INNOVATIVE AGRI-FOOD VALUE CHAIN MANAGEMENT THROUGH A UNIQUE URBAN ECOSYSTEM

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Abstract
Although agriculture has significantly evolved over the last decades, it is still adapting to the circular, innovative and digital economy; to the upsurge of modern agricultural technologies and to the imminence of environmental greening, especially in the European Union. The links involved in global agri-food value chain are transitioning from being economically competitive to being economically competitive and sustainable. The importance of greening the global agri-food chains along all of its links is instiled in the 2030 Agenda for Sustainable Development, the European Green Deal, the 2030 Climate Target Plan. In this context, the objective of this research was to design a circular agricultural system in the urban environment, and, more specifically, a solution for managing multidimensional complex issues, right in the campus of the Bucharest University of Economic Studies. A bibliometric analysis was elaborated with the purpose of identifying the favorable context and opportunity for implementing such a solution, grounded in the principles of urban agriculture. The result of this study consists of the authors' envisioned 'agro-urban' ecosystem; more specifically, an urban rooftop community garden that responds to challenges such as: limited resources (water, soil, labor force), unfavorable environmental conditions (specific to urbanization) and others. The proposed model is easily replicable and facilitates the transition to a cleaner, greener, circular economy.
Keywords: circular economy; community garden; agri-food supply chain; sustainable urban ecosystem management; decarbonized economy

1. INTRODUCTION

Supplying food to people living in urban agglomerations significantly contributes to the generation of greenhouse gas emissions, biodiversity loss, pollution in general, non-renewable resource exhaustion, land-use issues and other global environmental challenges (Bran et al., 2012; Goldstein et al., 2016; Fusco, Coluccia and De Leo, 2020; Thulasiraman, Nandagopal and Kothakota, 2021). In this context, the transition towards sustainable urban systems represents a priority – the agricultural sector being no exception. The latter must identify innovative and efficient solutions for the mitigation of complex environmental socio-economic issues (Istudor et al., 2019; Dinu et al., 2020a; Chiripuci et al., 2020) and to the increasing food consumption in urban areas (Nova et al., 2020; Hume, Summers and Cavagnaro, 2021).

The COVID-19 pandemic has significantly aggravated food security issues in urban agglomerations because of the disruption in the food supply chains (Lal, 2020; Ignat and Constantin, 2020b). In this context, a global major challenge generated by the COVID-19 pandemic is represented by the disrupting access to fresh and affordable food to the large and growing urban population (Moustafa, Cross and Gasim, 2018; Ignat and Constantin, 2020a). In order to consolidate its resilience, the global agri-food value chain should consider reducing food waste along its links (especially consumers) as a main priority, as well as strengthening the growth of local agricultural capabilities – which can be made possible through home gardening and urban agriculture (Sofo and Sofo, 2020). Regardless of the COVID-19 pandemic effects, there is an untapped potential for converting unused urban areas to impactful environmentally friendly production areas.

Management Research and Practice
Volume 13, Issue 3 / September 2021
ISSN 2067- 2462

Management Research and Practice
Volume 13, Issue 3 / September 2021

Urban agriculture represents an innovative solution for greening the global agri-food value chain. Wagstaff and Wortman (Wagstaff and Wortman, 2015) defined urban agriculture as all forms of agricultural production occurring within or around cities, with few peculiarities: the agricultural production is mostly designed for self-consumption and eventually trade (sales, barters, donation etc.), agricultural effort is mostly individual, family micro, small or medium enterprises, agricultural activities can be carried out indoors, on rooftops, or in any suitable land or area (Mougeot, 2000). Logistically, this form of agriculture provides easy day-to-day access to fresh vegetables and fruits, reduces food miles and the amount of greenhouse gas emissions generated by agricultural activities, as well as it shortens the supply chain and ensures short-term food security locally.

Urban agriculture also includes edible green infrastructures and it innovates the food supply chains through designing solutions meant to provide fresh agricultural products to the communities living in the urban areas, therefore shortening the chain, as well as cleaning it and lessening uncertainties from the risks associated to the food safety (Pulighe and Lupia, 2020; Cristiano, 2021). Besides the contribution to food security in urban agglomerations and to reducing the carbon footprint (Havaligi, 2011), the benefits of urban agriculture to urban biodiversity and the ecosystem service provision were also approached in many scientific papers (Orsini et al., 2014; Ricketts and Imhoff, 2003; Clucas, Parker and Feldpausch-Parker, 2018).

Reducing the greenhouse gas emissions represents an enormous challenge for achieving sustainable development, especially in a world where the degree of urbanization is high (United Nations, 2015; Popescu et al., 2020; Quintili and Castellani, 2020; Constantin et al., 2021; Shooshtarian and Ridley, 2016). Hu et al. (2019) demonstrated that there is a link between economic profitability and carbon footprint – they brought quantitative evidence of how particular inputs and activities, such as the ones specific to urban agriculture, can significantly reduce the amount of carbon emissions.

The economic and environmental efforts meant to facilitate the transition to the circular economy in the European Union are encouraged by the European Commission, which has adopted a many packages of measures designed to stimulate the emergence of innovative solutions for 'cleaning' the economy and making it more environmentally friendly (Teodor et al., 2020; Istudor and Negrei, 2018; Popescu, 2019; Ezeudu and Ezeudu, 2019; Drăgoi et al., 2018). The European Green Deal represents one of the strategies elaborated by the European Commission aimed at tackling climate and environmental-related challenges (European Commission, 2019) by transforming the European Union into a "fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use". The European Green Deal is considered an integral part of the European Commission's strategy to implement the United Nations 2030 Agenda and, implicitly, meeting the sustainable development goals (United Nations, 2015; European Commission, 2019; Dinu et al., 2020b).

Even though the European Union has fully committed itself to the implementation of the 2030 Agenda for Sustainable Development (Hametner and Kostetckaia, 2020), Romania is not one of the main engines of change in the European Union, especially if considering resource productivity and the targets set by Goal 12 of Sustainable Development (Frone and Frone, 2020). On the contrary, some sources claim Bucharest, the capital of Romania, is one the most polluted capitals in Europe (Pargaru, Dinu and Teodor, 2017). In order to achieve the Sustainable Development Goals, each country should foster the resilience of the agri-food sector in the face of crises (such as the one generated by the COVID-19 pandemic), reduce food waste, and increase the local food production capabilities. In this context, enhancing food availability at the household and community levels through home gardening and urban agriculture is essential (Modibedi, Masekoameng and Maake, 2020). Food production in urban areas, within the cities, include small land farming in households, local community gardens, indoor and rooftop gardens, vertical farming and other methods of production (Martellozzo et al., 2014; Pătărlăgeanu et al., 2020).

Integrated rooftop greenhouses prove to be sources of multiple benefits, including to the environment (Manríquez-Altamirano et al., 2020). Martin, Poulikidou and Molin (Martin, Poulikidou and Molin, 2019) consider that the largest environmental benefit comes from the replacement of conventional gardening soil with compost, which is generated with residual materials: mainly recycled paper and biowaste. Through this shift, the greenhouse gas emissions are reduced, the economy is slowly changing to a circular model and the issues such as global warming are mitigated (Sanyé-Mengual et al., 2013; Debrah, Vidal and Dinis, 2021). Not only that, but by implementing solutions meant to collect the rainwater, rooftop greenhouses can even contribute to

making best use of all the available resources and deliver sustainable development through reducing the water footprint in the urban areas (Andrei et al., 2018, 2020).

The objective covered in this research paper is to propose a practical and easily replicable innovative solution of urban agriculture meant to clean the agri-food chains, at least locally, as well as to empower the principles of sustainable development and of the circular economy in the local community. In order to ensure that the authors' proposal covers the most relevant socio-economic, technical, environmental and ecological aspects, a bibliometric analysis was initially carried out, with the aim of identifying the favorable context and opportunity for implementing a solution for greening the global agri-food value chain through an initiative specific to urban agriculture — an urban rooftop community garden.

2. LITERATURE REVIEW

A systematic and critical account of the literature has been developed in Table 1.

TABLE 1. SYSTEMATIC LITERATURE REVIEW ON THE TOPIC OF ROOFTOP GARDENS

Author(s) & Year	Findings	Location of the solution
Sanyé-Mengual et al., (2015)	Grew lettuce on a public housing building, on the rooftop, using three techniques: nutrient film, floating hydroponic and soil cultivation. On soils, the authors grew tomatoes, chilli pepper, eggplants, melons, watermelons. Results confirm that such initiatives boost the food security of urban areas and ensure access to healthy locally-produced food.	Bologna, Italy
Wong et al. (2003)	Growing vegetation on walls or building roofs represents an actual ecological solution in urban agglomerations. Many unquestionable benefits are involved as a result of implementing such solutions, both from the perspective of the environmental consequences and of the asthetics of the urban buildings.	Singapore
Grard et al. (2015)	Basic systems of rooftop gardening were tested in Paris. Local urban organic waste was used as crop substrates, aiming to contribute to the urban metabolism. Results confirm that high crop production levels were obtained compared to the reduced use of inputs.	Paris, France
Rahman et al. (2015)	Rapid and improper urban planning can often result in the destruction or degradation of the natural elements, including the loss of green space. Results confirm that greenery initiatives such as a community rooftop gardens contribute to regenerating and revitalizing the commercial setting in highly urbanized areas.	Kuala Lumpur, Malaysia
Safayet et al. (2017)	Megacities with alarming population growth call for sustainable food supply initiatives, such as rooftop farming. Based on findings from multiple roof gardens in Dhaka, research confirm rooftop farming can sustainably support the environment in many regards: by improving air quality, CO_2 reduction, water cost reduction and other socio-economic and ecological benefits.	Dhaka, Bangladesh
Hussein et al. (2020)	Since roofs are a big part in the Jordanian architecture, designing green spots have crucial aesthetic and environmental roles. Amman city requires special garden designs, due to water resource limitations. Urban garden rooftops add value to food production efforts green areas and help to create sustainable societies.	Amman, Jordan
Kim et al. (2020)	Increasing urbanization generates the environmental and aesthetic needs for more green spaces in built-up areas. In this regard, empirical evidence show that temperature reduction effect can be achieved by constructing rooftop gardens – they successfully reduced the temperature of the engineering area of Seoul National University's campus.	Seoul, South Korea
Thapa et al. (2020)	Rooftop gardening acts not only as an innovative source of fresh vegetables and fruits, but it also ensures an in-depth socio-economic and environmental ecosystem that promotes sustainability. The authors claim that the Government of Nepal's planning should be focused on urban agriculture and promote rooftop gardening and farming.	Kathmandu, Nepal
Nohorli and Rafieyan (2021)	Green rooftops represent a novel element in modern architecture, empowering the sustainability factor in highly urbanized environments. Research revealed the factors that hinder the development of rooftop community gardens the most in Tabriz city: the "cost and investment", the "climatic and ecological" factor, factor, the "legislation and management" factor, the "cultural and educational" factor and the "scientific and technical" factor.	Tabriz, Iran
Allaby et al. (2020)	The interest concerning new urban agriculture models was identified – more specifically an increase to produce the local food capacity in cities of the Global North. The emergence of urban rooftop farming in Montréal has created both positive and negative disruptions for existing small-scale agri-food producers. Some farmers enhanced their marketing strategies and collaborate with local organizations to collectively market their agri-food produce.	Montréal, Canada
Langemeyer et al. (2020)	Numerous neighborhoods were identified across Barcelona where green rooftops would offer important nature-based solutions to the city's environmental challenges.	Barcelona, Spain

Source: Authors' processing

Although the literature is broad on the topic of community garden, this paper enriches the field of knowledge with a unique perspective on the roles of community gardens. The authors envision a managerial solution of agri-food value chains based on the synergy with community gardens and their impact on co-creating value in a complex sustainable and circular manner. The novelty factor of this research resides in the fact that the authors' proposal is designed to be implemented in the urban area of Bucharest, on the rooftop of the Moxa Canteen, in the near proximity of the Faculty of Agri-food and Environmental Economics, in the campus of the Bucharest University of Economic Studies. Besides responding to many environmental and socio-economic issues, the authors' solution takes the education factor into consideration as well.

3. RESEARCH METHODS AND MATERIALS

The first method used in this research was a quantitative method, specific to bibliometric studies. The purpose of the bibliometric approach in this study was to identify emerging and innovative niche solutions for greening the global agri-food value chain through the implementation of urban agriculture. More specifically, this quantitative method was applied in order to identify good practice examples documented in the scientific research papers. Successful sustainable agro-urban models of horticulture act as reference points for initiatives such as the one proposed in this research.

Bibliometrics has become one of the standard tools for research management and trends evaluation (Akhavan et al., 2016; Pătărlăgeanu, Dinu and Constantin, 2020; Popescu, 2020; Torres-Pruñonosa et al., 2021; Zeng and Chini, 2017). Bibliometrics contains a unique set of techniques that can be used to monitor and analyze scientific resources (Gerry McKiernan AB, 2005; Hilal et al., 2019; Marinescu et al., 2019).

In this research paper, the bibliometric analysis was performed using the VOSviewer software tool, version 1.16.16. The software was designed by Ness Jan van Eck and Ludo Waltman, co-opted from the Center for Science and Technology Studies at Leiden University. The VOSviewer tool has proven to be extremely effective in analyzing keywords and terms in the title and abstract of scientific publications, such as the ones indexed in the Web of Science database (van Eck and Waltman, 2010). VOSviewer facilitates the creation of maps that graphically represent the density and link powers between words or keywords associated to the scientific publications identified in the various databases, based on database queries. The construction and visualization of bibliometric networks and maps is based on raw data and, more specifically, on the metadata of the scientific articles, reviews, book chapters, article proceedings and other documents indexed in various databases.

In this research paper, the bibliometric analysis is based on the Web of Science database. Thomson Scientific has developed the Web of Science and the latter is dominant in the field of academic references (Falagas et al., 2008). The database is currently maintained by Clarivate Analytics, but it was originally developed by the Institute for Scientific Information. The database is one of the world's most diverse resources for citation, indexing and quotation analysis in all possible areas of science. In this context, considering all the resources indexed in the Web of Science, the latter provides the basis for the development of quantitative research analyzes in various fields, including urban agriculture and agri-food value chains. Consequently, the Web of Science database was queried in the following manner: TOPIC: ("urban agriculture") AND TOPIC: (chain) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A & HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC. This query led to identifying 107 publications indexed in the Web of Science database in May 2021. Linking these two structures ("urban agri-culture" and agri-food "chains") represents the premises of identifying scientific publications specific to the topic of agro-urban models of agriculture and their relation with the agri-food chains.

4. RESEARCH FINDINGS

The first component of the bibliometric analysis was that of studying the evolution of the academic interest concerning the topics of "urban agriculture" and agri-food "chains", manifested under the shape of the scientific papers indexed in the Web of Science (the 119 scientific publications that respond to the query previously mentioned). Table 2 contains the yearly statistics regarding the scientific interest concerning the topics of "urban agriculture" and agri-food "chains".

TABLE 2. THE EVOLUTION (PER YEAR) OF THE SCIENTIFIC INTEREST CONCERNING THE TOPICS OF "URBAN AGRICULTURE" AND AGRI-FOOD "CHAINS", MANIFESTED UNDER THE SHAPE OF SCIENTIFIC PAPERS INDEXED IN THE WEB OF SCIENCE

No.	Publication year	Indexed records (number)	Share from the total identified publications (%)
1	2021	5	4.20%
2	2020	23	19.33%
3	2019	14	11.76%
4	2018	17	14.29%
5	2017	16	13.45%
6	2016	11	9.24%
7	2015	7	5.88%
8	2014	1	0.84%
9	2013	7	5.88%
10	2012	3	2.52%
11	2011	5	4.20%
12	2010	2	1.68%
13	2009	1	0.84%
14	2007	4	3.36%
15	2006	1	0.84%
16	2005	1	0.84%
17	2004	1	0.84%

Source: Authors' conceptualization based on the raw data extracted from the Web of Science (2021)

TABLE 3. TOP 20 KEYWORD / KEYWORD STRUCTURE OCCURRENCE IN THE IDENTIFIED PAPERS

No.	Keyword / Keyword structure	Occurrences	Total link strength	Occurance (%) from total
1	urban agriculture	61	255	25.00%
2	food security	18	85	7.38%
3	sustainability	17	120	6.97%
4	peri-urban agriculture	12	50	4.92%
5	life-cycle assessment	11	87	4.51%
6	agriculture	10	39	4.10%
7	food	10	41	4.10%
8	local food	10	67	4.10%
9	food systems	9	57	3.69%
10	life cycle assessment	9	66	3.69%
11	supply chains	9	54	3.69%
12	cities	8	55	3.28%
13	management	8	42	3.28%
14	policy	8	35	3.28%
15	urbanization	8	31	3.28%
16	water	8	41	3.28%
17	ecosystem services	7	55	2.87%
18	industrial ecology	7	54	2.87%
19	quality	7	37	2.87%
20	systems	7	43	2.87%

Source: Authors' conceptualization based on the raw data extracted from the Web of Science (2021)

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The intensification of the research scientific interest starting from the year 2015 can be linked to the publication of the 2030 Agenda for Sustainable Development. After the European Green Deal was published in 2019, the scientific interest concerning the topics of "urban agriculture" and agri-food "chains" reached a peak in 2020 (representing 19.33% of the total identified publications).

Another main component of any bibliometric analysis is the study of the correlations between the keywords associated to each of the publications identified after querying the Web of Science database. In the case of this research, the 119 indexed documents had 798 keywords associated. Table 3 contains the ranking of the keywords (or keyword structures), based on the link strength. The latter indicates the total strength of the link of a keyword or of a keyword structure associated to a publication, in relation to the rest of the publications (van Eck and Waltman, 2019).

According to the data included in Table 3, the topics of "urban agriculture" and agri-food chains were approached in relation with the following thematics: "sustainability" (17 occurrences as keyword), "life-cycle assessment" (11 occurrences), "food security" (18 occurrences). This ranking of the keywords demonstrates the need to empower the principles of urban agriculture in the context of meeting the Sustainable Development Goals and of the European Green Deal.

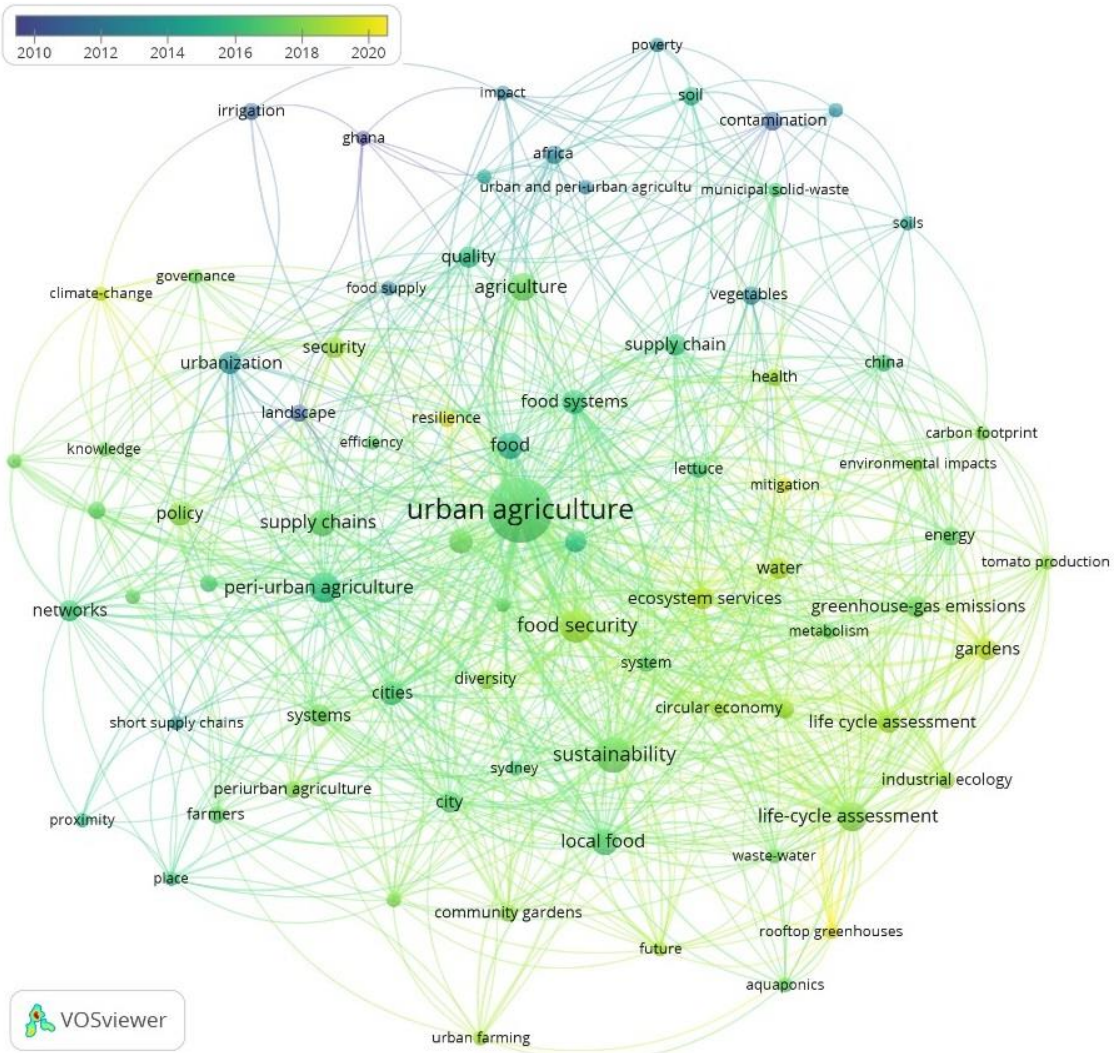

FIGURE 1. THE EVOLUTION OF THE CORRELATIONS BETWEEN THE KEYWORDS AND KEYWORD STRUCTURES ASSOCIATED TO THE PUBLICATIONS CONCERNING THE TOPICS OF "URBAN AGRICULTURE" AND AGRI-FOOD "CHAINS"

Source: Authors' own conceptualization in VOSviewer 1.16.16 based on the Web of Science metadata, 2021

Another component of this bibliometric analysis is the study of the evolution of the correlations between the keywords and keyword structures associated to the 119 documents. The transition is graphically illustrated in

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VOSviewer, in Figure 1.Only the 80 keywords and keyword structures which met the benchmark of at least 3 occurrences were displayed out of total of 798 identified keywords and keyword structures. At the beginning of 2010, the scientific interest was centered around the topics of "poverty", "contamination" and "irrigation" in relation with "urban agriculture" and agri-food "chains". As we get closer to the year 2020, one can notice the change in the scientific interests concerning urban agriculture and agri-food chains. In 2020, "urban agriculture" and the agri-food "chains" are approached in relation with subjects such as: "climate-change", "rooftop greenhouses", "gardens", "mitigation", "resilience" and others.

In relation with the topics of urban agriculture and agri-food chains, six clusters of keywords and keyword structures were identified in Figure 1:

Cluster 1. Keywords: "Africa", "Poverty", "Soil", "Contamination", "Quality", "Urban poverty". This cluster closely illustrates the direct link established at the beginning of the 2010s between the concepts of urban agriculture, agri-food chains and the need to solve social and environmental problems in developing countries.

Cluster 2. Keywords: "Alternative food network", "Climate change". "Food system", "Governance", "Knowledge", "Policy", "Networks". Through this cluster, urban agriculture and the agri-food chains were approached from the perspective of the need for a mutual aid mechanism for developing countries, yet still focusing on reducing the negative effects of urban pollution.

Cluster 3. Keywords: "Circular Economy", "Industrial ecology", "Growth", "Life cycle assessment" demonstrates the imminence of putting the concepts of urban agriculture and agri-food chains in the light of the 2030 Agenda for Sustainable Development. Moreover, this cluster highlights the needs of the transition from the linear economy to the circular economy.

Cluster 4. Keywords: "Community Gardens", "Diversity", "Ecosystem Services Efficiency", "Food Security", "Future", "Management". This cluster is the most relevant one for this research, considering that the authors propose an agro-urban, easily replicable model of doing horticulture: an urban community garden, as an innovative solution for greening the agri-food chains. Figure 2 contains the correlations of the "community gardens" keyword structure with other relevant keywords and keyword structures.

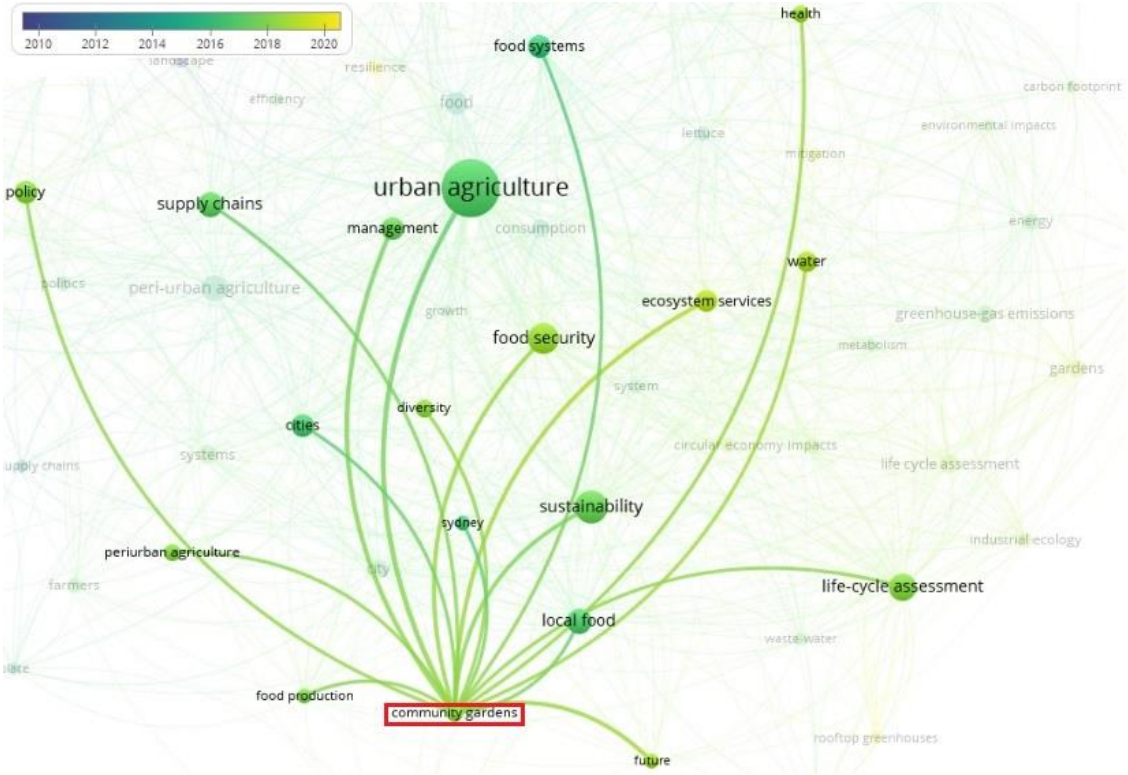

FIGURE 2. THE CORRELATIONS BETWEEN "COMMUNITY GARDENS" KEYWORD STRUCTURES WITH OTHER KEYWORDS AND STRUCTURES ASSOCIATED TO THE PUBLICATIONS CONCERNING THE TOPICS OF "URBAN AGRICULTURE" AND AGRI-FOOD "CHAINS"
Source: Authors' own conceptualization in VOSviewer 1.16.16 based on the Web of Science metadata, 2021

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Cluster 4 contains the "community garden" keyword structure and, consequently, the cluster is considered as one of high importance in the context of the proposed solution for greening the agri-food chains through urban agriculture and, more specifically, through the implementation of multifunctional community gardens. Community gardens alleviate the negative impact of urbanization and contribute to greening of the agri-food chains, as well as to the preservation of community short-term food safety (Rusciano, Civero and Scarpato, 2020). In relation to the concepts of urban agriculture and agri-food chains, the "community garden" keyword structure is correlated with keyword structures such as "periurban agriculture", "local food", "supply chains", "sustainability" and "future", therefore underlining the necessity of practicing urban agriculture in the light of a more sustainable and environmentally friendly agri-food supply chain.

Cluster 5. Keywords: "Cities", "Urban Farming", "Consumption", "Periurban agriculture", "Food production", "Sustainability". This cluster highlights the close link between the principles of urban agriculture, agri-food chains and food security in the race for achieving sustainability.

Cluster 6. Keywords: "Energy", "Gardens", "Environmental Impacts", "Greenhouse-gas emissions", "Local food", "Waste-water". This cluster expands the field of opportunities generated by the implementation of the idea of urban agriculture on a wider scale, taking into account the potential to increase the energy efficiency of buildings and reduce their carbon footprint (Colesca and Ciocoiu, 2012; Bodislav et al., 2020). Cluster 6 brings cluster 4 one step closer in terms of helping the authors design an innovative solution of urban agriculture capable of solving issues such as water waste and local food insecurity issues.

Because of the power of the links generated based on keywords occurrence, the bibliometric analysis proved that rooftop community gardens were highly approached in the literature in relation to the necessity of ensuring high levels of food security in a sustainable manner, especially in cities and urban areas.

Considering the impact of community gardens as a major topic of interest in the field of urban agriculture and of greening the agri-food chains, the authors propose for implementation an innovative agro-urban ecosystem – a rooftop garden in the campus of the Bucharest University of Economic Studies, on the rooftop of the Moxa Canteen, in the near proximity of the Faculty of Agri-food and Environmental Economics. The garden has multiple aims, including: horticultural production, rainwater harvesting, waste recycling, compost generation, biodiversity, practice hub for students, social and educational purposes. The urban garden is a place for composting leftovers from the student's canteen, as well as cardboards. The compost can be used as a growing substrate for the fruit and vegetables that go back as fresh input in the canteen, closing the cycle.

As designed in Figure 3, the rooftop garden is a mix of four areas: productive area with raised vegetable beds, fruit shrubs, medicinal plants and aromatic herbs; a technical area with composters, a tool shed and a rainwater filtering and collecting system; a wildlife area with a flowering meadow for bees, beehives, a small pond, wildlife shrubs (habitat/nesting/feeding); an education and social area for co-working, workshops, teaching and vegetable conditioning.

FIGURE 3. Moxa Canteen's Rooftop Before and After implementing the urban garden
Source: Google Earth 2021 (left), authors' own concept of the Moxa Canteen's Rooftop (right)

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The technical plan for Moxa Canteen Rooftop graphically resembles the four areas urban garden, as displayed in Figure 3 and Figure 4. The implementation of the urban community garden involves supporting biodiversity, achieved by improving and preserving the habitat of bees, birds and insects on the rooftop. In terms of waste management, the aim is to reduce compostable waste from the Moxa Canteen and reintegrate them into the circuit, ensuring the principles of circular agriculture in the campus. The compostable waste will be taken to the composting station; which will lead to a reduction of the Moxa Cateen's costs with the garbage. Moreover, this initiative can make a significant difference in public health matters, contributing to the decrease of carbon dioxide. Since the Moxa Canteen building is far from the heavy traffic in Bucharest, having numerous plants and trees in the academic campus will ensure the improvement of the quality of the environment and will be a proper space for students to study.

The productive area designed in Figure 5 is the place to raise vegetables, fruit shrubs, medicinal plants and aromatic herbs – with the main propose of providing all food the supplies back to the canteen needs that provides food residues. The latter are composted as displayed in Figure 6. The technical area from Figure 6 is where the garden's composters will be located. A tool shed and rainwater filtering and collecting system will be also located in the technical area. All compostable waste streams generated will be managed in the technical area and actual food waste from the university canteen will be reduced (food leftovers are currently sent to the trash bin). The education and social area for co-working, workshops, teaching and vegetable conditioning is displayed in Figure 7. Moreover, the urban garden will have a dedicated wildlife area (displayed in Figure 8) with flowering meadow for bees, beehives, a small pond and wildlife shrubs. Bees will bring health and vitality to the urban environment by pollinating green areas and will also offer inhabitants the opportunity to reconnect with nature.

The urban community garden initiative was created to come in the support of a more holistic plan of how the agri-food chains function or rather, should function in a sustainable and resource-efficient industry. The self-designed urban community garden was conceptualized based on the following structure: (i) the productive area meant to contribute to a better degree of food safety in the urban campus, as displayed in Figure 5; (ii) one technical (composting) area meant to ensure the circularity factor to the solution by integrating Moxa Canteen's food waste streams back into the production streams, as displayed in Figure 6; (iii) one meadow flowering and wildlife area meant to integrate bees and other beneficial fauna to the garden that can co-create value in the garden, as displayed in Figure 8; (iv) one education and social area meant to contribute to fostering the principles of urban circular agriculture through various lectures right in the space where it all happens, as displayed in Figure 7. The productive area consists of raised vegetable beds, fruit shrubs, medicinal plants and aromatic herbs. The technical area with composters also has a tool shed and a rainwater filtering and collecting system. In the wildlife area, the bee populations bring health and vitality to the urban environment by pollinating green spaces; as well as offering inhabitants the opportunity to reconnect with nature. Moreover, the urban community garden facilitates networking through its education and social area, where co-working, workshops, teaching activities are encouraged, when the sanitary conditions will allow it (the COVID-19 pandemic).

According to the authors' calculation, the budget for implementing the urban garden is 248,463EUR. The execution can be done in almost one year. The urban garden is planned to produce annually at least 200 kg of fruits and 1,000 kg of vegetables. The primary intention for this solution is to prove that it is possible to better manage urban areas and harness the drive in citizens to practice modern forms of circular agriculture, therefore to be one step ahead in ensuring food security in a more sustainable and environmental-friendly way.

As far as drawbacks and risks of constructing the urban garden are concerned: (i) inclement weather – the urban garden disposes of a greenhouse (displayed in Figure 5) where vegetables are grown all year round; during winter there are no vegetables grown in the garden; (ii) mitigating the excessive weight of the garden on the roof was done by integrating in the garden's budget a special line for structural evaluation of the building and design consultancy – all materials are selected in relation with the analysis of the building structure carried out by engineers; moreover – the feeding depth for most annual plants is maximum of 30 cm, which implies a thin layer of growing substrate, containing a special a mix ensuring both the needed nutrients for the crops and a minimum load on the roof; (iii) pest damage and bird predation risks were mitigated, aiming at achieving the full potential of the urban agricultural production. Protection systems (shading-net for vegetables, anti-frost

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protection net, anti-insect netting) were included in the budget. Bird feeding systems were also included in the budget in order for the urban garden to be populated by beneficial fauna which keep the insect population under control – this is corroborated with the companion plants from the garden that act as an insect repellent mix; (iv) from a human resource risk-perspective, the students of the Faculty of Agri-food and Environmental Economics can cover their internship included in the enrollment contract by carrying out activities in the urban garden, under the direct supervision of their teachers.

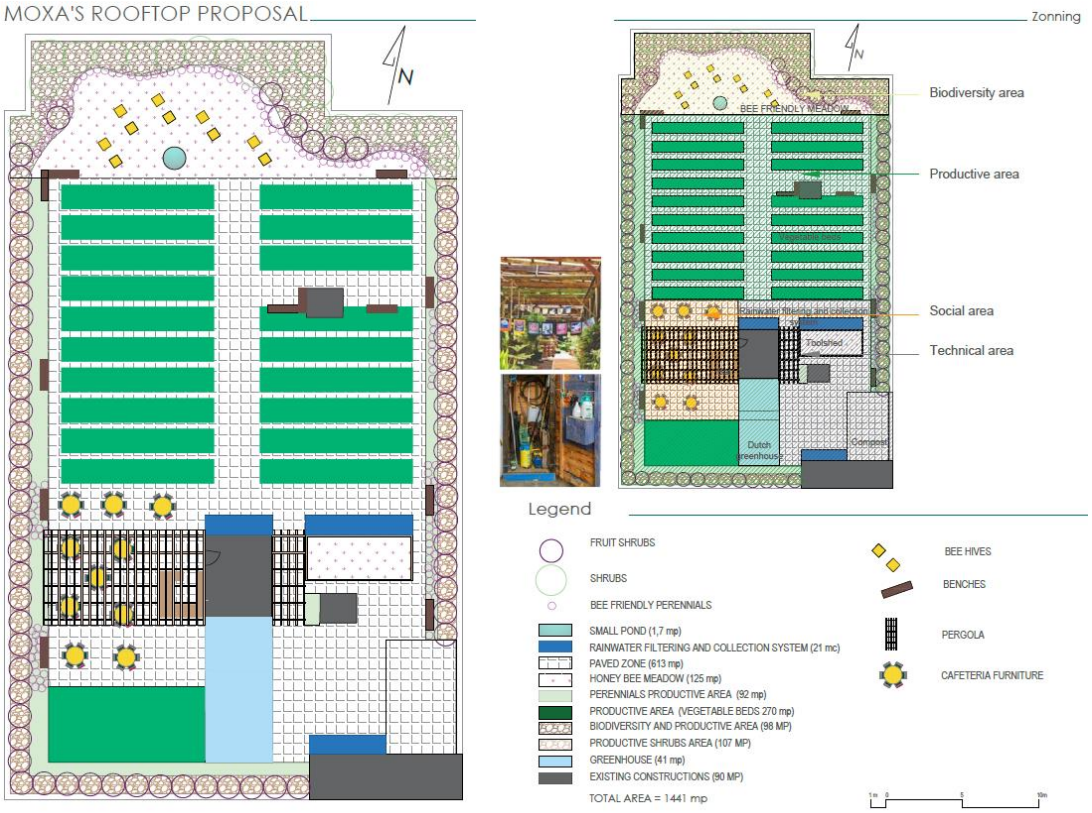

FIGURE 4. The proposed technical plan for Moxa Canteen Rooftop
Source: authors' own conceptualization of the Moxa Canteen's Rooftop

FIGURE 5. THE PRODUCTIVE GREENHOUSE AREA WITH RAISED VEGETABLE ON THE MOXA CANTEEN ROOFTOP
Source: authors' own design of the Moxa Canteen's Rooftop (3D randering)

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FIGURE 6. THE COMPOSTING AND TECHNICAL AREA ON THE MOXA CANTEEN ROOFTOP
Source: authors' own design of the Moxa Canteen's Rooftop (3D randering)

FIGURE 7. THE EDUCATION AND SOCIALIZATION AREA ON THE MOXA CANTEEN ROOFTOP
Source: authors' own design of the Moxa Canteen's Rooftop (3D randering)

FIGURE 8. THE PRODUCTIVE AND WILDLIFE AREA ON THE MOXA CANTEEN ROOFTOP
Source: authors' own design of the Moxa Canteen's Rooftop (3D randering)

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5. CONCLUSIONS

Considering the growing urban populations, the amount of food transported to cities worldwide increases as well – with many global environmental challenges associated: the generation of greenhouse gas emissions, biodiversity loss, non-renewable resource exhaustion, land-use issues and others. In this context, innovative agro-urban systems need to be developed in an environmentally friendly manner. These new agro-urban systems should also be designed with the aim of greening the agri-food value chain along all its links, starting from chain shortening.

Integrating agricultural production into buildings in urban areas, rooftop greenhouses for example, represents one of the vectors of delivering environmental benefits. Moreover, such solutions contribute to cleaning the agri-food value chain, through various methods: starting from shortening the chain as an obvious initial result. Obtaining agricultural production from rooftop greenhouses implies the decrease in the amount of the generated greenhouse gas emissions generated by agricultural and transportation activities. Rooftop farming based on the circular economy model acts as an innovative and new form of urban agriculture with important contributions to the advance of the Sustainable Development Goals of the United Nation.

As demonstrated through the bibliometric analysis, community gardens are of high interest regarding innovative green solutions. Creating an urban garden as the one proposed by the authors, on Moxa's Canteen Rooftop– it implies a considerable investment at the beginning, especially since everything will be constructed on an empty rooftop. However, the advantages go beyond the measurable revenues and production, they close a loop and bring a replicable urban model to be followed, especially on new buildings contributing to a shift in local mentality towards sustainability.

Regarding the significant contribution to delivering benefits for society, the proposed community garden is subject to be constructed within the campus of the Bucharest University of Economic Studies from Romania. With a long-lasting history of providing higher education services to economics students since 1913 (Lacatus, 2020), the Bucharest University of Economic Studies will also provide future students opportunities for practising circular agriculture within the campus, on the rooftop of the Moxa Canteen. Annually, more than 27,000 students would be able to participate in activities carried out in the community garden, grow vegetables and fruits locally, integrate food surplus into the composting process in the garden, decrease the nominal carbon footprint and food miles, learn theoretical agri-economic aspects by doing and many other benefits. Should this community garden be successfully implemented in the campus of the Bucharest University of Economic Studies, all the previously explained socio-economic, educational and environmental benefits are going to change the perspective of the future generations in relation with the environment and with the agri-food sector. Since the Bucharest University of Economic Studies enrolls almost 7,000 students annually (The Bucharest University of Economic Studies, 2021), the proposed community garden will serve as an actual solution for greening the agri-food value chain, bringing long-term benefits for many generations to come. Although the self-designed community garden cannot entirely ensure food security for all the Bucharest University of Economic Studies community (more than 27,000 people), the scope of this project is larger than meeting the food needs of the whole community and goes beyond – the rooftop community garden will stand for many years to come as an integral part of the students' Moxa Canteen building that will inspire the academic community to harness their care for the environment and for a more circular future. Concerning the financial viability, the construction of the garden is included in the Rector's managerial plan and it is currently subject to be financed. As far as the annual operational costs are concerned, they will be covered by the Bucharest University of Economic Studies. Therefore, the urban community garden will serve as a model in regard to: (i) transposing concept of circularity into practice by composting organic waste and using it as input; (ii) decreasing the food miles and the carbon footprint through locally producing agricultural products; (iii) exploit space as a resource at its full potential through interventions designed to enhance both utility and comfort by placing gardens, multifunctional furniture, various therapeutic plants; (iv) efficiently collect, store and manage rainwater in specially arranged places on rooftops and use it as a resource; (v) empower environmentally friendly behaviors in the academic community and raise awareness over the benefits of practising urban agriculture.

This research can help policymakers consider the positive socio-economic and agro-ecological impact of the innovative solutions involved through practicing urban agriculture. Financing such activities can contribute to

greening the global agri-food value chain, reducing the carbon footprint, food waste minimization, ensuring food safety and making best use of the available space.

Designing and implementing organic urban community gardens can generate significant, positive behavioral changes along the global agri-food value chain, starting from producers and ending with consumers. Not only do consumers contribute to greening the global agri-food chain, but they can also close the loop from waste to resource through recycling biowaste in special compost-generation areas in the urban garden. The compost can be used as crop fertilizer in the urban garden and can act as one of the instruments that facilitates the transition to the circular economy, even in the urban areas.

6. ACKNOWLEDGEMENT

A competition on circular agriculture initiatives was launched in Romania in 2019 with the aim of bringing the principles of the circular economy closer to the aspiring entrepreneurs, at the initiative of the Embassy of the Kingdom of the Netherlands in Romania. The “Circular Agriculture Challenge” aimed to ignite and empower creative project ideas. Many proposals were submitted for the competition from numerous Romanian universities, including the A.C.U.M. Project, affiliated to the Bucharest University of Economic Studies. The authors of this article are part of the A.C.U.M. Team.

In 2020, on 22 July, the winner of the competition was announced at the Awarding Ceremony – the A.C.U.M. Project. A.C.U.M. is a Romanian acronym for the “Circular Agriculture in my University”. The A.C.U.M. Project aims at implementing the urban community garden previously described in this article. Three members of A.C.U.M. Team were honored to pitch the project at the “Circular Agriculture Challenge” Ceremony (Figure 9). The A.C.U.M. Project calls for a paradigm shift in the agri-food system, as the main promotor of the transition towards a circular and inclusive economy.

FIGURE 9. THE A.C.U.M. TEAM PITCHING THE URBAN COMMUNITY GARDEN AT THE “THE CIRCULAR AGRICULTURE CHALLENGE” CEREMONY ORGANIZED BY THE EMBASSY OF THE KINGDOM OF THE NETHERLANDS IN ROMANIA
Source: The authors' archive

Food wastage and its accumulation represent an actual opportunity for growing in-campus fresh fruits and vegetables on the rooftop of the Moxa Canteen building. The cateen’s food leftover could be best used to produce compost, later integrated as substrate in the urban garden. The framework designed by the A.C.U.M. Team does not only involve building the path for the agri-food sector to a more circular future, but it also contributes to building bridges between economics students and sustainability.

This article was inspired by the A.C.U.M. Project. The authors express their sincere gratitude to the Embassy of the Kingdom of the Netherlands for their initiative of launching this competition that had the sustainability factor at its core.

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