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In search of a new quality of urban living. A contemporary vision of the garden-city and its derivatives: new challenges and solutions for self-containment in urban areas

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Abstract. The article discusses research on the ideal place of residence for modern individuals, based on theoretical concepts and urban housing estates designed with self-containment and Howard's 1898 garden city concept in mind. The paper presents a comparative analysis of theoretical designs and contemporary implementations related to urban agriculture principles influenced by Howard's concept. A typology of theoretical solutions is developed and compared to built facilities, revealing differences and reasons for their creation.

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1. Introduction

Since its inception, the concept proposed by Ebenezer Howard has had a major impact on the way urban space is perceived as a healthy place for human habitation, fulfilling all the needs of daily life in terms of broad well-being. Nowadays, in an era re-evaluating the way the city is perceived when confronted with articulated environmental needs or with the urge to prepare urban environments for possible emergencies, the idea has been revisited as a basis for further reflection on the future of cities. Important factors in this respect will ensure the city's food and energy self-sufficiency, in line with the development assumptions.

Urban agriculture, apart from the range of benefits it provides to city dwellers, the urban environment and the wider economy (Hodgson et al., 2011; Kleszcz, 2020: 58–68), has also recently become an important element in the process of revitalising urban areas, often affecting areas of historic importance to the architectural fabric and urban structure of the city (Szczepańska & Staszewska, 2016; Yagci & da Silva, 2021).

This has led to an evolutionary process of a new trend emerging in the search for a new quality of space in urban living – a trend that combines the search for new urban housing forms, with the search for more sustainable cities built on the principles of 5R (Balwan et al., 2022), urban renovation and revitalisation. The 5Rs constitutes the known concept of the 3Rs (reduce, reuse, recycle) extended to include issues vitally related to spatial aspects; The additional ones that have emerged in this chain are "refuse" and "repurpose", as an addition to the methodology of how to deal appropriately with how to reduce human impact on the environment in which we live (Johnson, 2013).

The development of urban functions is a continuous process that has been going on uninterrupted since the emergence of cities as a form of spatial development. It has always reflected the current state of society, its achievements and needs. Only the industrial revolution brought about a real change in the functional layer of the city, which was so clear that it required the first serious redefinition of the urban function.

Along with the simultaneous technical development in basically all spheres important for the functioning of the city – from technical infrastructure to defence systems, through the emergence of new materials and construction techniques, to the expansion of the social class system, there was a process of significant changes aimed at updating the space and adapting it to a number of requirements resulting from the rapid spatial development of existing cities and the need to establish new ones.

One of the first visionaries and explorers in this matter was Ebenezer Howard, with his well-known idea of the garden city, first physically developed in the towns of Letchworth and Welwyn (Howard, 1902). As it turns out, it is a solution to a problem of the past that now offers a chance to solve future problems, but more systemically. Howard's idea proved flexible enough to create space for its reinterpretation.

The shaping of residential development in accordance with sustainable development principles has already been well studied and described over the last quarter century (Daniels, 1997; Horn, 2019; Lima, 2021; Bać & Michalski, 2022; Stachura & Tutek-Memisevic, 2022). However, the contemporary connection between urban habitation and agriculture, though postulated for over 100 years (Howard, 1902; Waldheim, 2010), has only recently emerged as a research topic (Despommier, 1999; Poulsen & Spiker, 2014).

In design, there is currently a shift towards Howard's concept as a method for achieving sustainable development goals, although the investment model and the economic basis for its operation have completely faded (Pastor et al., 2023). Emerging research is concerned with capturing (on the basis of a re-examination of the implementation of garden cities and more recent concepts based on Howard's vision) general trends that can provide a basis for further development of existing settlements rather than building new ones from scratch (Pastor et al., 2023: 2). As I have noted, this idea is increasingly being combined with the goals of sustainable development, including the search for urban food self-sufficiency. In this context, Howard's concept, offers a comprehensive solution to the problem of the relationship of the city as a place to live, work and relax and can be brought up to date by augmenting it with the inclusion of the meeting of such contemporary needs as to multifunctional greenery, cheap electricity, water and heating, a reduction in and networking of daily mobility needs: this will provide a very good basis for further reflections on this topic (Pastor et al., 2023: 7–8).

2. Research materials and methods

The adopted research method is described in the diagram below (Fig. 1). It includes a literature review of the theoretical foundations of the Howard model and its implementations in Letchworth, Welwyn and Hampstead Garden Suburb. A further part of the research involved historical analysis and archival research into the development of the urban agriculture element design trend in theoretical solutions that preceded the appearance of the first commercial practical solutions. These were compared and contrasted with the new theoretical solutions, which represented a development of Ebenezer Howard's thought. The overall work was complemented by a critical analysis of the multiple case study, which was based on the development of a theoretical spatial model of urban agriculture functioning in urban space, cross-referenced with similar models used in implemented solutions.

The research involved the use of materials published on the Re-Imagining the Garden City Design Ideas Competition website and the participating designers' own websites. Further use was made of materials relating to housing development concepts, including design documentation and authors' descriptions, to conduct a multiple case study and further synthesise the findings. The entire study was preceded by an analysis of the latest literature in accordance with the set of keywords adopted for the topic. For the literature analysis, the Web of Science database supported by Artificial Intelligence Research Assistant (Elicit.org) was used.

For a clearer presentation of the research, a chronological arrangement has been chosen, showing the evolution of the concept of urban food self-sufficiency since the publication of Howard's theory at its most relevant stages.

The analysed cases have already been partly described in the relevant literature, although mostly in the context of specific, individual technical solutions in the case of contemporary implementations (Sanyé-Mengual et al., 2015; Buehler & Junge, 2016; Caputo et al., 2017; Ercilla-Montserrat et al., 2017; Nadal et al., 2017; Apolloni et al., 2021; Bousselot et al., 2020; Kleszcz, 2022) or as part of solution theory and practice in the case of historical examples (Fishman, 1998; Miller, 2010; Lewis, 2015; Pastor, Canniffe & Jiménez, 2023).

3. Research results

3.1. Howard's idea and its early developments

The publication of Ebenezer Howard's book *Tomorrow: A Peaceful Path to Real Reform* (Howard, 1898) initiated a very vibrant social movement to build garden cities as an alternative to the conservative attempts to heal contemporary cities suffering violently from the effects of the Industrial Revolution and progressive urbanisation (Purdom, 1913: 14–16; Miller, 2010: 4–7; Tizot, 2018; Pastor et al., 2023). Hence, ideas for implementing Howard's theoretical framework into real space emerged very quickly (Howard, 1902; Unwin, 1909; Osborn, 1942), at first primarily in the UK, where the movement was born, taking the form of the Garden City Association, established as early as 1899 (Miller, 2010: 13). An analysis of the concepts that developed moments before the publication of Howard's theory and in the years afterwards, up to the end of the Second World War, shows that the idea of garden cities significantly influenced the emergence of the concept of town planning as an independent

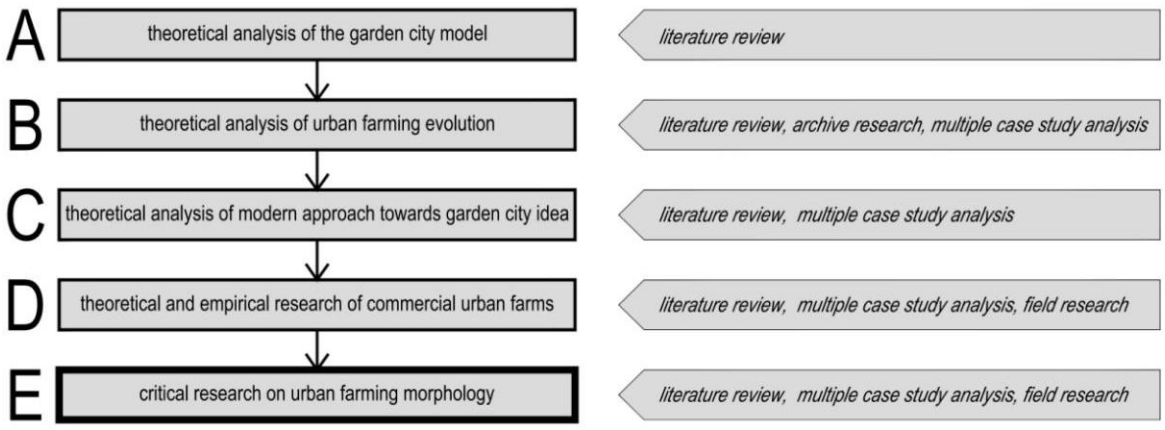

Fig. 1. Research steps and methods provided for each part of the research
Source: own study

discipline (Lampugnani et al., 2017). Three British developments from this period are assumed to most fully represent the idea described by Howard. These are: Letchworth and Welwyn, created with Howard himself, and Hampstead Garden Suburb, created on the initiative of Henrietta Barnett (Miller, 2010: 17).

Letchworth Garden City was the first town to be built on the principles of Ebenezer Howard's concept (Purdom, 1917; Lewis, 2015; Fishman, 1998; Miller, 2010: 18). Much of the town, which now has a population of over 33,000 was based on a masterplan by Barry Parker and Raymond Udwin designed around the pre-existing small settlement of Letchworth connected to two other villages, Willian and Norton. The masterplan was first published in 1904 (Purdom 1913: 42), following the outcome of a limited competition, which was won by Parker and Udwin (Miller 2010: 18). The development of the estate itself was described in detail by Charles Purdom just a few years after it was created (Purdom 1913: 37–62), relating a number of interesting facts about the whole process, from the choosing of the site to the voting on the name, which survives to this day as Letchworth Garden City. After the Second World War, development expanded beyond the original plan, which ultimately was not fully implemented on the eastern side. The estates of Grange, Jackmans, Lordship and Manor Park were created on the north and south sides.

In 1919, Welwyn Garden City became the third garden city (after Letchworth and Hampstead Garden Suburb) commissioned by Howard, Frederic Osborn and Charles Benjamin Purdom (Miller 2010: 31–32), built on land purchased from Lord Desborough Panshanger and Lord Salisbury by the Garden Cities and Town Planning Association. The first provisional layout of the estate was created by Osborn in 1919 but was abandoned due to a railway wayleave requirement. A second sketch, prepared by Malville Crickmer, defined the location of an industrial area, but was also abandoned due to the plan by Louis de Soissons from 1920 (Purdom 1925: 205; Miller 2010: 32–33;) whose realisation led the population increasing to 13,500 inhabitants in 1938.

Howard's legacy has been highly influential in shaping housing estates both in the UK and internationally. According to sources, this idea has gained many supporters both within and outside Europe (Szymańska, 1993; Baranowska, 2007: 21–23). There are at least 57 listed examples of garden city communities in England (Miller, 2010: 109–115) and at least 32 new towns from 1946–1970 for which this idea was used as a reference (Vernet & Coste, 2017: 48). This involves towns and estates from all over the world, including the interwar period in present-day Poland: Giszowiec in Katowice from 1907 (Tofilska, 2016), Miasto Ogród Młociny from 1914, Podkowa Leśna from 1925, Kolonia Letnia Żarki from about 1932 (Malczewska-Pawelec, 2020) and Miasto-Ogród Sokolniki, Tuszyn-Las and Grotniki (Szymańska, 1993; Baranowska, 2007).

3.2. Urban agriculture as a point-based intervention

Urban agriculture appeared as a new function in specific conditions related to the situation of uncertainty, the possibility of shortages in access to food – fresh food, as now, and any food, as throughout history. In the past, as an intervention, agriculture was much more associated with urban greenery, public and home gardens, becoming more closely related to architecture over time. The example of well-documented British or Dutch allotments or community gardens shows those moments in history in which the interventional role of agriculture caused significant, yet only temporary, changes in the way cities functioned.

What makes modern theories different from the past of sustainable development is the programmatic search for food self-sufficiency. It began in contemporary form during World War II with Dig for the Victory programmes, gardens in bomb craters or any soil exposed by warfare (Ginn, 2012). The post-WWII activities were merely an expansion and consolidation of the self-sufficiency resulting from the uncertainties of the post-war era, but in a more contemporary form, like the example of Runde Haver Nærumgårdsvej in Nærum (Dennmark), designed as accompanying suburban housing by C. Th. Sørensen in 1948–1952 (Lickwar & Thoren, 2020; Terzano, 2022).

3.3. The influence of modernism

The second half of the 20th century was an experimental period. It saw a lot of interest in vertical multi-functionality, which became a major trend in urban farming design. The turn towards vertical solutions to address the need for more intense development while providing access to green space essentially occurred almost in parallel with the spread of Howard's theory.

Due to a number of benefits associated with enclosing intensive agricultural production within urban vertical forms, including protection from adverse environmental factors and increased

production efficiency with a much smaller land footprint, these solutions very quickly replaced soil agriculture in theoretical considerations of urban food self-sufficiency. However, they focused mainly on the technological aspects of such a process (Hix, 1974; Douglas, 1977). A turning point is now recognised as the 1915 publication by Gilbert Ellis Bailey (Bailey, 1915), Arthur G. Walken's 'Theorem', a 1909 drawing for *Life*, and James Wines' 1981 drawing *The Highrise of Homes* from the drawing collection of the Museum of Modern Art in New York (McQuaid, 2020) showing the vertical relationship between urban agriculture and habitation. The transition from vertical agriculture to multifunctional towers closely linked to agriculture was only a matter of time (Despommier, 1999).

At this time, early attempts to implement hydroponic vertical agriculture in urban spaces were also being made. The first was made in Armenia (Douglas, 1977: 112), followed shortly thereafter by the Austrian engineer Othmar Ruthner beginning work in this direction. His company "Ruthner" Industrieanlagen fur Pflanzenbau G.m.b.H. began to implement the patented "Turmgewachshaus" in Austria, Germany, Sweden, Italy, Norway, Russia, Canada, Libya, Iran, Japan and Poland from the mid-1960s onwards (Eberling, 1978; Kleszcz et al., 2020).

The overtones of these theories and realisations can still be found in theoretical designs from the early 20th century. The image of the multifunctional vertical farm as the salvation of the city or as a substitute for it has appeared in the conceptual work of studios such as the Dutch MVRDV (e.g., The Pig City from 2021), the American Michael Sorkin (Self-Sufficient Skyscraper from 2010) and the WORK Architecture Company (Locavore Fantasia from 2008) or the French Vincent Callebaut (e.g., Dragonfly from 2009).

3.4. Implementation time: urban agriculture as urban acupuncture

Since the early 2000s there has been a shift from theoretical design experiments or ad-hoc corrective actions towards experiments in real life. The erected concept for ICTA_ICP Institute of Environmental Science at the campus of Universitat Autònoma de Barcelona in Cerdanyola Barcelona shows gathering the "selfs-" idea – self-sufficiency with food sufficiency and multifunctionality as a basic guideline (Sanyé-Mengual et al., 2015 Ercilla-Montserrat et al., 2017; Nadal et al., 2017).

This project, which combines the function of an academic building, laboratories and an experimental space for urban agriculture, is an attempt to implement the idea of point-based actions – small interventions to catalyse further revitalisation of a settlement or an entire district. This is now recognised as a promising direction for the transformation of neighbourhoods towards sustainability, as it involves small-scale, individual but significant changes at the beginning, which later have an impact on the functioning of the city as a whole.

3.5. The evolution of Howard's concept: the search for a method for urban redevelopment in a non-dispersed form

The first consideration of a return to the idea of the garden city in the context of the needs of contemporary urban planning and the problems of quality of life was undertaken even before the final formulation of the sustainable development principles. The new wave of analysis included a description of the state of decomposition of the idea that the environmental dimension had been dispersed to pursue contemporary urban planning practices (Ward, 1990: 251). Simultaneously, the garden city model served as a reference to a great number of urban ideas throughout the whole 20th century (Vernet & Coste, 2017: 49–50). Since then, several competitions have been launched to bring Howard's ideas up to date in terms of the need for social housing and to incorporate contemporary sustainable development guidelines into the idea (Vernet & Coste, 2017: 51–53), with the Wolfson Economics Competition from 2014 and the described further – The Re-Imagining the Garden City Design Ideas Competition from 2018.

The first one presented two, generally different approaches to the sustainability of the garden city as an autonomous human settlement – one presented by the winning urban planning agency URBED (Urbanism Environment and Design) by David Rudlin and Nicholas Falk with the project Uxcester Garden City (URBED 2014; Falk, 2017) and the other by DPZ (Duany Plater-Zyberk) (Vernet & Coste, 2017: 51). The Wolfson Economics Competition was the first one where the idea of sustainability as the increase of energy efficiency to zero or near-zero cost was to be achieved, meeting the Code for

Sustainable Homes Level 4 as a minimum (Wolfson Economic Prize MMXIV, 2014).

The Re-Imagining the Garden City Design Ideas Competition was held in 2018 by the Letchworth Garden City Heritage Foundation in partnership with RIBA, Anglian Water, BRE, Homes England, the Town and Country Planning Association and the University of Hertfordshire and was an attempt to find forms of expansion of the historic Letchworth Garden City, adapting Howard's vision to the modern level of knowledge, needs and possibilities on 45 hectares on a northern site of the historical town (Re-imagining the garden city, 2018). The competition was aimed at interdisciplinary design teams, led by architects. The site was included in the North Herts Local Plan 2011–2031 (North Herts Council, 2022). It was located to the north of the Grange Estate, which was built after the Second World War and whose masterplan was designed by Geoffrey Jellicoe as part of the Hemel Hempstead masterplan (Letchworth Garden City Heritage Foundation, RIBA 2018). The site was also adjacent to recreation grounds to the south. At the time of the competition, these were open farmland.

The conditions of the competition assumed two phases. Ninety-five works from all over the world were submitted to the first phase. Four works were qualified for the second phase, and finally one winner was selected – the submission of EcoResponsive Environments with Peter Neal Landscape Consultant, Studio 4215, Transform Places, Carbon Dynamic, Biomatrix Water, Holistic City Ltd and BNP Paribas Real Estate.

The winning project, entitled "To-morrow 2.0. Grange-in-the-Hedges", presents the clearest example of a shift in urban design from the traditional approach towards the creation of suburban housing complexes, Howard's concept, and the sustainable development goals updated to contemporary technological and social realities. It is for its holistic understanding of the fundamental issues involved in the way a settlement is organised as a system and for going beyond just the physical layer of the proposed architecture that it won.

Due to the nature of the competition – its two-stage format and the substantive scope of each stage (Re-imagining the garden city, 2018) – this analysis draws on the entries submitted as part of the second stage.

The authors of the individual entries at this stage were:

- L49 – "To-morrow 2.0. Grange-in-the-Hedges" EcoResponsive Environments and Peter Neal Landscape Consultant, Studio 4215, Transform Places, Carbon Dynamic, Biomatrix Water, Holistic City Ltd, BNP Paribas Real Estate,
- L38 – "Gardenia. Letchworth Garden Quarters" Stride Treglown, with Global Cities,
- L78 – "Growing Letchworth – Embedding resilience within the Garden City", Sarah Wigglesworth Architects, with Roundfield and Etude,
- L92 – "Growing Together – A Productive Framework", CF. Moller Architects UK Ltd with URBED and Human + Nature.

These concepts demonstrate a method of integrating neighbouring developments with newly designed ones, in addition to providing a physical connection through roads and pedestrian routes, by forcing the movement of residents. This is achieved by introducing functions into the new development that are lacking in the existing housing estates, so that the new fabric complements the facilities already in place. In the overall perception, thanks to the detailed formulation of the competition brief (Letchworth Garden City Heritage Foundation, 2018), they do not differ significantly from each other. Differences can only be seen in the scale of the urban detailing, in the way the social dimension of sustainability is addressed, in the multi-layered and multi-functional solutions of the spatial components of the estate, which consider elements of the 5R strategy and food production as a system and not just a task carried out by the individual resident (Fig. 2).

Apart from the general guidelines concerning the building structure, guidelines resulting from the contemporary assumptions of sustainable development were defined. These included the energy efficiency of buildings, minimising the environmental impact of new buildings, and the strategy's well-known inclusion of creating an urban–rural landscape. This included strategic element involves protecting and enhancing certain historically formed landscape types and their characteristic compositional elements by using, for example, the historic establishment of hedgerows, oak alleys, etc. The element whose importance was strengthened in relation to the original assumption of the Letchworth garden city was urban agriculture, understood as a systemic element of the sustainable development policy and not only as an element of the greenery composition. Hence, the idea of continuous productive urban landscapes (CPULs) was implemented as an element of the open space management policy.

This element was directly related to the urban planning solutions proposed in Letchworth, where,

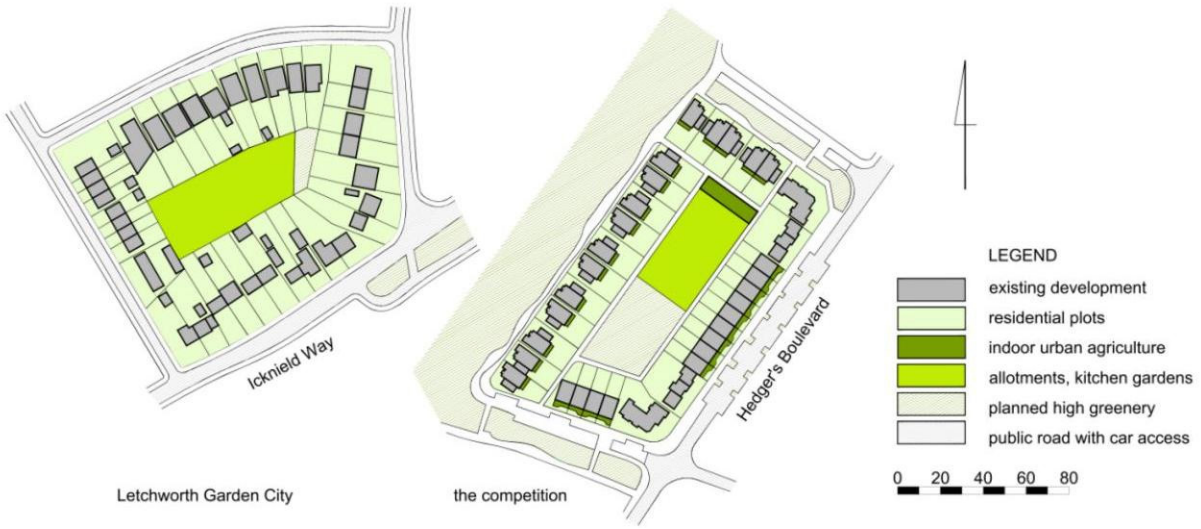

Fig. 2. Development of housing blocks in original Letchworth Garden City plan and in the winning competition design
Source: Author's own elaboration based on (Letchworth Garden City Heritage Foundation, 2018; North Herts Council, n.d.)

in semi-private spaces and inside the development complexes and accessible only to residents, space was provided for communal greenery, playgrounds, allotment gardens and outdoor kitchens. In all the competing solutions, in addition to individual soil-based gardens in private and semi-public spaces, proposals introduced home and community greenhouse agriculture and, into the development, integrated container agriculture and any mixed systems (Fig. 2). The sustainable development goals (SDGs), including activities aimed at achieving sustainable development in three integrated dimensions – economic, social and environmental – were implemented in each of the analysed entries not only at a basic level by reducing the need for electricity, heat and water, but also by adding recovery and generation on site, as well as by planning food production as a systemic solution, catalysing and bonding the local community and sustaining local history, while also reducing inequalities by addressing diverse housing structure and diverse funding options. Hence the more or less clearly hierarchical arrangement appears in each concept, distinguishing elements (buildings or land) with a public, quasi-commercial agriculture and accompanying functions (such as market spaces) from semi-public cultivation that is accessible to the inhabitants of the complex, and from private ones of various types. While the aforementioned public elements are single points that are also intended to act as a catalyst for city-wide movement, the others are intended to consolidate the settlement internally and provide viable food production.

3.6. Typology of architectural structures of analysed conceptual solutions

Based on the conceptual designs previously analysed, a typology of solutions has been developed to improve the quality of urban living in relation to elements of sustainability policy, including food production. The conceptual designs, although not constrained by the element of necessary commercialisation, propose solutions that, when fully implemented, will most comprehensively meet the need for self-sufficiency of the settlement in question. Hence, the proposed types are highly diverse, combining different types of cultivation, all of which refer in form to kitchen gardens and individual and community greenhouses. The variety of scales of solutions and types of development – from individual, to semi-public (community), to public and commercial – becomes characteristic here. Similarly, there is no clear separation of which type of residential development the functions combine with. The identified types will be used equally successfully in both single-family (A to H), multi-family (A, D, E-H) and mixed-use (J) developments (Fig. 3).

In the case of implemented solutions, therefore, a stronger reference was expected to be made to indoor urban farming in its various forms, either created as extensions to existing settlements or as an integrated element in newly designed developments, complemented by ground crops.

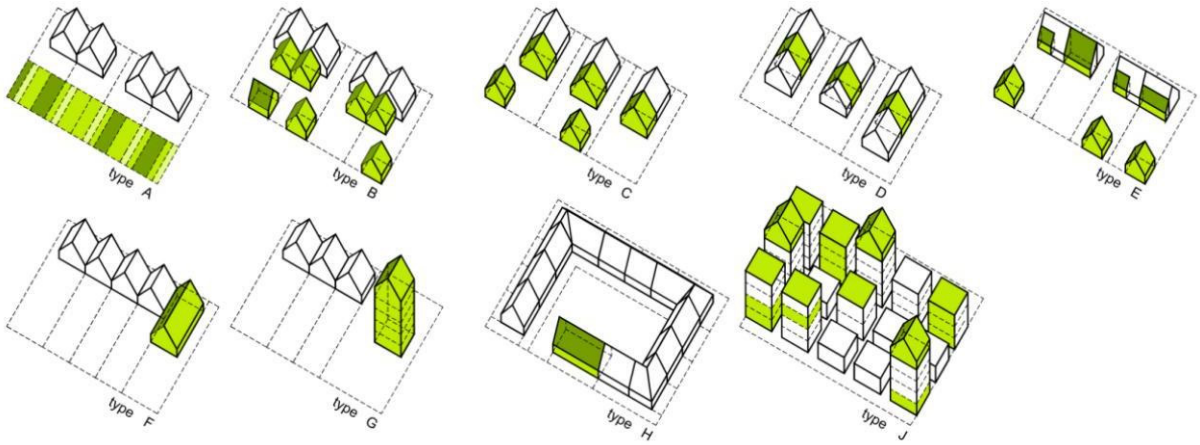

Fig. 3. Typologies of housing and urban farming connections based on theoretical models and concept designs
Source: Author's own elaboration based on typology presented by Kleszcz (2020: 117–123)

3.7. Contemporary solutions

However, the arrangements that are most often used to introduce agriculture in cities are not network solutions, but points, loosely linked to the surrounding built environment. As has been proven, current urban agriculture is directly derived from greenhouse agriculture.

Studies carried out in the Netherlands and Belgium show that greenhouse horticulture is often found in suburban areas, blending in with typically urban developments (Altes & Van Rij, 2013) – hence the conviction of some researchers that this is the form most likely to become the link between the rural and urban character of urban space (Zasada et al., 2011). The last decade has shown that they were right.

Hence, the proposed solutions were expected to take the form of more complex systems (Fig. 4).

Meanwhile, analysed cases of commercially developed urban farms associated with developments with a different function (residential, commercial, retail or industrial) that began to emerge worldwide after 2010 (Kleszcz, 2022; 2023) show a much flatter structure that practically evolved from large-scale greenhouse solutions and represents, as a form, an adaptation of greenhouse structures built as self-supporting.

Expectations for the typological transformation of the structure when elements to ensure the self-sufficiency of the development emerge, including the one that occupies the most space and is most visually apparent – agricultural production – include the implementation of solutions known from theoretical studies. Knowing the general typologies and characteristics of a given type of development and superimposing a theoretical model on this provides solutions of considerable complexity, elaborated formally and structurally,

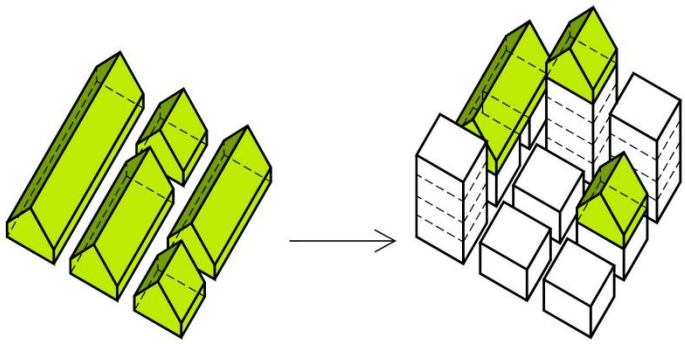

Fig. 4. Transition between form of greenhouse agriculture and urban rooftop indoor farming
Source: Author's own elaboration

Table 1. Analysed examples of urban farming: basic data with urban context

Name	Location	Year of realisation	Designer	Type of hosting facility	Functional context of the district	Type of farming	Other sustainability issues
Gotham Greens	Gowanus, New York, USA	2013	BL Companies	commercial, retail	Multi-family housing, commercial, retail	Rooftop greenhouse	Solar panels, grey water management
Gotham Greens	Jamaica, New York, USA	2015	–	retail, industrial	Industrial, retail, single-family housing	Rooftop greenhouse	Grey water management
Grow Community	Bainsbridge Island	2014–2020	Davis Design Studio	housing	Single-family housing, commercial	Greenhouse, container, soil-based, backyard garden Rooftop greenhouse, container, backyard garden, green roof	Solar panels, grey water management, retention,
S*Park	Denver, USA	2018	Tres Birds	housing, commercial	Multi-family housing, single-family housing, commercial	Rooftop greenhouse, container, green roof	Solar panels, grey water management
Abattoir BIGH	Anderlecht, Belgium	2016–2018	ORG Architects	commercial, retail	Multi-family housing, commercial, retail, industrial	Rooftop greenhouse, soil-based, backyard garden, green roof	Solar panels, grey water management
Secret Gardens	Montpellier, France	2021–2024	Vincent Callebaut Architects, Emmanuelle Navarro	housing, commercial	Single-family housing, multi-family housing, commercial, retail, green,	Indoor greenhouse, container, soil-based, backyard garden aquaponic	Solar panels, grey water management, retention,
Taisugar Circular Village	Tainan, Taiwan	2017–2021	Bio-Architecture Formosana	housing	Multi-family housing, commercial, office, green		Solar panels, grey water management, retention, circular economy rules

Source: Author's own elaboration

often fragmented so as to provide a variety of, among other things, forms of urban agricultural production. From the wide range of formal possibilities comes the selection of measures appropriate to the location, the cultural context or the type of functions with which the agricultural elements are to be combined. Hence, according to the projections, a variety of solid layouts should emerge, deviating from the typical layout solutions, i.e. zoning. At each scale, both in the case of single- and multi-family housing conversions and in the case of block development, the change in design approach should result in a much greater variety of highly individualised solutions (Fig. 5).

The analysed examples of the implemented assumptions that have so far been only theoretical show a great deal of variability in terms of plots and plans, and in the way in which the blocks are shaped

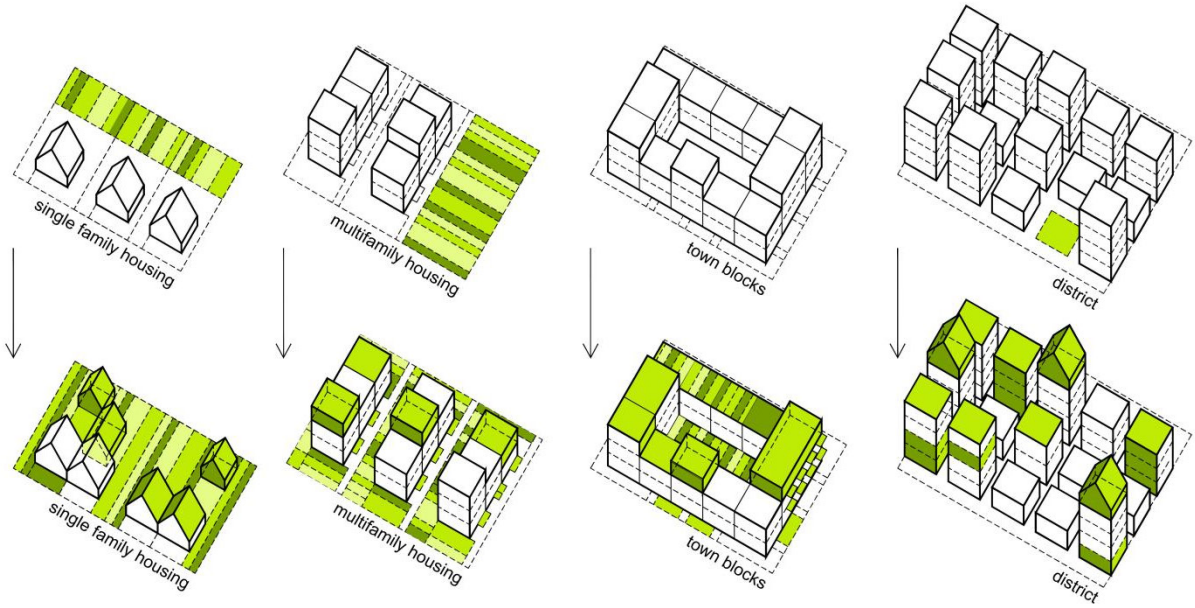

Fig. 5. Expected typological changes in different types of development in the case of emerging elements of self-sustainability of development based on analysed theoretical examples
Source: Author's own elaboration

and inscribed in the local context. Meanwhile, the element that shows very little variability is the way in which the elements intended to determine the self-sufficiency of the development on a city scale are shaped. Where individual solutions were expected to fit in with the context of the place, repetitive, systemic solutions are found that make direct use of technical solutions applied in industrial production. Hence, the most common form of ensuring self-sufficiency in a housing estate or neighbourhood is the introduction of systemic roof greenhouses based on hydroponic cultivation in a strictly controlled environment or, as a supplement, on outdoor container cultivation.

The applied solutions are very similar, regardless of the scale or type of development. The size of the greenhouse is limited only by the size of the roof suitable for agricultural purposes and its geometry by the technical possibilities of the greenhouse system supplier.

As the aforesaid analysis has shown, the idea of urban self-sufficiency, derived from the goals of the SDGs, has evolved from theoretical solutions to a stage of practical application. However, the form taken by these urban solutions is much more simplified and their structure is typical. Nevertheless, they are becoming more common and are being used in a wide range of applications, so it can be assumed that they are fulfilling their role in the urban space (Fig. 6).

4. Discussion

Analysis of the development trends of the urban housing estate concept oriented towards self-sufficiency, including for food, has been carried out on the basis not only of complexes that have been completed or are to be completed but also, in part, of competition and idea designs, which by definition are not execution works. This introduces an element of uncertainty in the results. In the case of architecture, the final result – the implementation of previous design assumptions – depends not only on the original concept, but on the possibilities of implementation dictated by legislation, local guidelines and the needs of the investor and future user. In the event of a large variation in these constraints, the final result of the project may differ significantly from the original concept.

Existing or newly built concepts cannot currently be compared with the implementation of the projects developed on the basis of the 2018 Re-Imagining the Garden City Design Ideas Competition, as they have not yet entered the stage of implementation into local planning guidelines. When this happens, it will be an important moment to undertake further research into the extent to which the ideas presented in the concepts have been implemented, the effectiveness of the solutions, and how the competition's very tight ideological guidelines have influenced the appearance

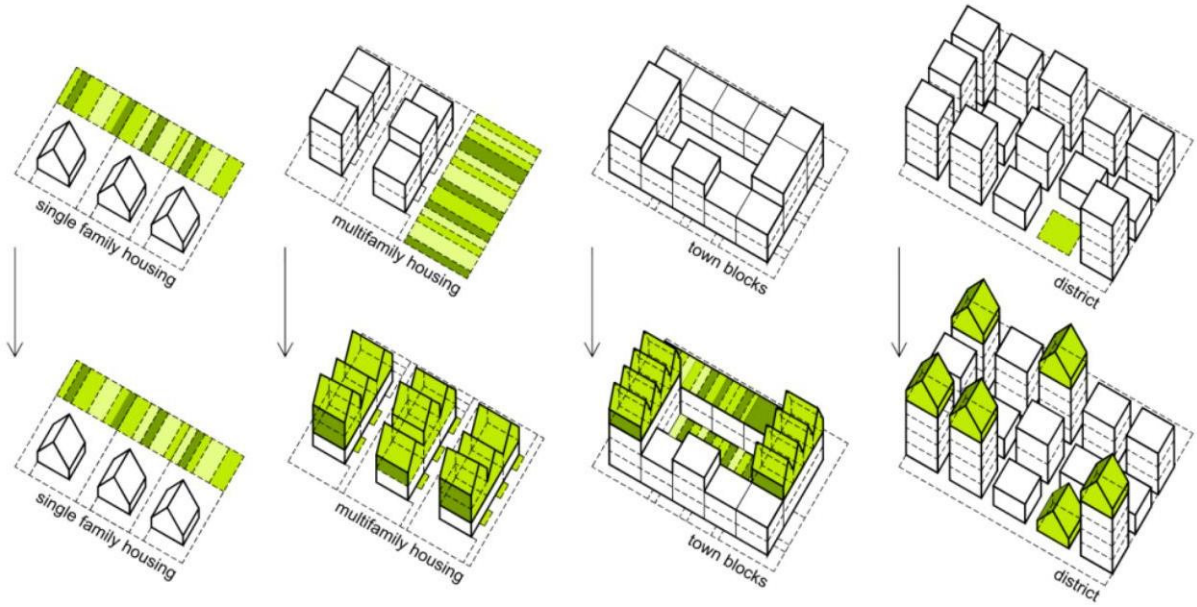

Fig. 6. Typological changes in different types of development in self-sufficient settlements based on analysed examples of implementation
Source: Author's own elaboration

of, or lack of difference between, previous realisations of the same idea and the solutions adopted on the Letchworth site.

Howard's idea of the garden city offers many possibilities for its transformation towards food self-sufficiency. The concepts analysed showed the multifaceted nature of the solutions, both as a strategy for planning individual cities and neighbourhoods as a systemic solution and as more individualised arrangements. Howard's concept is thus transformable both at its ideological basis and in detail. The proposed concepts can be implemented both as an imposed requirement of architectural form and as an optional solution, which can only be introduced if the residents in question are genuinely interested in the possibility of growing their own food at home. The multitude of possible solutions makes it difficult to choose the potentially most advantageous one, as the choice is subject to a number of conditions, ranging from geographical location, legal situation and local traditions. It therefore seems to need to be developed in all directions for the time being.

5. Conclusions

In the search for a new quality of life in cities, points-based solutions within single morphological regions are currently mainly proposed. They do not yet constitute network solutions and their centripetal role is limited to the area of the settlement or housing estate. The proposed theoretical solutions assume the possibility of using elements such as urban agriculture as a system to unite both space and the urban community around an element with functions that are purely utilitarian as well as recreational and aesthetic. Historically, this idea has evolved from the pure utilitarianism of agricultural production in vertical greenhouses or horticultural towers to the possibility of creating self-sustaining islands in urban space. Nowadays, the social potential of new solutions has been recognised, although this has not yet been translated into the type of created space.

The development complexes implemented so far show that the mere introduction of urban agriculture as a complement to the functional programme associated with urban self-sufficiency does not have the power to initiate a new morphological region, or a new urban form. Instead, they provide a catalyst for the emergence of new typological forms of development, although what emerges is not as diverse as what was envisaged in the theoretical designs.

The theoretical solutions discussed here are characterised by a great variety of forms and types, while the implemented solutions are characterised by a simplified typology, a limitation of spatial forms to the simplest, repetitive ones, and a strong relationship with the typical forms of development for a given function.

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