

# Investigating local policy instruments for different types of urban agriculture in four European cities: A case study analysis on the use and effectiveness of the applied policy instruments

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## ABSTRACT

Over the last decades, urban agriculture (UA) and controlled environmental agriculture (CEA) have been growing in many urban areas of the world to supply fresh food locally and to provide multiple benefits for the sustainable development of urban landscapes. Municipal policies and regulatory tools are increasingly employed to support UA/CEA and minimize practical challenges. However, especially in Europe, there is a lack of systematic reviews that evaluate the impacts of city-level food policies for UA/CEA and their effectiveness as perceived by local responsible actors. To address this gap, this study presents a qualitative overview of municipal policies that affect UA/CEA. We reviewed more than 83 policy documents and manuscripts and performed an online structured survey targeting key local managers or employees of UA and innovative CEA systems in four EU cities – Barcelona (Spain), Lyon (France), Trieste and Udine (Italy). We assessed policy tools, especially for three identified types of UA (allotment gardens, community gardens and closed spaces using CEA) by mainly focusing on public and private institutions and including aspects concerning land use planning, health and environmental policies. The findings demonstrate how the four cities' municipal governments specifically designed and combined a multiplicity of policy instruments to enable, regulate and acknowledge UA/CEA as part of the urban metabolism and landscape. The policy instruments were shaped by different local governance and institutional structures as well as by the local actors and community practitioners and their growing interest in UA/CEA.

## 1. Introduction

### 1.1. Urban agriculture (UA) as an alternative food production system

According to the United Nations, the global population is projected to surpass 9 billion by 2050 (UN, 2019), and scientists have reported how feeding sustainably the projected global population growth is among the biggest challenges of the 21st century (Godfray et al., 2010; Mehrabi et al., 2018). This is especially true as major contemporary food systems, characterized by complex, globalized and telecoupled organizational nature, have been declared unsustainable (Béné et al., 2019; Bricas, 2019; Garrett and Rueda, 2019; Holden et al., 2018; Liu et al., 2011). The demand for food in cities, which currently host over half of

the world population, has outgrown the supply capacity of their rural hinterlands based on conventional agriculture and accelerated their dependence on unsustainable globalized food supply chains (Bricas, 2019; Elmqvist et al., 2019; Osei-Owusu et al., 2019; UN, 2018).

Acknowledging this, many cities are in search of complementary strategies to satisfy the rising demand for local fresh and high-quality food produced more sustainably while reducing the environmental footprint of food imports and the dependence on globalized food production systems (Gladek et al., 2017). One increasingly adopted solution is the re-envisioning of cities as settings for production-level agriculture where vegetables are grown closer to where a large share of the population lives. Urban agriculture (UA) is defined as the practice of cultivating, processing, and distributing food to urban communities as the

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key to changing the urban metabolism from a linear economy metabolism into a circular self-sustaining metabolism (Clinton et al., 2018; Cong and Thomsen, 2021; Golden, 2013; Prové, 2018; Roggema, 2016). UA is not a new phenomenon and historically, the adoption of UA was a meaningful strategy to ensure food security (Bryant et al., 2016; Hallett et al., 2016; Vejre et al., 2016). In particular, in times of economic depression and war, but also in epochs of current pandemic (Altieri and Nicholls, 2020; Kahiluoto, 2020), UA is and was implemented in many cities as a viable food supply system for the local population (Brand et al., 2019; Dieleman, 2017; McEldowney, 2017). Today, with similar scope, UA is the main response to food security, poverty reduction and economic development, particularly in developing and less-developed countries (De Zeeuw et al., 2011; FAO, 2007). Furthermore, as sustainability and just city concepts are becoming a priority on the agenda of advanced economies (Fainstein, 2014), UA can potentially contribute to supplying high-quality and healthy fresh food for the cities and many other social and ecological benefits to the most developed economies (Artmann and Sartison, 2018; Lohrberg et al., 2016). It has been reconsidered among academics, policy-makers and practitioners alike, as a potential complementary strategy to food security with respect to traditional agriculture, and as a solution for addressing some of the main environmental issues concerning the current food systems and urbanization process (Duží et al., 2017; Edmondson et al., 2020; Ferreira et al., 2018). Depending on the underlying function of the UA (e.g. food production system for local markets or individual food subsistence, educational or leisure service), we can distinguish different forms of UA such as household, school and community gardens, city farms as well as rooftop gardens and vertical indoor agriculture (Pearson et al., 2010; Simon Rojo et al., 2015). Many UA types can also involve animal husbandry as practice: raising animals for eggs, dairy, meat, and honey. However, since this practice is less common in the EU and more frequently adopted in peri-urban areas (Alarcon et al., 2017), animal husbandry was considered outside of the scope of this research.

### 1.2. Benefits and challenges of UA

Overall, a potentially wide range of economic, social and environmental benefits for UA settings have been reported in the literature (FAAN, 2010; Feola et al., 2020; Miccoli et al., 2016; Smith et al., 2017). Economic benefits include 1) strengthened local economies with the creation of economic profit for local entrepreneurs (i.e. local residents who grow food in their UA and sell it in local markets) and new forms of economic activities (informal, non-profit or sharing economy); 2) possible diversification of business activities, such as agro-tourism, kindergarten farms and social care services; 3) creation of new workplaces; and 4) the reduction of transportation and logistics costs from importing vegetable products (Osei-Owusu et al., 2019).

Social benefits of UA include social cohesion (e.g. enhancing social inclusion, providing fresh and quality food at affordable prices, or gifting, sharing and exchanging crop surpluses) and community development (e.g. green public spaces, recreation and leisure opportunities, environmental education, cultural events, therapeutic scopes and increasing community resilience) (Duží et al., 2017; FAAN, 2010; Miccoli et al., 2016). Main ecological benefits range from ecosystem provisional services (food and nutrition supply), regulating ecosystem services for local microclimate (reduction of urban heat island effects, wind protection, sequestration of CO<sub>2</sub> and other pollutants), other regulating ecosystem services (pollination, pest control, and climate resilience) and cultural ecosystem services (recreation and education) (Fig. 1) (Camps-Calvet et al., 2016; Cong and Thomsen, 2021; Feola et al., 2020; Lin et al., 2015). Furthermore, UA can increase local resource efficiency and promote the circularity of bioresources (e.g. recycling of biowaste and process water inside the UA systems and energy reuse) (Dubbeling et al., 2016; Mohareb et al., 2017). Urban green spaces have great potential to become environments that develop, implement and experiment with innovative circular bioeconomy

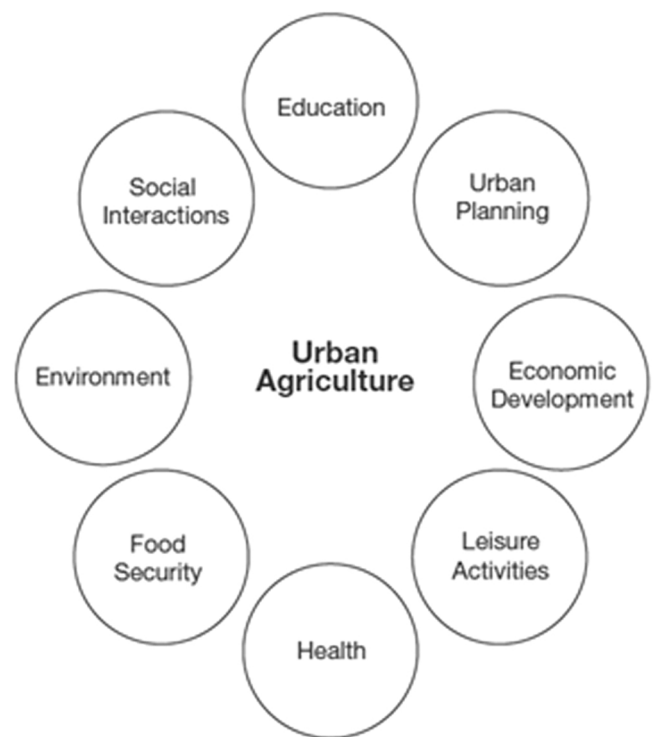


Fig. 1. The multiple benefits of urban agriculture in cities. Source: Duchemin et al. (2008).

solutions (Ellen MacArthur Foundation, 2019; Stuchtey and Vahle, 2019; Vargas-Hernández et al., 2018; Weidner et al., 2019), contributing to enhancing the overall sustainability of food systems (Feola et al., 2020; Sanyé-Mengual et al., 2019).

However, UA is not free from limitations, risks and challenges. Some authors argue that UA's contribution to overall food production would be insignificant (Badami and Ramankutty, 2015; Martin et al., 2016), while others estimate that 10% of the urban demand for plant-based food may be supplied from local UA within the big cities (Clinton et al., 2018; Fletcher and Collins, 2020). Other studies advocate that several factors, such as the size of UA, land use properties, the economic viability of UA activities and other market constraints (e.g. distribution and accessibility to the UA land), can constrain the implementation of UA (Siegner et al., 2018). Furthermore, several studies commonly highlighted an observed phenomenon of individual exclusion and marginalization from possible participation in UA, which undermines the social benefits of UA (Glover, 2004; Kato, 2013; Meenan and Hoover, 2012; Poulsen et al., 2014).

Some studies showed how UA practices may pose a threat in terms of urban ecosystem replacement (Shkaruba et al., 2021), biodiversity reduction (Clucas et al., 2018) and climate change (Dorr et al., 2021). However, it is difficult to precisely identify and quantify these risks as they may greatly diverge based on the sheer diversity of existing UA both in terms of typologies and geographic locations (Dorr et al., 2021). Furthermore, UA systems have a clear potential to reduce these threats based on how the UA is managed more practically by local farmers (Lin et al., 2015). In a few studies, negative environmental externalities associated with UA have been related to impacts on human health due to soil pollution and contamination (Bryant et al., 2016). In particular, risks have been associated with UA for what concern food safety and risks of exposure of food growers and consumers to urban contaminants such as heavy metals (HM) (Artmann and Sartison, 2018; Ferreira et al., 2018). HM are toxic micro-pollutants that represent a considerable risk for both human health and the environment as they bioaccumulate in the soil and contaminate vegetable food grown in agricultural lands

(Balotin et al., 2020; Marini et al., 2021). Certain extrinsic and intrinsic characteristics of the UA play an important role in reducing the risk cycle of these micro-pollutants (Aubry and Manouchehri, 2019). For example, an outdoor UA might be more exposed to air and water pollutants, depending on the geographical and environmental quality characterizing the UA location (distance from urban traffic, soil characteristics and type of crops grown). An indoor UA might be more exposed to contaminant sources based on how the UA is managed by the urban farmers; e.g. cropping management techniques adopted, skills of the urban farmers and use of mineral instead of organic fertilizers (Cheng et al., 2015; Izquierdo et al., 2015; Säumel et al., 2012; Sharma et al., 2015; Shrestha et al., 2020).

Significant risk-reduction opportunities for HM accumulation can be achieved within advanced closed-field indoor UA (Schnitzler, 2013). These systems are collectively referred to as controlled environment agriculture (CEA) (Benis and Ferrão, 2018). CEA takes place throughout various urban farming systems such as vertical farms and rooftop greenhouses being the most popular examples (Despommier, 2019), and can adapt soilless growing media, such as hydroponic, aeroponics and aquaponics (Gómez et al., 2019). Due to the lack of soil usage, those systems can reduce major contamination risks (Goodman and Minner, 2019; Hoevenaars et al., 2018; Pennisi et al., 2016; Wortman and Lovell, 2013). Furthermore, there is an easier predisposition to use natural and local more efficiently and to promote the circularity of bioresources (De Kraker et al., 2019; Dubbeling et al., 2016; Mohareb et al., 2017). As a remarkable example, the EU Horizon2020 project DECISIVE ([www.decisive2020.eu](http://www.decisive2020.eu)), shows the potential of changing the urban metabolism via the implementation of UA and CEA in combination with decentralized organic waste valorization systems (e.g. recycling of biowaste collected for combined bioenergy and solid and liquid fertilizer production, reuse of treated wastewater inside the system and energy reuse) (Angouria-Tsorochidou et al., 2022; Weidner and Yang, 2020). CEA systems coupled with sustainable circular innovations have been demonstrated overall compelling to achieve a more sustainable production process with reduced risks of HM accumulation in plant-based foods (Antisari et al., 2015; Hallett et al., 2016; Kozai and Niu, 2020; Pigford et al., 2018; Sanyé-Mengual et al., 2019).

### 1.3. European policy and regulatory instruments

Policy and regulatory instruments play a central role in enabling UA development and innovation systems (Droste et al., 2016; Reed et al., 2013; Van der Jagt et al., 2017). To steer UA in Europe, the importance of common strategies and policy tools at multiple governance levels (EU, national, sub-national and local) has become the focus of renewed attention and debate, particularly in the research field of urban food planning (Brand et al., 2019; Pettenati, 2019). Close attention has been paid to UA over the last 15–20 years, in particular, to how to design effective policy instruments capturing all possible benefits of UA and the capability of CEA to adopt innovative solutions that enable risk-mitigation measures and process quality control (Delaney et al., 2018; Dietz et al., 2018; Meenar et al., 2017; Reed et al., 2013; Van der Jagt et al., 2017). Existing high-level policies, such as those from the EU, have recently been assessed in several studies (Curry et al., 2014; McEldowney, 2017; Rolf et al., 2020), with some also focusing on policies and strategies to support high-tech CEA (Fruscella et al., 2021; Gregg and Jürgens, 2019; Hoevenaars et al., 2018; Joly et al., 2015; Reinhardt et al., 2019). Strategies, initiatives, plans, international networks and partnership schemes for UA have been implemented at the national level (Cinà and Di Iacovo, 2014; Moschitz, 2018), and city level (Baker and de Zeeuw, 2015; MUFPP, 2015; Oscilowicz et al., 2021; Piore, 2018; Raja et al., 2008), where, over the last few decades, the focus on the importance of governing urban food systems has significantly increased (Doernberg et al., 2019; Filippini et al., 2019). In contrast to 20 years ago, when food and agriculture were considered “non-urban” (Lerner and Eakin, 2011), and therefore marginal in urban

planning and policy-making, cities became essential spaces for food system innovation (Cretella, 2016). It is therefore important to evaluate the policies’ effectiveness at the local level, as cities and local administrations are the most appropriate sphere to regulate urban food systems (Doernberg et al., 2019; Sonnino et al., 2019).

The complexity of the policy landscape supporting UA today consists of a wide range of policy instruments and strategies issued within different food-related sectors and public domains (Brand et al., 2019; Halvey et al., 2020; Oscilowicz et al., 2021). The EU policy is mainly supporting UA indirectly via common programs and strategies (McEldowney, 2017). However, direct support from the central government is recognized as important for the future development of UA and CEA (Fruscella et al., 2021; Prové et al., 2015).

Extensive research analyses that specifically develop an understanding of policy strategies and instruments that support UA and CEA at various governance levels in Europe are rare (Curry et al., 2014). Moreover, there is a lack of studies that evaluate the impacts of city-level food policies for UA and CEA, plans or programs and their effectiveness as perceived by local UA and CEA actors (Baker and de Zeeuw, 2015; Curry et al., 2014; Doernberg et al., 2019). In particular, the main literature revealed a lack of systematic policy reviews that account for UA/CEA at the city level, especially across EU countries, together with studies assessing their effectiveness.

In this paper, we present the result of a case study analysis on the use of applied local policy instruments in four EU cities and the analysis of one aspect of policy effectiveness that measures the social acceptability of existing policy tools. We considered the policy perception of local UA/CEA stakeholders as indicative of whether and how the local policies were accepted and supportive (or inhibitory) for the development of UA and CEA. For this exercise, we conducted a systematic literature review and an online survey of municipal policies and regulatory tools of relevance to UA and CEA within the selected case studies. The survey includes UA and CEA actors involved in novel decentralized organic waste valorization systems in Barcelona (Spain), Lyon (France) and Trieste/Udine (Italy) included in the H2020 project DECISIVE. We provide an overview of existing policy tools by discussing regulatory and legal vacuums, economic incentives, information and technical support, and institutional measures (Pearson et al., 2010; Roemers, 2014). Furthermore, we considered essential land use planning aspects as well as important features related to food health and safety, such as heavy metal contamination, and environmental sustainability.

The paper provides important information on the differences in existing policy instruments, regulatory vacuums and potential ways forward in strengthening the support of local circular food systems. Exploring how individual cities organized their food strategies and policies to address UA/CEA across different governance contexts can support the research field of land use policy and urban food planning in how to design effective policy instruments to incentivize UA and capture their multiple potential benefits. We aimed to inform researchers, practitioners and policymakers interested in understanding the most relevant limitations and opportunities of the different categories of policy tools and instruments with respect to the responsible actors. This research also provides relevant answers related to the action fields of the categories of policies identified, such as whether and how the land use policy prioritizes the adoption of UA/CEA when new urban spaces are available; which categories of policy instruments are considered by the interviewed actors as the most important to develop or improve in better supporting UA activities; or whether the overall existing policy instruments develop a coherent supportive action in the four EU cities. We believe that informing on the use of local policies and the UA actor’s responses to these policies within the case studies might provide valuable insights into other city contexts.

## 2. Research design and methods

A systematic approach based on a literature review and a multiple

case study analysis using a structured survey for data collection and comparison was followed to investigate the government functioning and policy tools adopted or implemented by the EU and map and explore local policy and regulatory instruments concerning UA and CEA implemented in four EU cities (Barcelona, Lyon, Trieste and Udine) featuring an expansion of UA and high-tech CEA innovation schemes over the last years. Currently, the four EU cities represent rich cases of UA/CEA phenomenon and were chosen according to the qualitative purposeful sampling selection method (Patton, 2015) in addition to adequate availability of data from partners and stakeholders of the H2020 DECISIVE project on the operational development of local circular biobased solutions and technologies in these urban areas. Moreover, the city selection process was based on the population size and urban area dimension, which can represent a reliable approximation of the types of city contexts existing in the EU. According to the OECD, Barcelona is considered an extra-large city (1.6 million inhabitants), Lyon is a large city (about 500.000 inhabitants), Trieste is a medium city (200.000 inhabitants) and Udine a small city (100.000 inhabitants) (Table 1) (Dijkstra and Poelman, 2012).

In this study, we considered the cities of Trieste and Udine as one case study due to their geographical proximity and belonging to the same municipal region.

Fig. 2 provides an overview of the literature and survey methods adopted in this study, while Fig. 3 shows the geographic locations of the four cities considered.

An assessment of the geographic characteristics of the four cities, estimated number of UA gardens, numbers of UA/CEA actors surveyed, rate of response from the survey, and the number of documents collected via the literature screening is presented in Table 1.

## 2.1. Literature review

We reviewed and summarized more than 83 relevant academic publications, policies, and strategic documents in all the cities' main spoken languages (Spanish, Catalan, Italian and French). Academic papers were identified and collected by searching in all the previous languages through the databases Science Direct, Scopus, Web of Science and Google Scholar; while official documentation (documents and reports released by the local municipalities) was retrieved by using city-official web search engines. For each city, the main searched keywords and terms were "urban agriculture/farm", "urban controlled-environment agriculture", "vertical agriculture/farm", "urban hydroponic/aquaponic agriculture", and "urban rooftop agriculture". The keywords were selected based on the literature pre-screening using

**Table 1**  
Overview of the four EU cities.

Country	Spain	France	Italy
Region	Catalonia	Auvergne-Rhône-Alpes	Friuli Venezia Giulia
City	Barcelona	Lyon	Udine (U) Trieste (T)
Population (in 1000 inh.)	1664 <sup>a</sup>	519 <sup>b</sup>	99.7 (U) <sup>c</sup> 199.5 (T) <sup>c</sup>
Urban area (km <sup>2</sup> )	101.4 <sup>a</sup>	47.9 <sup>b</sup>	56.8 (U) <sup>c</sup> 85.1 (T) <sup>c</sup>
Estimated UA gardens (n)	~ 120 <sup>a</sup>	~ 200 <sup>b</sup>	~ 75 (U) <sup>c</sup> ~ 25 (T) <sup>c</sup>
Documents retrieved (n)	30	24	29
UA/CEA surveyed (n)	3 UA 3 CEA	3 UA 2 CEA	3 UA 2 CEA
Survey respondents (n)	6	5	5
Rate of response	75%	62%	70%

<sup>a</sup> Institut d'Estadística de Catalunya (2020).

<sup>b</sup> Institut National de la Statistique et des Études Économiques, France (2018).

<sup>c</sup> Istituto Nazionale di Statistica Italia (2021).

different keyword variations. We set out the search to gather legislative, regulatory, and administrative UA policies, strategies, programs, economic incentives schemes, information on technical supportive measures, and other institutional measures. Additionally, we performed a second review focused on grey literature accessed via Google search engine to refine our results and with regards to the relatively new emergence of urban CEA. This allowed complementing the scientific literature. After the screening, we identified, selected and reviewed the 83 research articles among which books, planning and policy journals, social science journals, interdisciplinary journals on health, food and agriculture, reports, grey literature and policy briefs that fulfilled the following inclusion criteria, where the document/manuscript:

- Relates to UA or innovative cultivation techniques such as CEA
- Considers policies, regulatory instruments, economic incentives, information and technical support and institutional measures
- Is contextual to the EU country/city level
- Considers additional aspects related to food safety
- Relates to new policy initiatives or strategies at a local level

## 2.2. Multiple case study analysis and stakeholder survey

We adopted a multiple case study approach to fully explore, describe, explain and confront the UA and CEA phenomenon in the four EU cities (Barcelona, Lyon, Trieste and Udine) (George, 2019; Yin, 2018). Our main research question was "how effective are local policy instruments in the development of urban agricultural food provisioning systems in European cities?". This research question led to the adoption of a case study research methodology to "investigate a contemporary phenomenon in depth and within its real-world context" (Yin, 2018). Furthermore, multiple case studies were selected since they are better suited to understand differences and similarities between the cases and analyzing the data both within each situation and across situations (Gustafsson, 2017). To present the results of case studies in a coherent and easy-to-understand way, we followed the multiple case study compositional format and procedure of Yin (2018) by presenting the single case study per city – (first) background information and (second) applied policy instruments – and (third) a separate cross-case analysis included in the discussion section.

To gain specific insights on the impacts of implemented policy measures (i.e., policy effectiveness), strategies, regulatory tools, and to understand gaps in policy implementation, our case study was designed to include a qualitative online structured expert case study survey with key local managers or employees of UA and innovative CEA systems. The questionnaire was filled out via an online format due to Covid-19 pandemic restrictions. In this way, we were able to match and eventually corroborate the findings from our literature review by documenting the direct knowledge and experience of local managers. We designed an online structured interview for stakeholders in the four languages (Spanish, Catalan, Italian and French) that included: general and descriptive questions on the type of UA/CEA; more specific questions on technical system description and specific policy instruments based on the literature review of urban farming policy regulatory instruments (Pearson et al., 2010; Roemers, 2014; Doernberg et al., 2019). Specific questions were formulated to assess the effectiveness of the existing and applied policy instruments. Moreover, a psychometric five-level format Likert scale was used to gain the level of perceived effectiveness, ranging from (1) unsatisfied to (5) more than satisfied.

In this study, we addressed the instrumentality aspect of policy effectiveness (Bali et al., 2019; Capano and Lippi, 2017; Mukherjee and Bali, 2019). The latter considers the political acceptability of a policy tool and assesses to what extent policies are socially accepted. We considered the policy perception of local UA/CEA stakeholders as indicative of whether and how the local policies were accepted and supportive (or inhibitory) for the development of UA and CEA (Curry et al., 2014; Wan et al., 2014). As an initial measure of policy



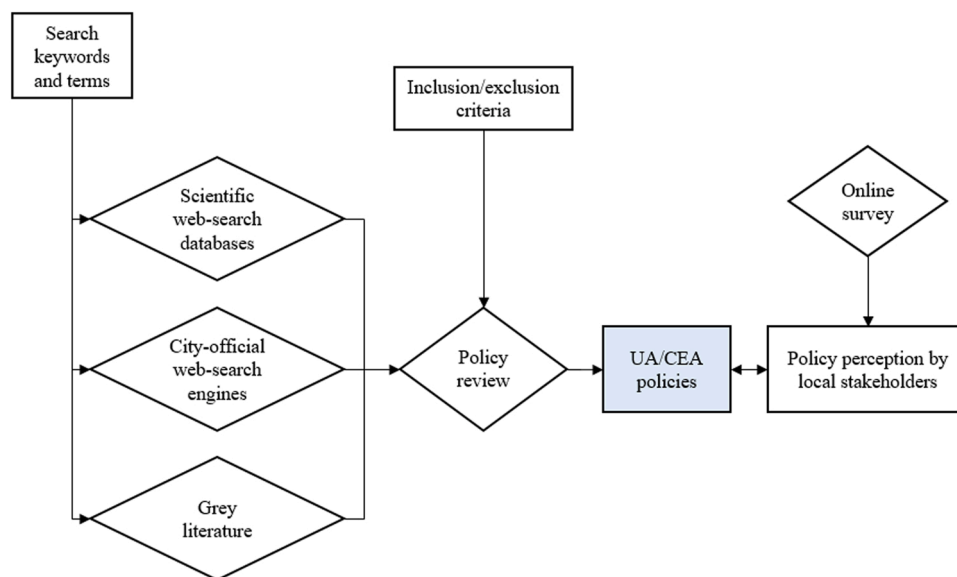


Fig. 2. Methods overview.



Fig. 3. Geographic location of the four EU cities included in the study.

effectiveness, analyzing the stakeholders policy perception within a survey can give a first – significant – overview of a phenomenon that is not yet considered a specific primary target in the political agendas of cities and governments. Additionally, we demanded which alternative instruments would be necessary and viable to use according to the respondents to understand their interests and needs. The questionnaire was mainly inspired by Roemers (2014) but further elaborated and tested by UA partners within the DECISIVE project before the involvement of external stakeholders in the structured interview. This step allowed us to identify existing policy mechanisms according to experiences and proposals put forward by the stakeholders.

23 stakeholders, representing 14 UA and 9 CEA systems, were invited to fulfill the structured questionnaire, and 16 stakeholders accepted. Qualitative data collection via interviews was performed between March and May (2021).

The reader can refer to Table A.1 in Appendix A for the list of interviewees (stakeholders and additional experts) grouped between the various UA/CEA within the EU cities. Table 2 shows the main categories

of public policy instruments that support UA/CEA and operate within the four cities.

### 3. Results

#### 3.1. Urban agriculture in Barcelona – contextual background and supporting initiatives

In Barcelona, one of the first examples of vegetable gardens appeared back in 1986 (Aragay Esmerats et al., 2010). Since then, UA activities are constantly increasing and today many types of UA cover and influence the entire urban area (Aragay Esmerats et al., 2010; Aragón et al., 2020; Jiménez Xiberta et al., 2008). Furthermore, initiatives and projects promoting UA have been adopted at the regional and municipal levels (Covarrubias and Boas, 2020). At the regional level, the Rururbal project (2009–2011) proposed guidelines to govern the territory toward supporting local food production systems (Caramaschi, 2014). At the municipal level, the network Urban Gardens (Calvet-Mir and March,

**Table 2**  
Categories of policy instruments identified.

Categories of mechanisms	Instruments identified	Main examples identified
Legal and regulatory instruments	Land use planning (or urban planning)	Municipal land use plans
	Government acquisition	SAFER organization (Lyon-France)
Economic incentives	Support for efficient production, e.g., pesticide use	Regulation for the concessions of allotment gardens (Trieste and Udine)
	Government grants	Lump-sum payment for UA in Barcelona
	Subsidies or reduced taxes	Reduced annual tax for allotment gardens (Udine)
Voluntary incentives/actions	Incentives for cultivation materials and technology implementation	Free concession of cultivation materials or compost facilities in Barcelona
	Contract agreements or covenant	Procedures for the UA concession established between municipalities and UA owners
	Government provision of land (and/or free services, e.g., water)	Urban plots leased free of charge to local associations in Lyon
	Institutional support (e.g., food policy council or associations)	Le Passe-Jardins association in France and Lyon
	Knowledge and technical support	Autonomous University of Barcelona (ICTA-UAB) for CEA
Educational activities and network	Local associations of UA farmers in Udine	

2019) promotes social gardens with the use of organic methods and practices (Ajuntament de Barcelona, 2015). Furthermore, the Barcelona City Council designed the strategy “Impulso de la Política Alimentaria 2016–2019” (Castro et al., 2018) that encouraged agro-ecological and local food production systems for self-consumption within the community, school and social gardens.

In Barcelona it is possible to find many examples of UA, such as private or individual urban gardens (precarious horticulture, balcony or rooftop urban gardens), allotment gardens (gardens managed by a private citizen, individuals or families), community gardens (gardens normally managed by a group of associated citizens), agricultural parks, school gardens and social-recreational horticultural areas that support local food production (Tulla and Vera, 2019). Besides individual urban gardens and informal self-managed gardens, these types of UA are normally public driven, with intense dedication to social and educational purposes. A limited but yet increasing presence of private companies is observed in vertical or rooftop greenhouse farming in Barcelona (Sanyé-Mengual et al., 2016) which adopt high-tech CEA production systems to commercialize their vegetable products in the local markets.

### 3.2. Analysis of main policy and regulatory tools identified in Barcelona

#### 3.2.1. Legal and regulatory instruments

The land use planning tools that regulate space allowances for the use of natural land for UA in the municipal zone of Barcelona are weakened by the strong demand to preserve land for future urbanization and development of the residential sector (Azevedo et al., 2019; Parés et al., 2019). The local communities have been recently reclaiming space for urban gardening plots and, especially between 2008 and 2010, several urban plots were also occupied illegally. From that moment, the local administration started to grant permission for the implementation of urban farming with specific social purposes or initiatives (Giacché et al., 2016). This led to the launch in 2012 of a public plan Vacant Lands Plan (PLA BUIITS) by the Barcelona administration which offers vacant lands to non-profit associations to create, renovate or revitalize abandoned urban spaces mainly through allotment gardens (Barcelona City

Council, 2012). Despite the PLA BUIITS and similar urban planning tools allowing the implementation of UA in abandoned or unoccupied urban spaces, these urban spaces can only be dedicated to UA with temporary free land use concessions (Barcelona City Council, 2012). According to the surveyed UA and CEA in Barcelona, the land use planning and the government initiatives were perceived as valid supportive tools that are however in need of improvements (e.g., expanding the concession of space dedicated to UA in the city urban plans or expanding the period of land use concessions).

Concerning CEA, the current land use rules limit the implementation of CEA and similar productive units in the city and indoor CEA facilities commercializing vegetables have been mainly developing in the city's outskirts. Legal authorizations for CEA are perceived as a barrier concerning their installation inside urban buildings (Cerón-Palma et al., 2012). Moreover, CEA must adhere to legislative schemes issued by the EU (e.g., Regulation (EC) No. 178/2002, 852/2004) which aim to ensure the safety and quality of commercialized food products in the local markets. These regulations, together with the EU regulations on pesticides and heavy metals (HM) contaminants in food products (e.g. Regulation 1881/2006, 2015/1005 and 2021/1323) have to be accounted for only food products that are commercialized due to the lack of an HM monitoring program when the UA production is mainly for personal consumption (Ercilla-Montserrat et al., 2018; Opitz et al., 2016).

#### 3.2.2. Economic incentives

For allotment gardens, the administration provides direct and indirect economic support, such as lump-sum transfers, free access to land for about five years, water and instruments for cultivation (Giacché and Tóth, 2013). On the other hand, in the case of community gardens (public ownership and participative management of space), economic incentives usually do not exist or are provided for a few years until the UA becomes self-managed and self-financed (Jiménez Xiberta et al., 2008). Our survey revealed that the economic incentives from the local administration were effective, especially for allotment gardens. Direct subsidies (financial or grants) are normally provided to support UA with the creation of a more sustainable food system, education and awareness-raising in the community and contribution to reusing organic waste materials.

Regarding CEA, economic incentives are mainly provided by the private sector. In this context, CEA actors are asking the public sector for simplified legal processes for business-activity recognition and economic incentives schemes.

#### 3.2.3. Voluntary incentives/actions

A well-defined institutional/organizational voluntary scheme that regulates UA has been operationalized over time through the establishment of contract agreements (or covenants) between UA and the local administration. According to these forms of contract, the local administration supervises the UA activity according to certain organizational rules and with the provision of economic support (Aragay Esmerats et al., 2010; Camps-Calvet et al., 2016). For example, in the case of allotment gardens, the administration provides direct and indirect economic support, such as lump-sum transfers, free access to land for about five years, water and instruments for cultivation (Giacché and Tóth, 2013).

The survey reported a lack in terms of institutional, technical and informational support for UA by the public administration. While the creation of institutional instruments, such as multi-actor networks e.g. institution of information points, urban agroecology centers, or food policy councils are emerging in Barcelona (Covarrubias and Boas, 2020), and are expected to be implemented soon (Llaurant Barcelona, 2016; Parés et al., 2019), the development of associative networks among community gardens was effectively able to establish local forums for UA farmers where to share good practices, inform and educate but also resolve possible conflicts among associations (Aragay Esmerats et al.,

2010; Mullins Garcés, 2010). Additional technical and informational support is provided by public and private knowledge institutes and universities such as the Autonomous University of Barcelona (Lapujade et al., 2018).

Concerning CEA, the local administration has not yet developed a consistent regulatory effort (Zambrano-Prado et al., 2021). While the City Council is aware of CEAs potentialities and mentioned CEA within the recently issued strategic plan called "Estratègia D'agricultura Urbana A La Ciutat de Barcelona", the strategy reveals common legal obstacles found by stakeholders that manage urban CEA and points out the necessity to promote appropriate regulations to ensure the development of CEA, together with the promotion of local food markets (Parés et al., 2019).

Table 3 provides a comparison list of policies and regulatory instruments and their perceived effects in Barcelona.<sup>1</sup>

### 3.3. Urban agriculture in Lyon – contextual background and supporting initiatives

Under the impulse of the Agenda 21 of the UN, UA has been explicitly mentioned as a possible lever for self-sufficiency in certain urban areas in Lyon (ARGOS, 2013). While the local authorities formalized in 2006 an inter-municipal resolution to support the creation of UA (Roggema, 2016), the city is also part of several associations that promotes UA.

**Table 3**

Summary of main policy effects found across the structured survey and literature review – Barcelona.

Sector/ Institution	Categories of policies	Instrument identified	AG	CG	CEA
Public sector	Legal and regulatory instruments	Land use planning or urban planning	(+)	(*)	(-)
		Government acquisitions	(+)	(-)	/
		Support for efficient production	(*)	(-)	(*)
	Economic incentives	Government grants	(+)	(-)	(*)
		Subsidies or reduced taxes	/	/	/
		Incentives for cultivation materials and technology implementation	(+)	/	(-)
		Contract agreements or covenant	(+)	(*)	/
	Voluntary incentives/ actions	Government provision of land (and/or free services, e.g. water)	(+)	(*)	/
		Institutional support (e.g. food policy council or associations)	(+)	(+)	/
		Knowledge and technical support	/	/	(+)
Private sector	Economic incentives	Educational activities and network	(+)	(+)	/
		Private funding	/	/	(+)
	Voluntary incentives/ actions	Knowledge and technical support	/	/	(+)

(+) = supportive effect, (-) = constraining effect, (\*) = uncertain effect, (/) = no information was found.

AG = Allotment gardens

CG = Community gardens

CEA = Controlled environmental agriculture

<sup>1</sup> For more specific information on the specific policy instruments included in the survey for Barcelona, the reader can refer to Table B.1 in Appendix B.

Among the most important ones, the BOL (Le Pôle de Coopération sur l'alimentation) and Le Passe-Jardins ([www.lepassejardins.fr](http://www.lepassejardins.fr)), the largest association for UA in France (Maurines and Olivier, 2017). In addition, the association Légumerie ([lalegumerie.org](http://lalegumerie.org)) aims to put city dwellers in contact with food by raising awareness of agriculture, organic production methods, short circuits, seasonal consumption and food waste issues.

In Lyon, the forms of UA are very diverse and range from self-production to sale activities (Giordano et al., 2017). Besides general private urban gardens, among the main forms of UA, we can find allotment gardens (or family gardens), community gardens, social integration gardens, and high-tech vertical farms (CEA) (Buisson et al., 2017). Shared gardens (i.e. name that define French community gardens) represent the majority of today's UA in Lyon, followed by allotment gardens (Le Passe Jardins, 2021). Nowadays, both the concept of allotment gardens and shared gardens have evolved as primary tools for social recreation and landscape management (Maurines and Olivier, 2017). Shared gardens are normally insufficient surfaces to grow food for commercial purposes, and are rather a place of social bond, meeting, and experimentation of "doing together". The participant's main vocation is often emphasized for social ties, ecology and diversity (ARGOS, 2013).

On the other side, there is yet a limited presence of CEA which developed only over the last few years, following a similar trend to the other cities considered.

### 3.4. Analysis of main policy and regulatory tools identified in Lyon

#### 3.4.1. Legal and regulatory instruments

Several levels of land use planning tools influence the development of UA and CEA in France (Mumenthaler, 2013; OECD, 2017). Both at the inter-municipal level and municipal level, the ZAP (Zone Agricole Protégée) and the PENAP (P é rimeter de Protection et the Mise en Valeur des Espaces Agricoles) establish intervention perimeters to protect agricultural areas from urbanization and are formalized within the inter-municipal territorial coherence schemes SCOT (Schéma de cohérence territoriale: territorial coherence scheme) and the municipal land use plans (Deshons, 2020). In Lyon, the municipal land use planning tools provide a detailed zone regulation to preserve UA in a situation of significant real estate demand (Desrousseaux and Stahl, 2014; Giordano et al., 2017) and encouraged the administration to preserve natural and agricultural lands within urban and peri-urban areas <sup>2</sup> (Maurines and Olivier, 2017; Rojo, 2014). However, this discipline cannot be extended to CEA spaces (rooftop or indoor farming within urban buildings), and the legal regime regulating their uses remains under property and civil law (Desrousseaux and Stahl, 2014). Furthermore, from what emerges from the French administrative case law, new UA and CEA cannot be established in lands that have not previously been cultivated (Court of Appeal of Versailles - 6 Apr. 2006, n° 04VE02945 and Administrative Tribunal of Amiens - 20 Sept. 2009, n° 0702242 and 0800276). In this context, the national organization SAFER (Société d'aménagement foncier et d'établissement rural) can acquire land or farms as well as uncultivated land from public and private owners to return them after possible development. The SAFER might pre-empt certain urban plots for UA activities (i.e. allotment gardens) (Perrin, 2014) or allocate the land to subsistence agriculture or toward agricultural spaces for social and recreational activities (Desrousseaux and Stahl, 2014). However, several limits in the legal procedures for plot assignments exist (Perrin and Baysse-Lainé, 2020), especially concerning potential non-build

<sup>2</sup> Adopting zoning regulation to protect urban agricultural lands does not necessarily mean that herein the landowner will implement UA. By contrary, many landowners still often retain their lands in the city before converting them into residential areas which, in terms of land use, are more profitable than UA (Rojo, 2014).

areas, urban wastelands, entire, or roofs of, buildings to conduct UA/CEA. In principle, such areas and buildings need to have a previous “agricultural vocation” or be located close to natural peri-urban spaces. .

While the national discipline is complex, vast, and regulates all the main aspects of the UA/CEA activities such as codes of definitions, authorization regimes, environmental authorizations and technical and operating requirements, the local discipline regulates only a few aspects (spatial and build permissions and disposal of output effluent streams in urban areas) (Cerema, 2019). However, specific requirements from the national legislation can be derogated by the local authorities under case-by-case circumstances (Foucard, 2019). For example, CEA with aquaculture systems can be allowed if they are installed 100 m away from residential houses as far as the project proves to be non-nuisance and do not impact third parties (noise, odors, lack of visual enjoyment, etc.). .

The direct sale of edible plants in urban areas is allowed if the cultivations respect the national regulation concerning the sanitary and microbiological quality of products (La Ville de Paris, 2017). The EU legal requirements in terms of food safety and quality exist in Lyon (e.g., Regulation (EC) No.852/2004), although specific regulations do not exist in terms of the use of inorganic fertilizers, or plant contaminants. The EU regulation on contaminants in food (e.g. Regulation 1881/2006 and 2021/1323) has to be accounted for when food is sold inside and outside of local markets.

3.4.2. Economic incentives

The municipality of Lyon directly provides financial subsidies (normally via public tenders) for allotment gardens and economic contributions to associations that support UA (i.e., Le Passe-Jardins). The survey reported that the public administration’s economic support was rather effective. A mix of direct and indirect economic subsidies enabled the surveyed allotment and community gardens to provide their public services in terms of education, income generation and employment, recreation, and the development and livability of spaces. Moreover, community gardens in particular might receive a wide range of different budgetary support from the municipality and/or from other single or multiple partners (e.g. associations) (ARGOS, 2013).

Concerning economic support for CEA, various direct or indirect public supporting schemes for CEA have been provided by the government, national agencies and other municipal departments (Parisculteurs, 2021). However, the interviewed CEA actors in the Lyon area did not benefit from public resources except, in some cases, from free land property concessions and economic funds by the private sector, as revealed by the survey.

3.4.3. Voluntary incentives/actions

In terms of voluntary tools supporting UA, allotment gardens have a well-defined institutional scheme in Lyon based on the early French Royer Law of 1973 (Bonnavaud, 2018) which allows the establishment of municipal-level contract agreements or covenants. Through these contract agreements, the municipality leases the urban plots free of charge to individual landholders (e.g. families or single individuals) throughout a UA association, the latter of which asks the landholders for a small annual fee to maintain the garden (Bonnavaud, 2018). Depending on the allotment garden, the municipality also provides the necessary equipment, such as compost bins, fences, tools, seeds and water supply (Bonnavaud, 2018). Furthermore, the municipality directly provides financial subsidies (normally via public tenders) for allotment gardens and economic contributions to associations that support UA (i.e., Le Passe-Jardins). These associations appear to be a strong response to day-to-day difficulties experienced by UA farmers and act as an important connective network among urban farmers (Maurines and Olivier, 2017). They promote the exchange of good practices, technical knowledge and expertise but also public visibility and, possibly, greater influence on local partners (municipality, associations, donors, etc.) (Ochoa et al., 2019). Additional technical support might be

provided by universities and other research centers and was considered effective by most of the UA surveyed but insufficient for CEA activities.

Community gardens in Lyon encompass a less formal type of institutional scheme where the residents (normally supported by an association) must formulate a demand for an agreement (Bally, 2017). If an agreement is signed between the municipality and the association, the land is leased for free by the municipality, usually without equipment. Despite the access to the community garden can be granted after the contract, the short duration of the latter (normally 1–3 years) can compromise the maintenance and future development of the gardens.

Table 4 provides a comparison list of policies and regulatory instruments and their perceived effects in Lyon.<sup>3</sup>

3.5. Urban agriculture in Trieste and Udine – contextual background and supporting initiatives

UA became a widespread practice within many large cities in Italy and found its largest expansion in the northern regions (Tei and Gianquinto, 2010) in the period 2000–2020. The region of Friuli Venezia Giulia (FVG) and its largest cities (Trieste and Udine) is also part of this trend, although on a smaller scale (Tei and Gianquinto, 2010).

Allotment gardens have been particularly supported in Udine and Trieste. In agreement with the UN Agenda 21 for sustainable development, Udine launched the project “IOrto e la Luna” which, every three

**Table 4**  
Summary of main policy effects found across structured survey and literature review – Lyon.

Sector/ Institution	Categories of policies	Instrument identified	AG	CG	CEA	
Public sector	Legal and regulatory instruments	Land use planning or urban planning	(*)	(*)	(-)	
		Government acquisitions Support for efficient production	(*) /	(*) /	(-) (*)	
	Economic incentives	Government grants	(*)	(+)	(+)	
		Subsidies or reduced taxes Incentives for cultivation materials and technology implementation	(+) (+)	(+) (*)	/ (+)	
		Voluntary incentives/ actions	Contract agreements or covenant	(+)	(*)	/
	Government provision of land (and/or free services, e.g. water)		(*)	(*)	/	
	Institutional support (e.g. food policy council or associations)		(+)	(+)	(+)	
	Private sector	Economic incentives	Knowledge and technical support	(+)	(+)	(+)
			Educational activities and network	(+)	(+)	(+)
		Voluntary incentives/ actions	Private funding	(*)	(*)	(+)
Knowledge and technical support			(*)	(*)	(+)	

(+) = supportive effect, (-) = constraining effect, (\*) = uncertain effect, (/) = no information was found.

AG = Allotment gardens

CG = Community gardens

CEA = Controlled environmental agriculture

<sup>3</sup> For more specific information on the results of the policy survey for Lyon, the reader can refer to Table B.2 in Appendix B.



years, assigns next to 75 allotment gardens to up to 2000 citizens (Udine Municipality, 2016). The project still represents a remarkable success for the municipality and all associations involved (Ardengo, 2013). A similar initiative was launched in Trieste with the project “Urbi et Horti”. This initiative was launched in 2012 as a pilot project promoted by several associations with the partnership of the municipality (Trieste Municipality, 2012). Today it counts more than 30 public or privately donated allotment gardens that revitalize abandoned or disadvantaged urban and peri-urban areas. Private citizens can also allocate their land to the municipality by granting a free loan for use to other citizens/associations in return for part of the share of the vegetable harvested (Cacciari, 2017).

With numerous examples of urban allotment gardens, social and educational-oriented green spaces constitute the main UA archetypes in Udine and Trieste (Udine Municipality, 2016). On the other hand, community gardens developed more recently (Alaimo, 2018). Despite their number is increasing in large Italian cities, urban farming activities are still fewer in smaller cities like Trieste and Udine (Cognetti et al., 2012). A similar pattern regards commercial types of CEA in Italy although not many examples of CEA have been found in the cities and region.

### 3.6. Analysis of main policy and regulatory tools identified in Trieste and Udine

#### 3.6.1. Legal and regulatory instruments

In Italy, the territorial planning frameworks consist of a multitude of governing tools operating at different levels. At a regional level, the overall discipline of the Friuli Venezia Giulia (FVG) can indirectly influence UA/CEA and their current and future developments to contrast strong urbanization processes (Il piccolo, 2017; Salata et al., 2019; SNPA, 2020; Strollo et al., 2020). A step in this direction is represented by the recently adopted FVG Regional Landscape Plan (Pascolini, 2019) and its Strategic Framework for Green Infrastructure that integrates the concept of UA as an opportunity to pursue urban revitalization and regeneration (Peccol et al., 2021).

At the municipal level, UA as a distinct and recognized practice is not specifically regulated or institutionalized inside the urban plans with the only exception of allotment gardens that, only recently, a few cities started to discipline within their urban plans called General Development Plans (GDP). Both Trieste and Udine have recognized allotment gardens inside their GDPs and further delineated specific regulatory guidelines to follow (GDP-T, 2014; GDP-U, 2017; Trieste Municipality, 2013; Udine Municipality, 2013). More specific normative references for UA can be found within the instruments of municipal urban planning that are part of the GDP, such as the urban planning regulations and the implementation plans (Casazza et al., 2015). Urban plans such as building and town regulations provide a normative reference for UA/CEA (GDP-T, 2014; GDP-U, 2017). They define specific rules to integrate UA/CEA into private/public buildings or outdoor structures. However, the municipal and zoning plans currently prohibit geographically locating CEA in urban areas (Casazza et al., 2015). Possible exceptions or derogations to this rule have been proposed in a few Italian cities, which can originate from a legal vacuum for commercial UA by local administrations. Moreover, CEA must conform to several normative frameworks at various administrative levels concerning land zoning, planning policies including construction regulations, waste streams disposal, and food health and safety regulations for product commercialization (e.g., EU Hygiene Package, National Law 114/1198, National Law 148/2008 and Regional Law 19/2016).

Land use planning tools were conceived as rather effective from the point of view of the UA actors interviewed, while the CEA (located on the outskirts of the cities) reported a lack of policy effectiveness as it would be of their interest to implement CEA inside the local boundaries of the city.

#### 3.6.2. Economic incentives

According to the survey, economic incentives for UA are scarce from the public sector and the CEA sector highly relies on the private sector's financial incentives that were considered quite effective. Only recently, the national government disposed of an Ateco code of classification for CEA that would enable access to public tenders or other financing tools (Marson, 2020). In this context, the FVG region is also working to implement specific lines of financing for hydroponic and aquaponic systems (Agrifood.Tech, 2021; Regione, 2021).

#### 3.6.3. Voluntary incentives/actions

The city administrations of Trieste and Udine have increasingly supported UA by designating and regulating allotment gardens through the tool of the covenant (Cognetti et al., 2012). In this context, various projects have been launched in which the city administrators allocate allotment gardens to certain categories of people (e.g. families, elders, schools and associations) to encourage social, recreational and cultural purposes (Trieste Municipality, 2012; Udine Municipality, 2016). In both municipalities, procedures for the concession of allotment gardens have been formalized (Colli et al., 2015). A public tender is released (normally every 5 years) in agreement with the will of local actors (private citizens or associations). The tender establishes specific rules and ranking procedures for the public demands. Environmentally friendly criteria are often considered to prevent the use of chemical pesticides, inorganic fertilizers and encourage the adoption of organic cultivation methods and closed fences or restrained access rules for local people have been increasingly limited (Colli et al., 2015; Trieste Municipality, 2012; Udine Municipality, 2016).

Usually, no financial support is provided, and landholders must pay a fixed tax of around 30–50 € per year to the municipality to cover water and electricity costs and other possible services (composting, toolboxes, or toilet services). However, the same fee can be reduced to support difficult stakeholder circumstances and the economic viability of UA activities (Ardengo, 2013).

Technical support is provided by various experts within the main associations involved in the UA projects (experts in farming and pruning, architects, coordinators, etc.). Training and educational sessions are frequently organized and provide an important source of know-how for the whole UA stakeholder community. Furthermore, the University of Udine has been recently involved in the creation of a UA network to improve the expertise of urban farmers (ilFriuli.it, 2019).

Compared to allotment gardens, community gardens lack a clear regulatory discipline (Baccichet, 2017), and normally follow similar norms and allocation procedures to allotment gardens, although without adopting public tenders (Cacciari, 2017). In particular, only the citizens' associations are allowed to send a formal request to the public administration to govern the space autonomously, and short-term public funding is allocated to the UA community only on rare occasions (Colli et al., 2015).

CEA lacks an ordinary legal framework of guidance and a proposal of national legislation is currently under evaluation (Italian national decree, 2021).

Table 5 provides a comparison list of policies and regulatory instruments and their perceived effects in Trieste and Udine.<sup>4</sup>

## 4. Discussion

We presented the result of a systemic literature review and survey of how key actors perceive existing regulatory, economic and voluntary instruments of relevance to UA and CEA in four EU cities: Barcelona, Trieste, Udine and Lyon. The literature review revealed a lack of systematic policy reviews that account for UA at the city level and

<sup>4</sup> For more specific information on the results of the policy survey for Trieste and Udine, the reader can refer to Table B.3 in Appendix B.

**Table 5**

Summary of main policy effects found across the structured survey and literature review –Trieste/Udine.

Sector/ Institution	Categories of policies	Instrument identified	AG	CG	CEA
Public sector	Legal and regulatory instruments	Land use planning or urban planning	(+)	(-)	(-)
		Government acquisitions Support for efficient production	/	/	/
		Government grants	(+)	/	(+)
	Economic incentives	Subsidies or reduced taxes	/	/	/
		Incentives for cultivation materials and technology implementation	(*)	/	/
		Contract agreements or covenant	(+)	(-)	/
		Government provision of land (and/or free services, e.g. water)	(*)	(-)	/
	Voluntary incentives/ actions	Institutional support (e.g. food policy council or associations)	/	/	/
		Knowledge and technical support	(*)	/	/
		Educational activities and network	(+)	(*)	(*)
Private sector	Economic incentives	Private funding	/	/	(+)
	Voluntary incentives/ actions	Knowledge and technical support	/	/	(+)

(+) = supportive effect, (-) = constraining effect, (\*) = uncertain effect, (/) = no information was found.

AG = Allotment gardens

CG = Community gardens

CEA = Controlled environmental agriculture

especially across EU countries. Similar studies within EU cities concerning policies and regulatory instruments are often focused on the overall complexity of urban food policies without specifically targeting UA or CEA (Brand et al., 2019). Furthermore, the use of a structured survey allowed us to evaluate the impacts of city-level food policies, plans or programs issued for UA and CEA. We considered the policy perception of local stakeholders as indicative of how the local policies were considered supportive (or inhibitory) for the development of UA and CEA (Curry et al., 2014; Wan et al., 2014). As an initial measure of policy effectiveness, analyzing the stakeholder's policy perception within a survey can give a first – significant – overview of a phenomenon that i) is not yet considered a specific primary target in the political agendas of various cities and governments in the EU and ii) is indirectly influenced and affected by a large number of policy instruments which are related to various “concurrent” public sectors (education, food, health, etc.).

Within the four cities, we identified three main distinctive and supported archetypes of UA which essentially shape a social-type vs production-type dichotomy: allotment/community-oriented gardens and commercial-oriented CEA gardens. While the main aim of the social-oriented forms of UA is to achieve social, recreational and leisure goals, the main purpose of the commercial-oriented form is either producing for self-supply (individual urban gardens or communitarian spaces) or selling vegetables within the local markets (CEA) (Weidner et al., 2019). Another way to categorize these forms was to distinguish between the public-driven motivations that are normally embedded within allotments (and especially community gardens) and the main private and commercial logic followed by the urban farmers within CEA. Moving within these two logics helps distinguish and evaluate different shreds of public strategies as well as regulatory forms and policy support

provided.

The findings demonstrate how the four cities' municipal governments specifically designed and combined a multiplicity of policy instruments to enable, regulate and address UA/CEA. A wide range of diverse tools has been assessed among which direct governmental policies, contract agreements with the local city governments (Wilbers and de Zeeuw, 2006), economic incentives, tax deductions, expertise support, cultivation tools and high-tech provisioning. These tools were shaped by different local governance models and institutional structures as well as by the local actors and community practitioners and their supportive interest in UA.

#### 4.1. Cross-case analysis: relevant policy implications identified and recommendations for each policy category

##### 4.1.1. Legal and regulatory instruments

The scarcity of natural land is becoming a common problem within the four EU cities due to the ongoing strong urbanization processes. We found that, to a large extent, when a new urban space is available, the land use policy frameworks do not often prioritize the implementation of UA/CEA in the four cities. Especially in the two large cities - Barcelona and Lyon - when a new portion of land is available, the land allocation for UA is often excluded from land use plans (e.g. Desrousseaux and Stahl, 2014). We deemed that UA is not enough integrated within the local urban policy agenda and UA is often considered a remaining option (Pires, 2011; Wadumestrigue Dona et al., 2021). This is even more complex for an urban farmer that wants to implement CEA (supposedly with high agricultural land use productivity) as compelling special permissions to operate are often required within the city (Casazza et al., 2015; Foucard and Tocqueville, 2020).

To improve access to land suitable for outdoor soil-based circular food production as well as indoor soilless recirculating systems, it is necessary to include UA as a separate land use category in land use plans and change existing zoning categories to include UA as a prioritized and legitimate form of urban land use (Wilbers and de Zeeuw, 2006). Concerning CEA, it is overall necessary to relax the legislation regarding the permissions for CEA to operate (Camps-Calvet et al., 2016). This could also regard the support for efficient production through the implementation of a soil health and food safety monitoring program as an integrated element of urban food production certification schemes.

Table 6 provides a comparison list of the main identified legal and regulatory instruments for UA and CEA in the four cities with a summary of the main limitations and opportunities identified for each of these instruments.

##### 4.1.2. Economic incentives

Among all the types of public policy instruments, economic incentives to support UA/CEA activities remain essential and therefore considered the most important and relevant policy category according to the interviewed actors.

With the main exception of Lyon, where economic incentives are provided to a relatively larger extent, we found that, within the other geographical areas considered, economic incentives do exist but are insufficient especially for community gardens and CEA. Economic incentives are in most cases implemented as an initial supportive measure (e.g. grants or loans) but, as also revealed by the survey, they are insufficient or lacking especially to maintain these UA activities long-term (e.g., subsidies, reduced taxes or incentives for cultivation materials and technology implementation). Of the total respondents, 70% mentioned economic incentives as the category of policies that are needed the most (therefore more essential) to support their activities in the future compared to 45% of respondents mentioning support needed in legal and regulatory policies and 30% in voluntary incentives/actions. Moreover, with the only exception of Lyon, the economic support is often within general provisioning schemes (general support schemes for agriculture or industry with innovative entrepreneurial endeavors)

**Table 6**  
Limitations and opportunities of legal and regulatory instruments.

City	Instruments	Limitations and opportunities	
		UA	CEA
Barcelona	Land use planning (or urban planning)	The land use planning schemes provide valid support for UA which however needs to be improved to ensure more urban spaces are dedicated to UA	The land use scheme is not supportive to install CEA in the city. There is a need for relaxing the procedures for land use permissions
	Government acquisition	Abandoned urban spaces are temporarily conceded to UA. However, the rights of usufruct can be revoked at any time by the government	Not identified
	Support for efficient production, e. g., pesticide use	Regulation is lacking for the safety and quality of foodstuff that is not commercialized by the UA	Regulation of the safety and quality of the foodstuff is mandatory. However, the use of organic fertilizer is not sufficiently promoted
Trieste/ Udine	Land use planning (or urban planning)	The GDP only recognizes allotment gardens. It would be necessary to integrate other forms of UA within the GDP	The land use scheme is not supportive to install CEA in the city. There is a need for relaxing the procedures for land use permissions
	Government acquisition Support for efficient production, e. g., pesticide use	Not identified The regulation for the concessions of allotment gardens recommends the adoption of organic methods. The use of pesticides is prohibited by the same regulation	Not identified Food safety and hygiene need to respect before the commercialization of foodstuff. Aquaponic production systems need to respect the regulation concerning animal safety and welfare
Lyon	Land use planning (or urban planning)	For current urban spaces dedicated to UA, the land-use instruments preserve these spaces from urbanization pressure. For new urban spaces to be dedicated to UA, it is forbidden to allocate urban spaces to UA unless the plots have been previously cultivated or situated next to natural peri-urban spaces	The land-use discipline cannot be extended to CEA within buildings, and the legal regime regulating their uses remains under property and civil law. For new urban spaces to be dedicated to CEA, it is forbidden to allocate urban spaces to CEA unless the plots have been previously cultivated or situated next to natural peri-urban spaces
	Government acquisition	The right of pre-emption of land is important to allocate new spaces to UA. However, certain limits exist for this procedure, especially in dense urban areas	The right of pre-emption of land to allocate new space to CEA is very limited
	Support for efficient production, e. g., pesticide use	Not identified	Food safety and hygiene need to respect before the commercialization of foodstuff. The Departmental Directorate for the Protection of Populations (DDPP), in charge of health and hygiene aspects, will provide appropriate

**Table 6 (continued)**

City	Instruments	Limitations and opportunities	
		UA	CEA
			advice to enable companies and associations carrying UA or CEA projects to make the right choices in terms of food and health

without specifically targeting urban agriculture for direct financial provisioning, for example in terms of materials, tools for UA or CEA (Weidner et al., 2019).

Table 7 provides a comparison list of the main identified economic incentives for UA and CEA in the four cities with a summary of the main limitations and opportunities identified for each of these instruments.

#### 4.1.3. Voluntary incentives/actions

Within the four cities we found that allotment gardens are remarkably more policy-integrated within the urban landscapes compared to community gardens and CEA and remain the favorite longstanding type that is vigorously supported by voluntary incentives and actions.

Allotment gardens represent a consolidated historical type of UA in most EU cities. Their origin stems from the industrial revolution and the Second World War in which allotment gardens were an important response to alleviate unhealthy living conditions, poverty and famine of people. Over time, allotment gardens achieved multifunctional land use, providing meaningful social and integrative features (Zheng et al., 2022). The recognition of the importance of allotment gardens from the public and the need of containing the phenomena of unauthorized land occupation and spontaneity led to adopt the first models of regulations containing the criteria for assigning the allotment gardens already at the beginning of the 1980 s (Tei and Gianquinto, 2010). In addition, with the recognition and support of allotment gardens by the UN Agenda 21, they become one of the earliest organized archetypes of UA. For these reasons, allotment gardens are generally well supported by public administrations through the category of voluntary incentives/actions. Spain, Italy and France adopted institutional schemes, contracts or covenants, and issued legislative and regulatory measures for allotment gardens. Furthermore, the local administrations supported allotment gardens by means of well-defined policy strategies and instruments.

Despite that community gardens are better institutionally recognized in France (Lyon), especially since UA associations play a crucial role in supporting and facilitating their implementation, community gardens remain less policy integrated and economically supported (overall) than allotment gardens. Likewise, commercial-oriented urban CEA did not receive any supportive measures, especially in Trieste and Udine. Within the four cities, CEA still encounters large skepticism for its social acceptance as it is not consistent with the traditional picture of horticultural production (Sanyé-Mengual et al., 2016).

While promoting contextual social acceptance is considered crucial in the successful implementation of CEA (Di Fiore et al., 2021; Jürkenbeck et al., 2019), a reconsideration of the overall national institutional strategies for allotment gardens would be necessary to encourage the allocation of financial resources and the concrete design of institutional *voluntary* supportive schemes for the other UA forms (community gardens in Barcelona, Trieste and Udine, and CEA in all the four cities). Finding better strategies that also prioritize less developed forms of UA would represent a valuable asset that is achievable by increasing collaboration between local authorities and private actors and employing ad-hoc policy tools to find more equilibrated support (Low, 2019).

Table 8 provides a comparison list of the main identified voluntary incentives/actions for UA and CEA in the four cities with a summary of the main limitations and opportunities identified for each of these instruments.

**Table 7**  
Limitations and opportunities of economic instruments.

City	Instruments	Limitations and opportunities	
		UA	CEA
Barcelona	Government grants	Direct subsidies are rather effective. Stronger support depends on the type of UA (for community gardens the subsidies are normally less)	The national schemes (e.g., ENISA) can be generally supportive of CEA
	Subsidies or reduced taxes	Not identified	Not identified
	Incentives for cultivation materials and technology implementation	Free concession of cultivation materials and technology implementation is necessary and effective in several UA cases	The support for technology implementation exists but is not considered effective
Trieste/ Udine	Government grants for UA	Not identified	Not identified
	Subsidies or reduced taxes	The reduced annual tax for allotment gardens in Udine is considered an important and effective supportive tool that do not exist in community gardens	Not identified
	Incentives for cultivation materials and technology implementation	Free concession of cultivation materials, composting facilities and other services are considered a valid and appreciated tool by local UA farmers that is missing in community gardens	Not identified
Lyon	Government grants for UA	Government grants are provided through public tenders at the beginning of the implementation phase of the allotment gardens. Community gardens receive monetary support from the municipality and other associations	Various financing schemes exist to support UA and CEA which have been provided over the last years by the government and national agencies
	Subsidies or reduced taxes	The Rhône-Alpes Region financially support the implementation of allotment gardens for peoples with socio-economic difficulties	Not identified
	Incentives for cultivation materials and technology implementation	The UA associations provide the necessary equipment for allotment gardens. For community gardens, the municipality does not usually provide incentives for the equipment	Various financing schemes exist to support UA and CEA which have been provided over the last years by the government and national agencies

**4.1.4. The need of comprehensive policy frameworks and multi-level governance systems**

The policy instruments resulted generally fragmented in the four cities and did not develop a coherent supportive action perhaps due to the absence of a comprehensive policy framework dedicated to UA and CEA.

**Table 8**  
Limitations and opportunities of voluntary incentives/actions.

City	Instruments	Limitations and opportunities	
		UA	CEA
Barcelona	Contract agreements or covenant	Contract agreements are established and essential to institutionally recognize and regulate the main typologies of UA in Barcelona. Contract agreements are different for different UA typology	Not identified
	Government provision of land (and/or free services, e.g., water)	Free use of the urban land and various public services (use of water) are effectively provided to the UA	Not identified
	Institutional support (e.g., food policy council or associations)	Food policy councils are lacking but expected to be implemented soon	Not identified
Trieste/ Udine	Knowledge and technical support	Not identified	Universities and research centers are active local providers for technical and advisory support services for CEA
	Educational activities and network	UA networks and associations create important educational activities for sharing good practices	Not identified
	Contract agreements or covenant	Procedures for the concession of allotment gardens are widely institutionalized. Other types of UA (e.g., community gardens) can be included but with scarce support	Not identified
Lyon	Government provision of land (and/or free services, e.g., water)	The use of land is for free for allotment gardens. Water and other public services have to be paid for every year	Not identified
	Institutional support (e.g., food policy council or associations)	Not identified	Not identified
	Knowledge and technical support	Knowledge and technical support are considered rather effective although it only comes from local UA associations	Not identified
Lyon	Educational activities and network	Local associations of UA farmers organize educational activities. The University of Udine was involved in the creation of a UA network to share local experiences and contribute to improving the expertise of urban farmers	A few CEA are involved in social programs to create educational projects for schools to promote CEA around their territory
	Contract agreements or covenant	Contract agreements are established between the	Not identified

(continued on next page)



Table 8 (continued)

City	Instruments	Limitations and opportunities	
		UA	CEA
		municipality, the associations and UA and are essential to regulate the main typologies of UA in Lyon	
	Government provision of land (and/or free services, e. g., water)	The land is allocated for free by the municipality, but the associations ask for an annual fee from the landholders in exchange for water and other equipment supply	Not identified
	Institutional support (e.g., food policy council or associations)	Large associations exist in France with local supporting activities all over the municipalities. These play an important role in the political interface between UA and public institutions	The Interdepartmental Regional Directorate for Food, Agriculture and Forestry (DRIAAF) or the Regional and Interdepartmental Directorate for the Environment and Energy (DRIEE) can inform companies and associations carrying out UA or CEA projects on the regulations applicable and support them
	Knowledge and technical support	Universities and UA associations support, advise and organize training meetings and practical workshops	Associations of UA and CEA professionals exist such as the national AFAUP (French Association of Professional Urban Agriculture) which promotes mutual aid, technical advice and collaboration
	Educational activities and network	Local networks appear to be a strong response to day-to-day difficulties for UA as it provides a pool of services that promote for example the exchange of good practices, knowledge but also public visibility and, possibly, greater influence on local partners (municipality, donors etc.)	Collaboration between a company and association carrying out UA or CEA projects offers an ideal testing ground for research institutes (AgroParisTech, INRA, universities, etc.). Real synergies can be created by working with agricultural training organizations

Within each of the four cities considered, the analysis documented the existence of a wide range of overlapping legal frameworks and fragmented policy tools within the land use, social development and food production policies that indirectly influence UA and CEA. While these fragmented policy tools enabled multiple archetypes of UA to shape and coexist, the design of more *direct* policies, formulated within a more comprehensive policy framework for UA and CEA might result beneficial to better integration of UA and CEA within the urban food policy sector (Sarker et al., 2019). However, UA is still regarded as a phenomenon legally and politically influenced by major public sectors (health, education, transport, etc.) and lacks recognition as a separate policy entity (without an “institutional home”) (Wilbers and de Zeeuw, 2006). This recognition is highly required in many EU cities to encourage the implementation of more effective policy instruments

(Lohrberg et al., 2016).

One possible way to recognize and allow UA to gain political and institutional importance in the EU might consist in encouraging the adoption of a multilevel type of governance in which the multiplicity of UA policy instruments designed at the municipal level (bottom-up) is implemented in coordination with a top-down governance scheme at EU level (Krikser et al., 2016; Prové et al., 2015). A properly designed multi-level governance would i) enhance the participation of local actors in the UA policymaking processes and contribute to translating UA as a distinctive policy entity from the local to EU level (Prové, 2018); ii) encourage the establishment of comprehensive policy frameworks dedicated to UA and the employment of a more *direct* regulation for better supporting and coordinating the expansion of UA and CEA in urban areas and iii) create harmonized policy schemes at EU level. In the long run, an EU-level harmonized policy scheme for UA might be beneficial to inform local administrators on which policy instruments to adopt to integrate UA and CEA based on their specific differences in terms of cities’ governance structures and policymaking capacities.

#### 4.2. Limitations and opportunities of future research

This research was limited by the literature sources for CEA. More traditional UA are covered to a larger extent than CEA in the growing academic body of literature regarding urban food policies (Wadumestrigue Dona et al., 2021). Much of the policy documentation was retrieved from grey literature and less official sources which were sometimes difficult to rely on. This might have occurred as the CEA topic is still considered a relatively modern developing UA type on cities’ urban landscapes compared to more traditional UA. On the other hand, it might be a consequence of the underlying scarce CEA social acceptance that is slowing down the development of CEA compared to more traditional UA. There is a need for city officials to start documenting the urban CEA phenomenon and perhaps publicly inform UA/CEA policies to reduce the complexities faced by researchers and practitioners.

The survey method was also limited by the low stakeholder responsiveness rate for some of the questions in the survey. Although the general rate of responses was good (70%), we had the impression that adopting face-to-face interviews would have been beneficial by overall reducing the limited responsiveness rate for the policy categories covered and improving the accuracy of some of the questions within the survey.

Our analysis considered the general support from public institutions and other relevant aspects connected with land use planning, but we might have underestimated the effects of relevant policies from other sectors (health, education, transport, etc.) and especially in consideration of the existence of other stakeholders who are also important collaborators in UA/CEA policies, such as civil society groups, foundations, local inhabitants, schools, UA platforms, sectorial organizations, NGOs (Halvey et al., 2020). Furthermore, evaluating how different policies are shaped and interact with different levels of governance was outside of the scope of this current study but should be encouraged in future research. This is necessary also in view of the expected reform of the EU common agricultural policy that, perhaps, might establish a renewed framework of interest for UA in the future (Lohrberg et al., 2016; Piore, 2018).

Lastly, our study analyzed a large variety of policies that were not either directly supportive or restrictive. In this context, adopting more sophisticated methods to assess the degree of uncertainty in the policy influence would be beneficial together with exploring and comparing socioeconomic and cultural reasons behind the differences in the number and scope of policies across different cities (Wadumestrigue Dona et al., 2021). Further research shall also possibly consider other types or specific features of UA/CEA that are not included in this research and could become representative in the context of different geographical areas in the next future.

## 5. Conclusions

Like other areas of the world, various EU cities have recently started to increase their ambition in terms of policy action to support UA and innovative UA systems such as CEA. In this respect, we identified, reviewed and described the functioning of a multiplicity of municipal policy instruments within four EU cities: Barcelona, Trieste, Udine and Lyon to understand how local policies are supporting the development of UA and CEA and how these are perceived by the responsible stakeholders.

Our findings show that the four cities employed a multiplicity of policy tools that exerted supportive and constraining effects on UA/CEA. Allotment gardens resulted generally well-supported by all cities considered, as the municipalities developed a more coherent framework and policy effort for these types of UA. On the other hand, constraining policy effects were particularly evident for some types of growing UA (i. e., community gardens and CEA) in Barcelona and Trieste/Udine, as well as CEA in Lyon. The development of a more inclusive policy action plan for community gardens and CEA shall be therefore encouraged by the single municipalities.

To facilitate the reorientation of policies toward better integrating UA/CEA within the urban landscapes and minimize the UA/CEA practical challenges, one solution is to institutionally recognize UA within political agendas and create more comprehensive policy frameworks dedicated to UA/CEA. Comprehensive policy frameworks would help establish more specific and *direct* regulations to support and coordinate the expansion of UA and CEA in urban areas and the right conditions for multilevel governance in cooperation with the EU institutions. A similar approach would also create the necessary conditions for UA to i) be prioritized within the land use frameworks, ii) more efficient and equilibrated support to less developed forms of UA (community gardens) and CEA; iii) establish long-term economic incentives to UA activities.

Our findings have provided an analysis of the main instruments existing in a few EU cities to enable academics, practitioners, and policymakers in comparing and contrasting the scope of existing policies and impacts on local UA/CEA actors. Exploring how individual cities organized their food strategies and policies to address UA across different governance contexts can still offer much to learn among academics, practitioners and policymakers alike. Further analysis can outreach other EU cities to inspire and inform the EU community on how to guide cities in better integrating UA based on their differences in policymaking capacities and not least to develop a circular resource flow, soil, water and food safety program for the certification of safe food production in general.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data Availability

Data will be made available on request.

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## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.landusepol.2023.106695.

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