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15-MINUTE CITY: IDENTIFYING CURRENT AND SETTING FUTURE RESEARCH DIRECTIONS

Łukasz Jarosław KOZAR[1*], Małgorzata MATUSIAK[2], Szymon BOLIMOWSKI[3]

[1] University of Lodz, Faculty of Economics and Sociology; lukasz.kozar@uni.lodz.pl, ORCID: 0000-0002-8426-8471
[2] University of Lodz, Faculty of Economics and Sociology; malgorzata.matusiak@uni.lodz.pl, ORCID: 0000-0002-4287-617X
[3] Graduate of the University of Lodz; s.bolimowski@wp.pl, ORCID: 0009-0007-7834-2149
* Correspondence author

Purpose: The main aim of the research was to identify the most common research areas in scientific publications addressing the issue of the 15-minute city, which were expressed by researchers of the concept through the author's keywords. An additional aim of the analyses undertaken was to identify key green research areas in the scientific studies analyzed.
Design/methodology/approach: The study was planned and conducted from November 2023 to May 2024. To achieve the aims of the study, the method of systematic literature review and classical literature review was used. 126 scientific publications were analyzed.
Findings: The analyses conducted showed that the issue of the 15-minute city is a relatively new and still area-evolving research concept. Numerous research threads are raised around this issue. Nonetheless, the most frequently discussed issue is the proximity and accessibility to city residents of facilities with social functions, which are defined as essential or basic. Even though green issues have been discussed in most of the scientific publications analyzed (mainly the issue of green spaces, green areas, and green zones), issues that can be directly linked to the issue of the green economy have been a marginal research thread.
Research limitations/implications: The study is limited by the choice of the database for bibliometric analysis (Scopus database) and the content of the bibliometric query. Hence, the same study based on a different database may result in different results (a problem further described in the article). The Q1 bibliometric query can be repeated in the future or applied to other databases (provided the record is adjusted). Thus, the study is reproducible and can provide a point of comparison for other researchers of the 15-minute city in the future.
Originality/value: Directions for future research at the intersection of the 15-minute city concept and green economy issues were proposed. In terms of this issue, among other things, the research issue of green jobs (one of the key pillars of the green labor market) was highlighted. In addition, it was pointed out that the concept of the 15-minute city applied in practice can stimulate the formation of a green business ecosystem in cities. The article is addressed to anyone interested in the issues of the 15-minute city.
Keywords: 15-minute city, green business ecosystem, green city, green economy, green jobs, green labor market, sustainable development.
Category of the paper: Literature review.

1. Introduction

Modern cities are complex entities that face numerous social, economic, and environmental challenges that determine their development. Past studies, for example, have stressed that more than half of the world's population already lives in urban areas, and at the same time, urban population is expected to continue to grow quite rapidly in the coming years (Demir, 2022). The phenomenon of urban sprawl and the numerous negative effects flowing behind it are already being observed with concern (Chettry, 2023; Restivo et al., 2019; Sharma et al., 2024). Issues such as air pollution (Wang et al., 2023), land degradation (de Sousa et al., 2023), increased costs of urban services (e.g., public transportation) (Hajilou et al., 2022), loss of agricultural land and green space (Mansour et al., 2023), traffic congestion (Parvinnezhad et al., 2021), or negative impacts on the health of urban residents (Yan et al., 2021, 2022), among others, are pointed out.

The aspects indicated above represent a significant challenge for urban planners especially those taking up the challenge of sustainable urban planning (Jooste et al., 2019; Stephens, 2017). At the same time, in the literature one can notice a discussion around various concepts that assume the development of urban areas in such a way as to improve the quality of life of its residents. These considerations emphasize that urban space should become friendly to all stakeholders, which also poses an extremely difficult challenge for urban planning. Moreover, in such a focused scientific discourse, there is also an increasing reference to the issue of urban sustainability. In recent years, as noted by the authors of this article, among the concepts raised in the scientific discourse covering the issue of the functioning of modern cities stand out: smart city (Han, Kim, 2024; Jacques et al., 2024; José, Rodrigues, 2024; Rothe et al., 2018), soft city (Crisostomi, 2020; Madsen et al., 2022), eco-city (Bibri, 2021; Tang et al., 2022), green city (Javidroozi et al., 2023; Zain et al., 2022), or 15-minute city (Allam, Bibri, Chabaud et al., 2022a; Allam, Nieuwenhuijsen et al., 2022). In this article, the concept of the 15-minute city will be scientifically considered.

In introducing the idea of the 15-minute city, it is important to point out that it was initiated by C. Moreno (Allam et al., 2023; Moreno, 2024). This concept assumes that all basic needs can be met by a given city resident within a distance that can be covered walking or by bicycle in a maximum of fifteen minutes. It is indicated that the creation of such an opportunity for urban residents to move between areas of residence, commerce, work, educational, health and entertainment centers has a positive impact on their quality of life. Hence, an important place in this concept is given to the issue of proximity, which plays a key role in changing lifestyles and transforming the city (Moreno, 2024). Proximity is understood here through the prism of moving in a shortened time (without unnecessary restrictions that could lengthen the time of movement and the road), so that longer time can be devoted to local social contacts (Moreno et al., 2021). The concept of the 15-minute city is the subject of scientific criticism from some

researchers dealing with the issue of modern urban development. For example, insufficient methodological refinement is pointed out (Beim, 2021). In addition, in the scientific discourse around the issue of the 15-minute city, it can be noted that the concept is sometimes identified with a kind of utopian vision of urban development (de Leániz, Lobo, 2023).

The main aim of the research was to identify the most common research areas in scientific publications addressing the issue of the 15-minute city, which were expressed by researchers of the concept through the author's keywords. An additional aim of the analyses undertaken was to identify key green research areas in the scientific studies analyzed. The study focused on exploring the Scopus database. The systematic literature review (SLR) and classic literature review (CLR) methods were used to achieve the stated aims of the study. The bibliometric analyses undertaken were supported by the VOSviewer software (version 1.6.20), which allows visualization of bibliometric data and their statistical summary (e.g. counting co-occurrences of author keywords).

The article is divided into four parts, the first of which is this introduction. The second part presents the research methodology. The step-by-step research activities undertaken are indicated here. This part of the article also points out the limitations of the research due to the adopted research procedure. The penultimate section presents the results of the analyses and provides a discussion. The article concludes with a summary, in which the authors point to future interesting research directions that would fill the previously perceived research gaps observed at the intersection of the 15-minute city concept and the green economy.

2. Research methodology

The study was designed and conducted from November 2023 to May 2024. The different stages of the conducted research procedure are presented in Figure 1. Four consecutive research stages were distinguished. At the first stage of the research, a preliminary conceptualization of the research was conducted. From there, a literature review was conducted around the issue of the 15-minute city based on scientific publications indexed in two bibliometric databases. These were the Web of Science database and the Scopus database. The review of scientific publications selected from these databases led to the conclusion that it becomes necessary to summarize the existing research presented in the literature around the issue of the 15-minute city. Already preliminary observations have shown the diversity of the research issues addressed. In addition, it was perceived that scientific considerations insufficiently in the context of the concept of the 15-minute city come to the analysis of green research areas. This is still a kind of research gap. Especially the lack of a broader and comprehensive discussion of how the implementation of the 15-minute city concept into the practice of the existence of cities can contribute to their greening, not only understood through the emergence

of green spaces generally available to residents, but more broadly in the dimension of a kind of impetus to the formation, or development of the local green economy.

Based on the review conducted and the observations made in the second stage of the research, a proper study was designed, the results of which are presented in this article. First, two mutually complementary research objectives were constructed, which were presented in the introduction. Next, research methods were selected to achieve the adopted research objectives. It was decided to base the scientific considerations undertaken on bibliometric analyses using the SLR and CLR methods. The combination of these research methods was expedient if only because of the identification of green research areas addressed in scientific publications addressing the issue of the 15-minute city. For analyses of a bibliometric nature, which were decided to be further supported by the VOSviewer software, the Scopus database was selected. The choice of this database for the study was motivated by the fact that various bibliometric studies emphasize the quality of the data collected in this database, its international coverage and recognition in the scientific world (Kozar, Bolimowski, 2024; Kozar, Sulich, 2023). In addition, the data contained in the Scopus database can be further processed in various types of bibliometric analysis software, including the VOSviewer software indicated above.

The stage of designing the study was completed by creating a bibliometric query for the Scopus database (Table 1). The syntax of the bibliometric query follows from several important research premises. Primarily, one can notice the use of the "*" designation in the syntax, which allows searches for the same word, but with different word endings. Such a procedure was necessary in view of the observation, for example, that 15-minute city is recorded by researchers of the subject as: 15 min city (Balletto et al., 2022), 15 minutes cities (e.g. Pinto, Akhavan, 2021), 15 minutes city (e.g. Gaxiola-Beltrán et al., 2021), 15-min city (e.g. Guo et al., 2023; Ulloa-Leon et al., 2023; Urrutia-Mosquera et al., 2023), 15-minute cities (e.g. Bartzokas-Tsiompras, Bakogiannis, 2023), 15-minute city (e.g. Gorrini et al., 2023; Papadopoulos et al., 2023; Vizmpa et al., 2023), 15- min cities (e.g. Pozoukidou, Chatziyiannaki, 2021), fifteen minutes cities (Murgante et al., 2022), or fifteen-minute city (Burke et al., 2022). Hence, the syntax notation used led to a more synthetic notation of the bibliometric query.

Table 1.
Details of search query syntax for Scopus databases

Database	Symbol	Query syntax	No. results
Scopus	Q1	TITLE-ABS-KEY ("15-min* cit*" OR "fifteen-minute* cit*") AND PUBYEAR > 1974 AND PUBYEAR < 2024 AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j") OR LIMIT-TO (SRCTYPE , "p")) AND (LIMIT-TO (PUBSTAGE , "final")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "cp") OR LIMIT-TO (DOCTYPE , "re"))	138

Source: Authors' elaboration.

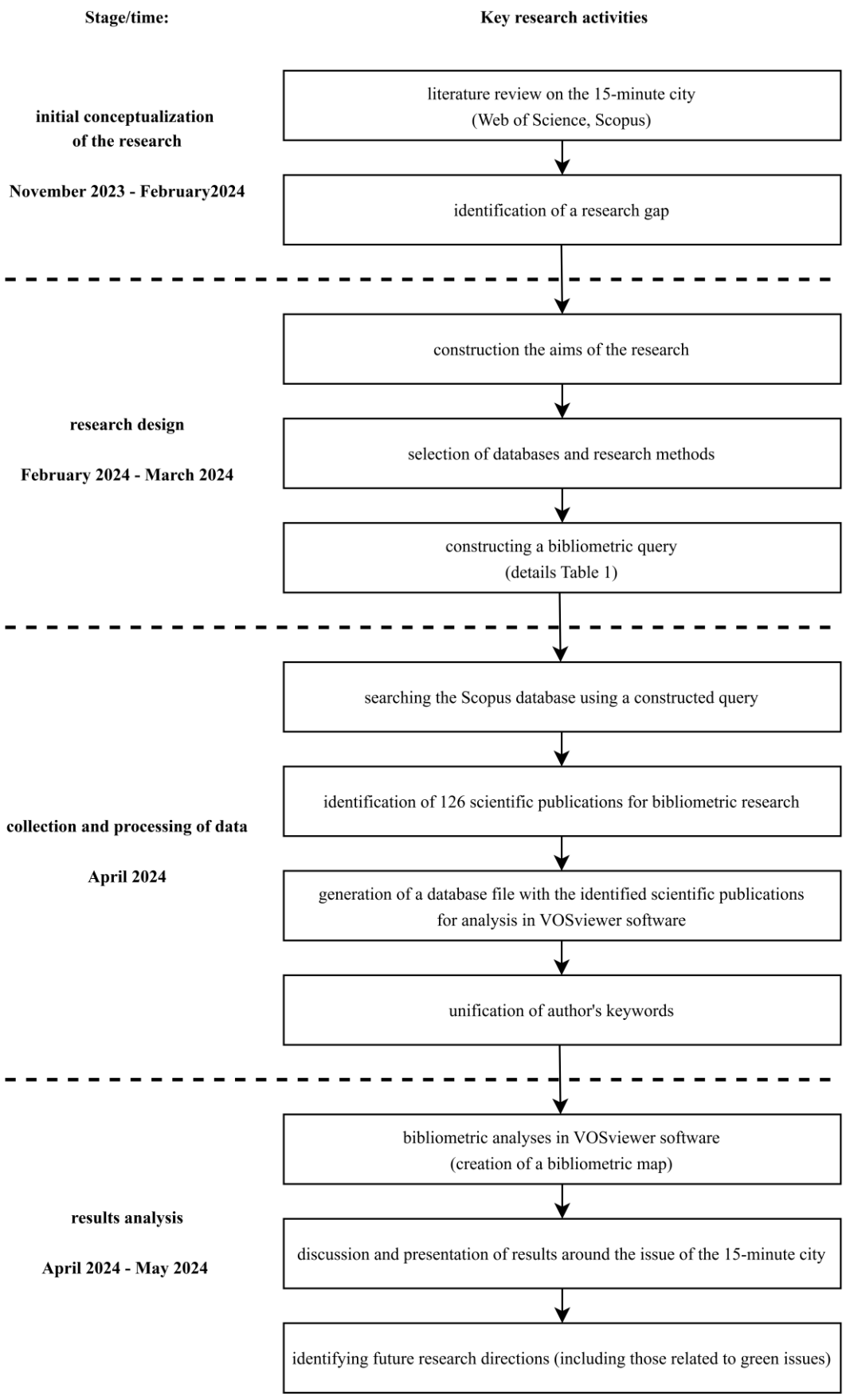

Figure 1. Research procedure stages and timeline.

Source: Authors' elaboration.

References to the 15-minute city were searched in the titles, abstracts and keywords of scientific publications indexed in the Scopus database. Analyses were narrowed to English (language), journal (source type), final (publication stage), as well as article, conference paper and review (document type). In addition, the year 2024 was excluded from the analyses. This restriction on the part of the authors of this article was intentional, as it will ensure better comparability of the presented results with other studies (in the year 2024, new publications are still coming to the Scopus database, which is related to the publication cycle). The indicated research move can be seen in various bibliometric studies, in which their authors aim to increase the comparability of this type of analysis.

The third stage of the research was aimed at collecting data for bibliometric analyses. As shown in Table 1, the bibliometric query led to the extraction of 138 scientific publications from the Scopus database that met the set search criteria. Subsequently, the scientific publications thus extracted were reviewed in terms of their suitability for the assumed analyses. These analyses led to:

- exclusion of 4 scientific publications that did not refer to the concept of the 15-minute city, but included in their content an acronym referring to other fields of science or the way the study was conducted (such an error may arise from searches using "*" in the syntax),
- observed that one scientific publication in the Scopus database lacks author keywords (Moro, 2022), and this publication has such words (this forced at further stages of analysis to fill this lack in the scope of the analyzed publication),
- to exclude from the analyses 8 scientific publications that did not have author keywords (a necessary condition for the first research objective).

As a result of the procedure carried out, 126 different scientific publications were finally identified, in terms of which the analysis of the author's keyword record and the content of individual scientific publications served the intended purposes of the research. Hence, a file with such selected scientific publications was generated from the Scopus database, which was used for further analyses (including those using the VOSviewer software). The third stage of the research was completed by the procedure of standardizing the author's keywords, which consisted of standardizing the form of their writing. This procedure was necessary due to the observation of, among other things, the already mentioned different forms of notation for the 15-minute city issue. As a result of the analyses undertaken, a total of 468 authoritative keywords assigned to the scientific publications extracted for analysis, different in their form of notation, were subjected to this procedure. As shown in Table 2, in addition to the different notation of the same words in terms of meaning (for example, the differences between American English and British English), the issue of the use of acronyms, the occurrence of the same word in the singular and plural, or different nomenclature, in the face of the same research problem (the issue of Covid-19) was noticed. Table 2 shows only alignments against those keywords that were finally included in the bibliometric map obtained during the analyses.

Table 2.
Unification process for author keywords used in the research

Replaced author keyword	Replacement word	Replaced author keyword	Replacement word
15 min city	15-minute city	covid19	covid-19
15 min city concept	15-minute city concept	covid- 19 pandemic	covid-19
15 minutes cities	15-minute city	decarbonisation	decarbonization
15 minutes city	15-minute city	fifteen minutes cities	15-minute city
15-min city	15-minute city	fifteen-minute city	15-minute city
15-minute cities	15-minute city	neighbourhood planning	neighborhood planning
15- min cities	15-minute city	pandemic	covid-19
chrono urbanism	chrono-urbanism	smart city	smart cities
cities	city	sustainable city	sustainable cities
coronavirus	covid-19	the 15-minute city	15-minute city
covid-19 pandemic	covid-19	the 15-minute city concept (fmc)	15-minute city concept

Source: Authors' elaboration.

The standardization of author keywords carried out in the above manner led to the final selection of 442 unique author keywords, which were used at stage four of the research to generate a bibliometric map in the VOSviewer software (further described in results and discussion). In addition, at stage three of the research undertaken using the CLR method, the green research areas undertaken in the scientific publications analyzed were reviewed.

The adopted stages of the study, the specifics of the research procedures carried out and the Scopus database adopted for analysis are elements that limit the study. The authors are aware that extending the analyses to other databases, or conducting them based on other databases, may contribute to different results. Nevertheless, considering the development of bibliometric databases, their indexing procedures, as well as the fact that some scientific publications are not indexed in any database, it is impossible to conduct a study that would include all publications created up to 2023 (inclusive), and covering the issue of the 15-minute city. At the same time, the methodological description provided allows the study to be repeated in the future, as well as conducted according to the above description based on other databases. Thus, researchers working on the issue of the 15-minute city gain the opportunity not only to compare their research with that presented, but also in the future to demonstrate changes over time in the context of this research problem.

3. Results and discussion

To generate a graphical representation of the main research areas addressed in the analyzed articles, it was assumed that the bibliometric map would depict only those author keywords that, after the standardization procedure, appear in at least three different scientific publications (the so-called minimum number of co-occurrences). The minimum number of co-occurrences adopted in this way was set deliberately and due to two scientific reasons. First, the aim was to

show as many relevant areas of research highlighted by the authors through the author's keywords as possible. In addition, it was noticed that most of the publications taken for consideration were from 2021-2023, which also indicates that a relatively new research area is being explored. The assumed indicator of the minimum number of co-authorships was met by 30 different author keywords. Barcelona (the name of the city), geographic information system (an information system for the input, collection, processing, and visualization of geographic data) and spatial analysis (the type of analysis performed) were excluded from the pool of these words before the bibliometric map was generated. These words, in the opinion of the authors of the article, due to the indicated issues they refer to, do not indicate the key research areas around the issue of the 15-minute city, and the case study problem undertaken (as an area of analysis of the issues studied), the systems used or the methods of analysis. Hence, the bibliometric map presented in Figure 2 was created based on the remaining 27 author keywords. Each of the words that builds the bibliometric map forms a node marked with a dot and was automatically assigned by the VOSviewer software to one of five clusters that differ in color.

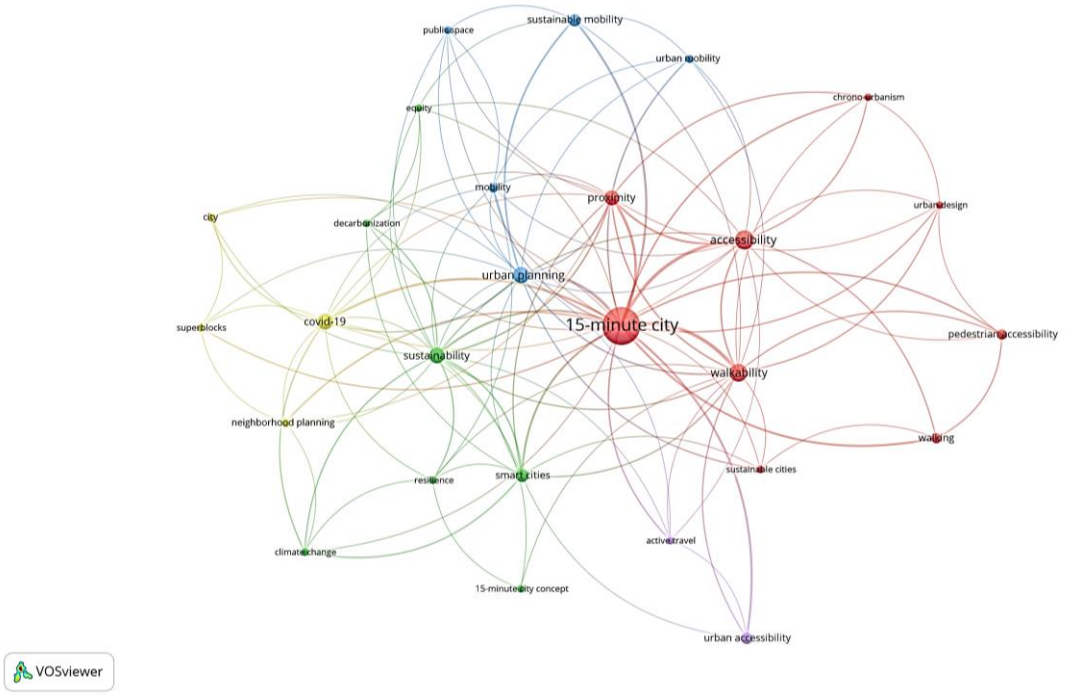

Figure 2. Bibliometric map of co-occurrence results of author's keywords based on the generated database for bibliometric analysis.

Source: Author's elaboration in VOSviewer software (version 1.6.20).

The construction of the clusters presented in Figure 2 is presented in detail in Table 3. Note that the various research areas are listed here by using alphabetical ordering. In addition, each of the indicated author keywords was assigned two bibliometric measures, which were generated by the VOSviewer software. The first measure shown next to each author keyword indicates the number of author keywords with which the keyword under analysis is associated. This is the summed number of outgoing lines from a given keyword, or links (L). The second

measure, occurrences (O), in turn, affects the size of a node on the bibliometric map and indicates the number of research papers involved in the analysis in which a given research area was an author keyword (in the case discussed in the article, the area after the standardization process).

Table 3.
Keyword co-occurrence clusters presented in Figure 2

Cluster	Color	Keywords
1	red	15-minute city (L = 24, O = 78); accessibility (L = 14, O = 20); chrono-urbanism (L = 5, O = 3); pedestrian accessibility (L = 5, O = 6); proximity (L = 13, O = 12); sustainable cities (L = 5, O = 3); urban design (L = 6, O = 3); walkability (L = 16, O = 17); walking (L = 4, O = 6);
2	green	15-minute city concept (L = 3, O = 3); climate change (L = 6, O = 3); decarbonization (L = 5, O = 3); equity (L = 6, O = 3); resilience (L = 7, O = 3); smart cities (L = 11, O = 9); sustainability (L = 17, O = 13);
3	blue	mobility (L = 9, O = 5); public space (L = 6, O = 3); sustainable mobility (L = 6, O = 8); urban mobility (L = 6, O = 4); urban planning (L = 15, O = 15);
4	yellow	city (L = 5, O = 4); covid-19 (L = 13, O = 13); neighborhood planning (L = 6, O = 4); superblocks (L = 5, O = 3);
5	violet	active travel (L = 6, O = 3); urban accessibility (L = 4, O = 7);

Source: Authors' elaboration in VOSviewer software (version 1.6.20).

In the research studies analyzed, the most frequent author keywords referred to the issues of 15-minute city (red cluster), accessibility (red cluster), walkability (red cluster), urban planning (blue cluster), Covid-19 (yellow cluster) and sustainability (green cluster). At the same time, it is important to point out that the identified research area of the 15-minute city issue was associated with the largest number of research areas.

Indeed, the issue of the 15-minute city on the bibliometric map was illustrated directly by two different author's keywords, namely 15-minute city (e.g. Balletto et al., 2021; Moreno et al., 2021) and 15-minute city concept (Hardi, Murad, 2023; Karamitov et al., 2023; Mocák et al., 2022). Also notice the reference to the issue of chrono-urbanism (Ferrer-Ortiz et al., 2022; Noworól et al., 2022; Shabtay et al., 2023).

Numerous research issues are related to the issue of the 15-minute city, as Figure 2 shows. Primarily, it should be noted that the issues of accessibility (e.g. Willberg et al., 2023; D. Zhang et al., 2023; S. Zhang et al., 2023) and proximity (e.g. Di Marino et al., 2023; Pozoukidou, Chatziyiannaki, 2021) are very prominent. The issue of accessibility in the analyzed articles was addressed from different perspectives. One can see, for example, references to urban accessibility (e.g. Cheng et al., 2022; Gaglione et al., 2022), or directly to the issue of pedestrian accessibility (Caselli et al., 2022; Rhoads et al., 2023; Şahin Körmeçli, 2023).

To ensure proximity and accessibility to workplaces, various types of facilities that fulfill social functions (e.g., public places for recreational activities in green urban space) and services, proper urban planning becomes necessary. In the bibliometric map obtained, this issue is evident through references in the author's keywords to urban planning (e.g. Abdullah et al., 2022; Logan et al., 2022) and neighborhood planning (e.g. Khavarian-Garmsir et al., 2023;

Marchigiani, Bonfantini, 2022). In terms of such planning, it becomes important to recognize the role of public spaces as a kind of common good. The need to reorganize modern cities to promote social interaction is indicated. This implies the need to think about new solutions aimed at redistributing public spaces between vehicles and urban residents. This type of solution is generally aimed at implementing various types of mobility plans and innovative solutions into the urban fabric that would allow to reduce or change the existing car traffic. It should not, however, be forgotten that the design of any changes in the urban fabric cannot take place without the participation of citizens. At the same time, it is impossible to point to a one-size-fits-all program of changes that would fit all cities. Hence, in the literature on the subject one can see references to programs developed for the needs of strictly defined cities. It is worth noting, for example, the Superblocks program underway in Barcelona (Fabris et al., 2020; Nieuwenhuijsen, 2021; Staricco, Brovarone, 2022), which is designed to bring about not only favorable environmental changes, but, above all, to return some urban space to the residents.

The concept of the 15-minute city is also closely related to the issue of urban mobility (e.g. Borghetti et al., 2021; P. Lima et al., 2023). In this regard, it is important to point out that the classical approach emphasizes that the implementation of the basic needs of residents should be possible walking or using a bicycle. In the bibliometric map obtained, in the author's keywords analyzed, the fulfillment of the needs of urban residents walking was particularly emphasized. This is indicated by references to walking (e.g. Hosford et al., 2022; Song et al., 2022) and walkability (e.g. Abdelfattah et al., 2022; Choi et al., 2023; F.T. Lima et al., 2022).The range of identified major research areas also included sustainability (e.g. Barratt, Swetnam, 2022; Moreno et al., 2021), the issue of smart cities (e.g. Allam, Bibri, Chabaud et al., 2022b; Allam, Bibri, Jones et al., 2022) and climate change issues (e.g. Boulanger, 2022). Researchers working on the issue of the 15-minute city recognize that implementing this concept into the practice of city operations can result in sustainable development. This can be achieved, for example, by reducing the number of car trips within cities (Wagner et al., 2022), or by developing infrastructure for green forms of transportation. In this context, it should be emphasized that the promotion of sustainable patterns of freight transport and mobility of urban residents is an extremely important challenge for those responsible for managing and creating the urban fabric. Mentioned issues of sustainable mobility (e.g. Fayyaz et al., 2022; Tammaru et al., 2023; Wolański, 2023) have also been identified as an important area of scientific consideration addressed in the context of the 15-minute city issue.

The bibliometric map generated in the VOSviewer software (Figure 1) lacks any green research area. Recognizing the aspect indicated, the total of author's keywords, as well as the content of individual articles participating in the analysis were reviewed in search of green research areas indicative of the green transformation of the economy taking place. In terms of authorial keywords, very few and rather general references to green issues were noticed. Above all, individual researchers, as they recognized green issues were quite classical references to green infrastructure (Acosta, Haroon, 2021; Cimini et al., 2023), or green space (Luo et al.,

2022; Nieuwenhuijsen, 2021). Nevertheless, this framing did not constitute scientific inquiry on the part of the authors of this article. In addition to the issues indicated, a general reference to green deal (de Leániz, Lobo, 2023), or green transition (Ibric, 2023), was identified through the authors' keywords. Thus, it was found that in the analyzed scientific publications, through author keywords, the individual authors did not show issues directly related to the greening of entities operating in urban space.

Analyses of the content of scientific publications confirmed the observations obtained from the author's keywords. Issues related to the green economy are sporadically mentioned. However, in one of the analyzed studies there is a reference to a very important issue closely related to the green economy, which is green jobs (Maestosi et al., 2021). At the same time, it should not be forgotten that the greening of urban space and, consequently, the building of green cities (e.g. Marchigiani, Bonfantini, 2022; Noworól et al., 2022) can have, as the authors of this article recognize, a positive impact also on the business ecosystem itself of economic entities operating in the city. One may even be tempted to speculate, which should be verified by future researchers, that with the intensification of activities aimed at green transformation, a kind of urban green business ecosystem will emerge. In addition, the very process of creating green urban spaces and any changes taking place within them contributes to the emergence of business entities in the market offering their services and/or products in this direction. Hence, it can be assumed that the implementation of the 15-minute city concept into business practice will not only contribute to the construction of accessible green urban spaces but will indirectly lead to the emergence of market-specialized business entities creating green jobs.

4. Summary

Based on the analyses carried out and presented above, it may seem that the problem of the 15-minute city is based on rather simple and easy to put into practice assumptions. Nevertheless, the opposite is true. The concept of the 15-minute city is a multidimensional and multifaceted research concept. This is because it should not be forgotten that the urban fabric is not only formed by individual parts of cities (e.g. green spaces), but also by their inhabitants, who represent different generations characterized by their needs and insights into the surrounding reality. Moreover, this concept continues to be developed by numerous researchers in various directions, which increasingly stimulates scientific discourse on the matter forcing a rethink on the question of further urban development.

Considering the analyses and conclusions made, the rather narrow area references to green issues by researchers dealing with the 15-minute city issue are worrisome. While, as shown, issues related to green spaces are widely discussed, there are no relevant analyses referring to how the implementation of the 15-minute city concept into economic practice can boost the

local green economy. Moreover, it is impossible to indicate the impact resulting from the implementation of this concept into economic practice on the shape of local labor markets. It would be useful in this regard to initiate at least a study aimed at examining the impact of the transformation of cities to the 15-minute city on the creation of green jobs, which are, along with green self-employment (Kozar, 2023b) and green social enterprises (Kozar, 2023a), one of the key pillars of the green labor market.

The development of research focused on the problems of the 15-minute city is inevitable, as this concept is increasingly seen as a solution to various problems of the functioning of modern cities. Especially an opportunity is being seen to solve environmental problems arising in urban space. Hence, in the opinion of the authors of this article, it would also be appropriate to study how and at what rate the process of greening the attitudes and behaviors of members of the public in cities where the 15-minute city concept has been implemented or is being implemented.

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