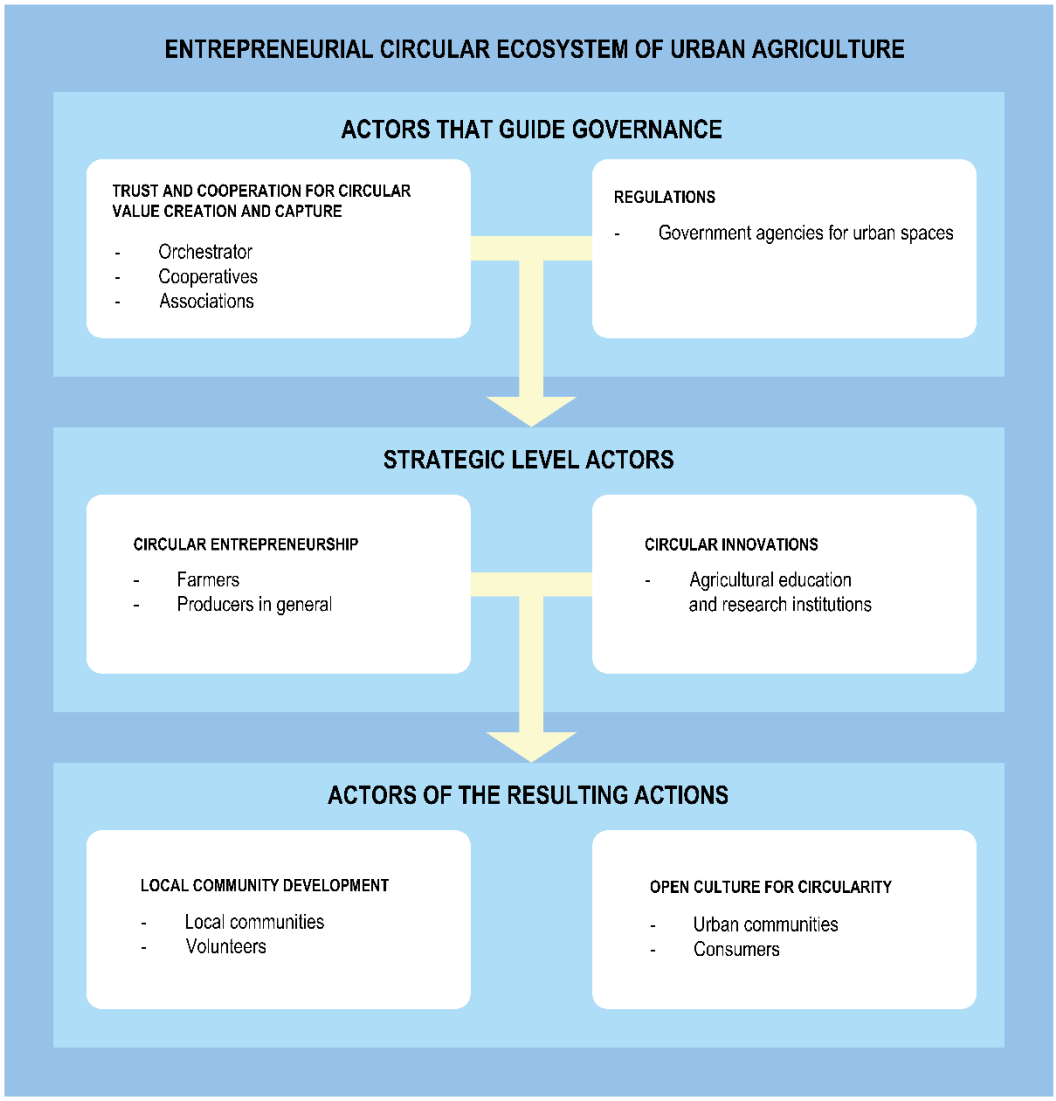
Sopelana et al. (2021) also emphasize the need for orchestrators to instigate actor engagement in the circular ecosystem, considering that the transition process to circularity requires changes in business practices, cultural values, and policies. In other words, in the ecosystem, orchestrators are responsible for aligning stakeholders in obtaining the skills and knowledge necessary towards sustainability (Moggi and Dameri, 2021).

Some examples of initiatives aimed at forming ECEs were found in the literature on UA, although they were not exactly referred to in this way, but their characteristics point to an embryonic ecosystem. iZindaba Zokudla (IZ) is a multi-stakeholder engagement project aimed at creating opportunities for UA in a sustainable food system in Johannesburg. IZ implements the Farmers' Lab, a social laboratory used as a transition mechanism to sustainability. The project involves the university as an orchestrator and promotes social laboratories that facilitate innovation in the food system. Emerging entrepreneurs use these social laboratories in the development of their activities and in engaging different stakeholders (Malan, 2020).

In Norway, UA projects are becoming more popular in compact areas, and Norwegian public authorities are promoting them as a means for local food production, learning, and public involvement. The project involves the public sector as an orchestrator, encouraging creative and collaborative participation of actors in workshops for the development of regenerative cultivation skills, planning, and business (Tomprou, 2023).

In the city of Turku, Finland, a circular food system project was implemented to reduce food waste in the restaurants of the Turku University Campus and support urban agriculture through local recycling of nutrients generated by composting food waste derived from the restaurant. This required promoting campaigns for cultural change among consumers, aiming for less waste and more recycling. The project was initiated by the university as an orchestrator and connected different actors: public bodies, third-sector association, volunteer students, local farmers, and entrepreneurs (Erälinna and Szymoniuk, 2021). Figure 1 relates all the actors of the ECE identified in the second literature review.

Figure 1: Entrepreneurial Circular Ecosystem of Urban Agriculture



Source: Developed by the authors, 2024

The framework presented in Figure 1 encompasses several key aspects of AU. Firstly, it outlines the actors involved in ecosystem governance through regulations and ecosystem orchestration. These governance actors provide support to actors at the strategic level. Here, entrepreneurial action and innovation development take place. Actors at the strategic level stimulate social development and pro-environmental behaviour among resulting actors, involving local communities and influencing consumer culture and disposal practices.

However, despite the high potential of UA, some challenges are also raised in the literature, such as: limited availability of space in cities, which raises land costs (Gulyas and

Edmondson, 2021; Deksissa et al., 2021); not all available space may be suitable for food production, as urban soils can be contaminated and spatial management policies often do not consider agricultural functions; lack of long-term security for vulnerable cultivation spaces susceptible to vandalism (Gulyas and Edmondson, 2021; Nowysz et al., 2022); lack of professional experience among some producers may lead to improper use of phytosanitary products, exacerbating pollution issues in the city (Canet-Martí et al., 2021); some inconveniences may affect urban space residents, such as compost smell, flies, and soil and plant worms (Bhattarai and Adhikari, 2023).

Despite the challenges, UA still stands as a relevant alternative for sustainable development in cities and contributes to a healthy and resilient community when combined with good planning strategies (Bhattarai and Adhikari, 2023).

It is worth noting that UA can take place in residential yards, rooftops, balconies, community gardens, schools, public parks, degraded green areas, and vertical spaces (Bhattarai & Adhikari, 2023; Lee, 2020). Depending on the type of agriculture, the actors involved may vary.

Environmental symbiosis is also highlighted as a major research field that has been addressing urban agriculture over the last decade (according to Scopus data). For example, Martin et al. (2022) explored the potential for the development of circular urban vertical agricultural systems in buildings based on the concept of industrial symbiosis. Muñoz-Liesa et al. (2020) reported the energy benefits of integrating rooftop greenhouses for renewable energy production intended for air conditioning and ventilation systems in buildings. Sanyé-Mengual et al. (2018) used the industrial symbiosis approach to study the potential of rooftop greenhouses in European and Latin American cities.

Finally, industrial symbiosis is a concept that denotes significant action on the part of industry to develop interaction among actors (Martin et al., 2019), while the ECE highlights entrepreneurial action as agents of social change and the principles of the circular economy as important values for environmental care.

6 Final Considerations

From the dimensions of ECE identified in the literature, it was possible to detect essential elements for the development of an ECE in UA. This includes the need for multidisciplinary partnerships, technological innovation, cultural change, entrepreneurial action, cooperation among various ecosystem actors, and engagement of local communities. Additionally, the importance of an orchestrating organization that synergistically unites all stakeholders is emphasized. The study also contextualizes the need for public policies and initiatives that promote UA and encourage collaboration among

different actors in the urban ecosystem to achieve more sustainable and resilient cities in the future.

The research contributes to studies in UA management by introducing the perspective of ECEs to organize the business network. This approach can also assist public managers in the context of sustainable urban planning. Finally, the research has a positive social impact by stimulating insights and encouraging the formation of partnerships and cooperation among the various actors involved in the UA ecosystem.

Future work perspectives include conducting empirical studies that investigate the effectiveness and practical impacts of implementing an ECE in diverse contexts of UA. These studies can provide valuable insights into the challenges faced in operationalizing the ECE, as well as tangible benefits for local communities and the environment. Furthermore, the application of established theories, such as the Natural Resource-Based View theory, can serve as a solid theoretical foundation for further exploration of ECEs in UA.

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