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Technology transfer and urban issues: state of the art of the last ten years

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Authors' note

Authors declare that there is no conflict of interest

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Abstract

This study reviews the last ten years of literature relating technology and knowledge transfer with issues that permeate urban planning. In order to compose the bibliographic portfolio of articles, the methodology Methodi Ordinatio was employed in order to qualify and rank the papers according to their scientific relevance. Papers from the last ten years are used as the study framework. Results indicate that the subject, applied to the context of cities, it is little explored and existing studies are predominantly theoretical. This article also contributes by bringing important information on the topics, serving as a guide for future publications.

Key Words: technology transfer, urban planning, literature review

Introduction

After undergoing a transition from place space to space of flows, economic geography is increasingly focused on interregional flows and technology transfers (Dicken, 2014). Regional economic growth in cities is increasingly dependent on technological advancement and innovation, especially on the ability to acquire external knowledge and technology (Boix & Trullen, 2007). One way to advance technologically is through technology transfer.

Technology transfer between cities is one of the most important ways for cities to combine their local knowledge capital base with high levels of innovative regions. Evidence has shown that technology transfer can narrow regional gaps and promote the integrated development of urban agglomerations (Chen & Xie, 2018). For example, international technology transfer led by multinational companies is crucial for global economic integration (Duan et al., 2019). Among the policy options to promote this new growth mechanism is the need to accelerate the transfer of technology on a large scale and implement an innovation-oriented development strategy (Li, 2017).

The promotion of technology transfer has become an important focus, not only for policy makers but also among academics. After all, according Marques et al. (2021), the universities have a high degree of knowledge, which is proven by the high production of scientific articles published

annually. Research on technology transfer originated from the problems highlighted in the international technology transfer dominated by multinational companies in the 1960s and 1970s. Therefore, in the initial stage of technology transfer research, the academic community was more concerned with international technology transfer. With the scientific capabilities of universities and research institutions as national laboratories increasing, scholars have begun to pay attention to the issue of technology transfer between universities and companies in countries (Bozeman, 2000).

This article seeks to answer, through literature review, the following question: What is the state of the art in the literature regarding the dialogue between technology/knowledge transfer and urban issues in the world's last decade?

To answer this question, a systematic review of literature was done using the methodology Methodi Ordinatio. A portfolio with ten papers was composed, being the basis for this research. This paper is composed of five sections, being this the first one. The second section presents the theoretical background. The third section describes the methodological procedures. The fourth section brings the results. The fifth and last section draws the conclusions.

Technology Transfer

Throughout time, several concepts that permeate the theme of Technology Transfer (TT) has been posed on the literature. Bozeman (2000) emphasizes that there is no clear distinction between knowledge transfer and technology transfer, since technology is based on knowledge and that knowledge is always transferred at the same time that a technology is shared between two organizations, whether public or private. For Stevens et al. (2005), TT can be understood as a set of steps that describe the formal transfer of creations resulting from scientific research carried out by academies to the productive sector.

Edler et al. (2011) define knowledge transfer as a multi-step process, involving relevant knowledge identification, current transfer and its final use by the receiving organizational unit. According to Pagani et al. (2016), the sources of technology include several institutions such as private companies, agencies and laboratories, universities, non-profit research organizations and

even nations. At the other end of this bond, absorbers of knowledge and technology can be schools, military agencies, small businesses, cities, states and nations.

The transfer of knowledge and technology can also be defined as a process where products, processes, materials, and even people are moved, imbued with technological knowledge that serves to implement products or processes. This process contributes to scientific and technological progress, strengthening sustainable development in the social, economic and environmental dimensions of an organization, city or country (Pagani et al., 2016).

In this sense, the effects of globalization, urbanization and deindustrialization, particularly in the 21st century, are rapidly changing contemporary local economies, forcing cities around the world to adopt advanced information and communication technologies (ICTs) and forcing them to become more innovative and therefore competitive (Ygitcanlar & Lee, 2014). In this area of global rivalry, the main factor of insertion in the global knowledge markets is standing out in the knowledge economy, adopting innovative knowledge generation mechanisms (Pancholi et al., 2014).

Therefore, many cities seek knowledge-based urban development (KBUD). As a popular development approach, KBUD aims to bring economic prosperity, environmental sustainability, a fair socio-spatial order and good governance to cities. This development model also encourages the production and circulation of knowledge in an environmentally conserved, economically safe, socially just and well governed human environment, that is, a city of knowledge (Bulu, 2014).

Innovation is fundamental for competitiveness, but it is not only used to generate value and benefit individuals or organizations, it must seek solutions to social problems, generate quality of life for people and contribute to an intelligent future (Lee & Trimi, 2018). Given the above, the importance of transferring knowledge and technology to urban development is highlighted. For a better understanding of the state of the art of the subject, this study presents a review of the literature, whose procedures are presented in the following section.

Methodology

In the present study, the methodology Methodi Ordinatio was used. This methodology was born from the need to qualify the articles obtained in a systematic bibliographic review (Pagani et al., 2015; 2018). The methodology uses the InOrdinatio equation (1) which applies three important factors to be considered in a scientific article: impact factor (JCR), year of publication of the article, and the number of citations that the article obtained until the research to be carried out.

InOrdinatio = (IF/1000) + α * [10-(Research Year-Publication Year)] + (Ci)   (1)

Where:

- IF = article impact factor (JCR);

- α: weighting factor that varies from 1 to 10 (attributed by the researcher in 10);

- Research Year: year in which the research was developed;

- Publication Year: year in which the document was published;

- Ci: number of times the article was cited until the time of the research.

Thus, the articles used as references for the present study have the highest scores in terms of impact factor, year of publication and number of citations.

Searches were carried out in the Scopus, Science Direct and Web of Science databases with a defined time interval between the years 2010 and 2020. Searches totaled 567 results as shown in Table 1, with six different keyword crossings. In data filtering, research documents such as review articles were selected.

Table 1

Results of keyword combinations for each database

Item	Scopus	Web of Science	Science Direct
"technology transfer" AND "urban*"	112	66	228
"technology transfer" AND "cities"	129	95	252
"technology transfer" AND "city"	129	61	252
"knowledge transfer" AND "urban*"	159	168	175
"knowledge transfer" AND "cities"	122	95	190
"knowledge transfer" AND "city"	122	114	190

Source: Elaborated by the authors (2022)

The portfolio construction process was based on the steps proposed by Pagani et al., (2015; 2018) and are detailed as follows:

Step 1: According to the intention of the research, some possible keywords were defined, and research was carried out. From this, the main keywords were defined that served as axis to guide the research (Table 1).

Step 2: The databases selected for the research were Science Direct, Scopus and Web of Science. More than one database was used to return as many articles as possible.

Step 3: The search settings for each database were:

- Science Direct: Search by topic, filtering for documents such as review articles, with a time frame from 2010 to 2020. This database does not allow the use of the Boolean operator (*), so the keywords that contained the Boolean operator (*) were used without this operator.

- Scopus: Search by topic, filtering for documents such as review articles, with a time frame from 2010 to 2020 and use of the Boolean operator (*) at the end of the words.

- Web of Science: Search by topic, filtering for documents such as review articles, with a time frame from 2010 to 2020 and use of the Boolean operator (*) at the end of words.

Step 4: Conduct the final search and results obtained.

Step 5: The article filtering process was carried out, excluding duplicate works and works with themes unrelated to the central theme of this research. In total, 416 papers were excluded.

Step 6: The impact factor (Fi) used to judge the relevance of the journal was the JCR (Journal Citation Reeport). When the magazine did not present this metric, the metrics used were CiteScore and Scimago (SJR). Not presenting any of the metrics mentioned, the value attributed to the Fi of the article was zero. The years of publication of the articles were collected and their citation numbers extracted from Google Scholar. The α weight assigned was 10, due to the importance of the most recent studies for this research.

Step 7: Application of Equation 1, called InOrdinatio (Pagani et al., 2015; 2018).

Step 8: The last step is defined by the final composition of the portfolio of articles to be analyzed.

The research was carried out systematically, with the help of reference managers Mendeley® and JabRef® and listed, through InOrdinatio, the most relevant articles according to the JCR of the magazines where they were published, the number of citations and year of publication.

Duplicate documents were verified and excluded, as well as documents that were not aligned with the studied theme. Thus, 151 works remained to compose the review of this study. In addition to the fact that the present study has 151 articles to structure its theoretical framework, the relevant bibliographic references of these works were not ignored in order to complement the framework of the study.

Results

Results will be presented in two categories, the Location of the researched articles from the 151 articles, and the content analysis and discussion of the ten most relevant papers.

Location of the researched articles

According to the 151 studies filtered from Table 1, it was possible to perform, through the 'data analysis' tool of the Web of Science, the mapping of the countries with the highest volume of publications since 2010 (Figure 1).

Figure 1

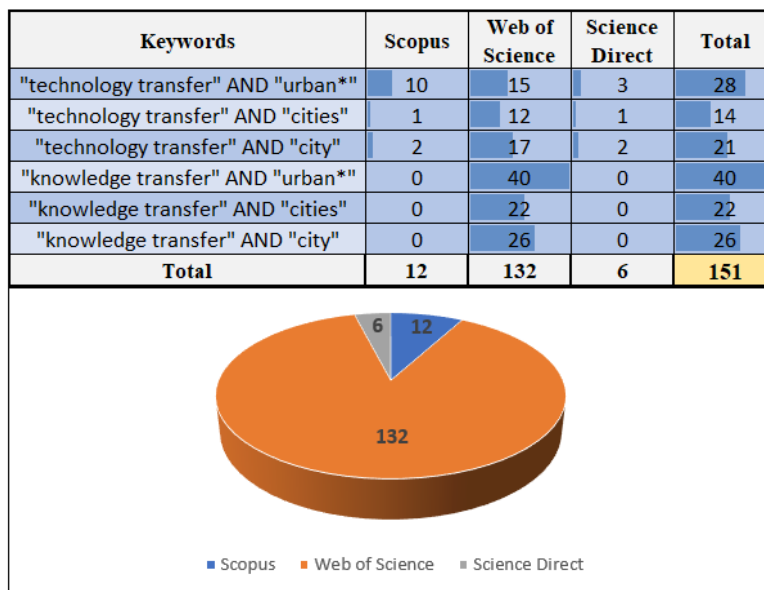*Location of the researched articles*
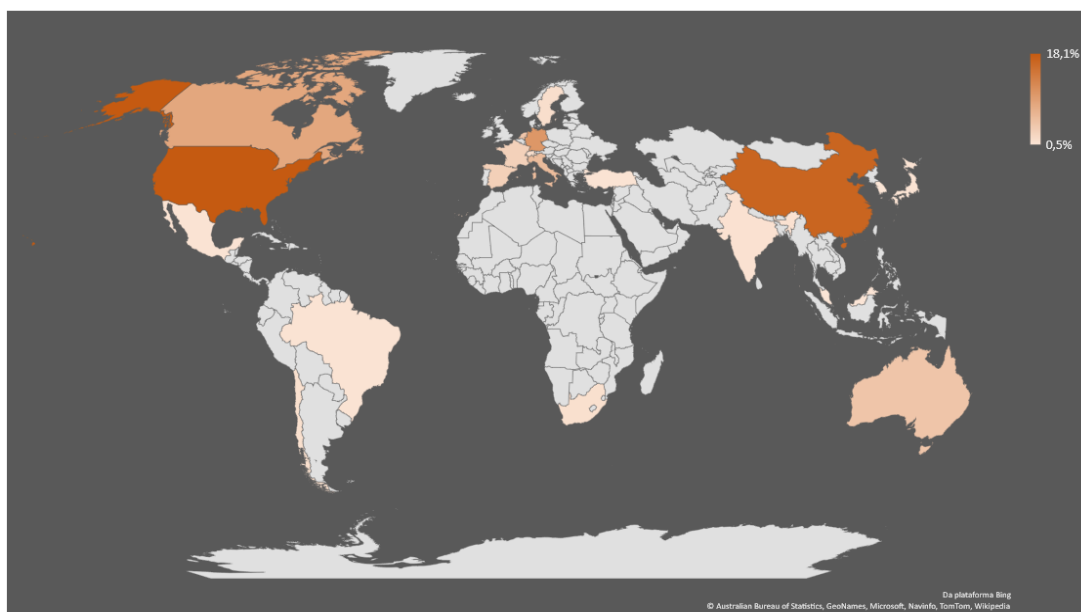
Source: Research data (2022)

Through Figure 1, it can be seen that the countries that most published studies related to the searched keywords were: USA (18,1%), China (16,7%), England (16,1%), Germany (10,4%), Canada (8,4%), Italy (5,7%), Australia (4,5%), Netherlands (4,5%), Spain (3,2%), France (2,9%), Sweden (1,4%), Switzerland (1,4%), Chile (1,1%), South Africa (1,1%), India (0,9%), Brazil, Japan, Mexico e Turkey (0,7%), Malaysia (0,5%) and South Korea (0,5%).

It was also possible to verify the volume of publications according to the databases searched (Figure 2).

Figure 2

Volume of studies per database

Keywords	Scopus	Web of Science	Science Direct	Total
"technology transfer" AND "urban*"	10	15	3	28
"technology transfer" AND "cities"	1	12	1	14
"technology transfer" AND "city"	2	17	2	21
"knowledge transfer" AND "urban*"	0	40	0	40
"knowledge transfer" AND "cities"	0	22	0	22
"knowledge transfer" AND "city"	0	26	0	26
Total	**12**	**132**	**6**	**151**

Source: Research data (2022).

It is possible to conclude that the Web of Science is the database that contains the largest volume of publications representing 88% of the total volume, followed by Scopus (8%) and Science Direct (4%).

Content analysis

In view of the information extracted from the bibliometric review, it was possible to sketch an overview of the studies that provoke a dialogue between technology / knowledge transfer and urban planning issues in the last decade.

After the application of the methodology used in this study for the classification and ranking of articles, it was possible to select the 10 most relevant works to outline the panorama in question (Chart 1). In turn, this panorama allows a clearer understanding of the state of the art on the subject in question with the categorization of the most relevant studies, as well as with the location of each work (Figure 3).

Chart 1

Ranking articles by relevance

Item	Author	Title	Year	Magazine	Country
1	Bulu & Olcay	Assessing the role of Technology Transfer Offices for being na innovative city: the case of Istanbul	2014	Proceedings Of The 7th Knowledge Cities World Summit: Knowledge-Based Services	Estonia
2	Valencia-Vazquez et al.	Knowledge and technology transfer to improve the municipal solid waste management system of Durango City, Mexico	2014	Waste Management & Research	Mexico
3	Santamaria-Varas. & Martinez-Diez	How urban fabric fosters knowledge transfer and innovation: the example of Barcelona	2015	Proceedings Of The 51st Isocarp Congress	Spain
4	Lin & Li	Knowledge Transfer for Large-Scale Urban Growth Modeling Based on Formal Concept Analysis	2015	Transactions In Gis	China
5	Hope	Creating sustainable cities through knowledge exchange A case study of knowledge transfer partnerships	2016	International Journal Of Sustainability In Higher Education	England
6	Karlštrema & Karlstrema	Knowledge transfer and advanced urban planning in the newly established ring of boulevards in riga: The case of the first municipal gas factory	2017	Journal Of Urban History	Latvia
7	Miszczak & Patel	The role of engaged scholarship and co-production to address urban challenges: a case study of the Cape Town Knowledge Transfer Programme	2018	South African Geographical Journal	South Africa
8	Hidalgo, Lemonsu & Masson	Between progress and obstacles in urban climate interdisciplinary studies and knowledge transfer to society	2019	Annals Of The New York Academy Of Sciences	France
9	Moodley	Defining city-to-city learning in southern Africa: Exploring practitioner sensitivities in the knowledge transfer process	2019	Habitat International	South Africa
10	Perrotti	Evaluating urban metabolism assessment methods and knowledge transfer between scientists and practitioners: A combined framework for supporting practice-relevant research	2019	Environment And Planning B-Urban Analytics And City Science	Belgium

Source: Author (2020).

Figure 3

Location of articles from Chart 1
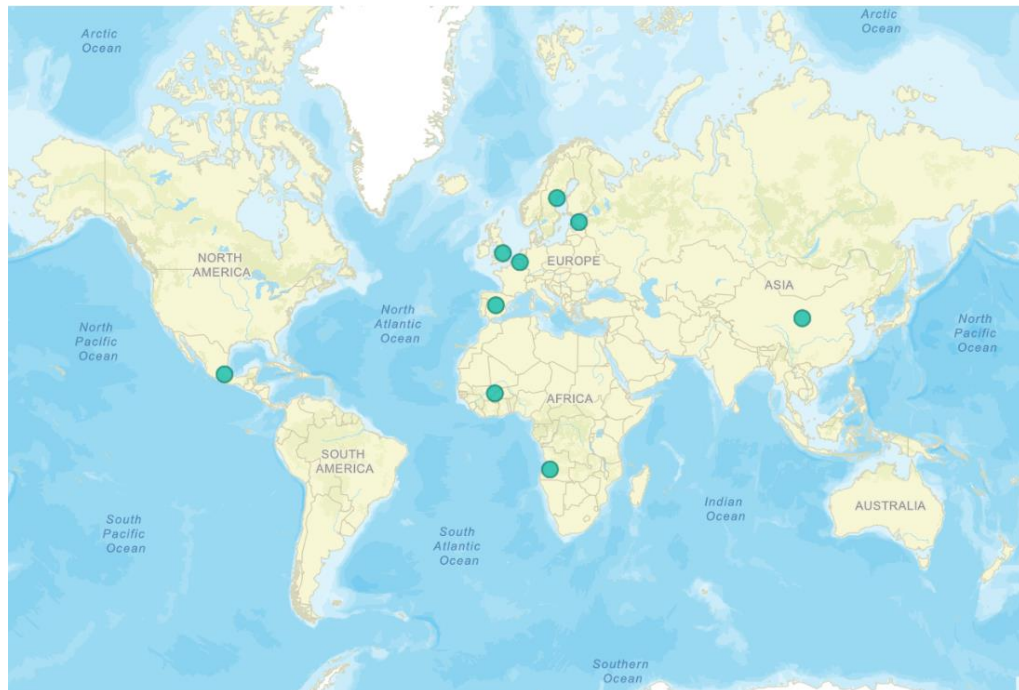
Source: Research data (2022).

1. The study "Assessing the role of Technology Transfer Offices for being in the innovative city: the case of Istanbul" (Bulu & Olcay, 2014) highlights the contribution of technology transfer offices (TTO's) to the potential of Istanbul (Turkey) become an innovative city. The work provides a brief review of studies in the literature to understand the contribution of TTO's to innovation in cities. The position of the city as an innovator in the perspective created by the TTO's based on the university as a result of the work is discussed. The authors cite that, in order to strengthen technology transfer practices, the Turkish government has introduced new initiatives to establish new technology transfer offices and further support existing ones from 2011. This article is distributed in five sections, where the second section focuses on the role of technology transfer offices based on the dissemination of research by universities to industry. The third section analyzes the literature on innovative cities, in the fourth section an assessment is made of Istanbul's potential to be an innovative city and, in the last section, recommendations and future research paths are pointed out.

2. In "Knowledge and technology transfer to improve the municipal solid waste management system of Durango City, Mexico" (Valencia-Vazquez et al., 2014), the authors analyze the evolution of municipal solid waste management in the city of Durango, Mexico, which includes actions such as proper construction of facilities, acquisition of equipment and implementation of social programs. In this work, the World Bank is cited for offering courses to municipal managers on landfill operation and waste management, and with that, the institution promoted the process of transferring technology and knowledge. Subsequently, municipal authorities participated in regional and international waste management workshops. In addition, these municipal managers followed suggestions from international contractors and equipment dealers with the intention of improving the city's waste management situation. The authors note that, after a period of 15 years, the transfer of knowledge and technology has resulted in a modern municipal solid waste management system in the municipality of Durango.

3. In the work "How urban fabric fosters knowledge transfer and innovation: the example of Barcelona" (Santamaria-Varas & Martinez-Diez, 2015), the authors present the main conclusions of the study "Geographies of Innovation", commissioned in 2014 by the City Hall from Barcelona to the design studio called 300,000 km/s. The work analyzes the urban conditions necessary to promote innovation, the relationships established between innovative initiatives, the urban morphology of the Barcelona ecosystem and the transfer of knowledge between different areas of the city. The authors emphasize that, while previous studies have focused on business quality, excluding specific measures regarding the location or impact of research performance to define a city's competitive advantage, this study assesses the impact of research and innovation facilities on an urban scale beyond individual success. This study also had a database of successful institutions such as startups, leading companies, and E-commerces, for example. The data and analysis in this study was intended to help guide evidence-based decisions about which companies and industries should invest

in Barcelona and how planning and policymaking can enhance this process. The authors analyze the research scenario underlying the urban scenario, highlighting opportunities for collaboration, innovation and economic development.

4. The study "Knowledge Transfer for Large-Scale Urban Growth Modeling Based on Formal Concept Analysis" (Lin & Li, 2015) highlights the use of automated cells (CA) and states that they are useful for studies on urban growth and changes in the use of Earth. The authors state that, although several methods have been developed to define transition rules, modeling urban growth in large areas is still a difficult challenge due to heterogeneous geographical characteristics. To solve this problem, the authors present a new method based on the combination of Formal Concept Analysis (FCA) and knowledge transfer techniques. The FCA is used to request association rules between cities in large areas. The authors claim that this method can provide a theoretical basis for the knowledge transfer process. The proposed method is applied to urban growth modeling in Guangdong province, a large region that has 21 cities in China. The authors concluded that the combination of FCA and knowledge transfer provided a useful tool for calibrating large-scale urban Logistic-CA models.

5. The study, "Creating sustainable cities through knowledge Exchange: A case study of knowledge transfer partnerships" (Hope, 2016), aims to examine the use of the knowledge transfer partnership (KTP) as a tool for universities to generate and exchange knowledge to promote sustainable cities and societies. The study reports a series of separate KTPs, but interrelated, between a university and the local authority in northeastern England, designed to improve the environmental, social and economic performance of a large-scale urban housing project. The author notes that the results of these partnerships indicate that KTPs can play a crucial role in building the capacity of local authorities charged with creating sustainable cities and societies, while improving skills and knowledge in the communities they represent and their partners in the world. sector. This study, according to the author,

contributes to the understanding of how universities can act as a channel for the generation and exchange of knowledge to achieve sustainability. It presents a case study that examines how a series of KTP's can provide a useful mechanism for improving environmental, social and economic sustainability in urban centers.

6. In "Knowledge transfer and advanced urban planning in the newly established ring of boulevards in riga: The case of the first municipal gas factory" (Karlstrema, 2017), the author examines that the history of the first gas plant in Riga, Latvia, contributed to the Riga Industrial Revolution. The factory has become an important urban landmark in the rapidly growing city due to its sophisticated architecture and its central location in the most picturesque recreational area of the city, namely, in the vicinity of the city's canal vegetation. The purpose of this study is to examine how knowledge transfer is incorporated into the first municipal power plants in Riga, its internationally developed planning phase and its locally prominent buildings, which have gained importance by becoming a symbol of technological and social progress in Riga. The author mentions that in the process of modernization of the city of Riga, the first gas factory in the city is particularly suitable as a case study to characterize the rise of modern Riga. The production of coal gas was a new challenge for the city on its path to modernization. For the author, the transfer of knowledge from previously industrialized areas in Western Europe, together with advanced urban planning, was essential for an effective result.

7. In "*The role of engaged scholarship and co-production to address urban challenges: a case study of the Cape Town Knowledge Transfer Programme*" (Miszczak & Patel, 2018) the authors rely on the Knowledge Transfer Program (KTP) to better understand how knowledge configurations are formed and sustained through the growing appearance of scholarships and knowledge co-production in Cape Town. The KTP, during the years 2012 and 2015, was a partnership between academic researchers from the University of Cape Town and professionals from that city, based on the assumption that a single knowledge base is not

sufficient to respond to the changing nature of urban areas. The authors state that more engaged interactions, including approaches to co-production of knowledge between researchers and professionals, generate multiple benefits and that, although the engagement of both institutions is in the knowledge produced during the interaction, the process of incorporation into alternative institutional spaces for prolonged periods resulted in the creation of trust, the deepening of partnerships and the dissemination of tacit knowledge. Finally, the authors cite those individual benefits accumulated by the participants were found, including support available to researchers and employees through promoted relationships, access to data and knowledge, better understanding of urban issues, expanded networks through new partnerships, reflection and broader knowledge bases through collaboration and embedded research.

8. In "Between progress and obstacles in urban climate interdisciplinary studies and knowledge transfer to Society" (Hidalgo et al., 2019) the authors comment on progress and obstacles in three active research topics that contribute to increasing the capacity for knowledge transfer to society in the urban climate research community. The first topic is linked to the production of characteristics of the urban surface which are useful for urban climate studies. Land use, morphological, architectural, and social data are also needed and have been collected using different approaches. The second topic is linked to the need to produce information directly linked to the effects on society. This requires, according to the authors, a strong multidisciplinary approach, since impact studies are not limited to just one dimension. The last topic is the process of transferring all information to urban actors, so that the characteristics of the urban climate are considered, among many other aspects, in the city administration. The authors guarantee that for urban planning, the introduction of cartographic tools encompasses climate diagnosis, as well as recommendations for future urbanization. And they conclude the work by stating that interdisciplinary topics were discussed due to their technical angle in relation to methods and tools so that the ideal of

standardization is not axiomatic and that knowledge transfer emerges from widely different contexts depending on the needs and identity of researchers and Decision makers.

9. In the study "Defining city-to-city learning in southern Africa: Exploring practitioner sensitivities in the knowledge transfer process" (Moodley, 2019), the author begins by exposing his point of view about urban development. For him, cities revived the tendency to look for other cities in a conscious attempt to learn, adapt or adopt innovative practices in the field of urban planning and development. Moodley still notes that much has been published about how these cities learn from each other in the global north, as well as in some cities in Latin America and Asia, but little empirical research is available on sub-Saharan Africa. As a result, little is known about the perception of practitioners in this part of the world, the predominant international nomenclature in learning, or their understanding and interpretation of the dynamics of the complex associated learning processes. The author focuses attention on a case study of the international "guidance program" of United Cities and Local Governments (UCLG), involving the municipality of Thekwini (South Africa) and the cities of Otjiwarongo in Namibia and Mzuzu in Malawi. Instead of a single, unified and coherent conceptualization of "city by city" learning, the study found a confusing and complex image of multiple understandings of this concept among stakeholders in learning. Crucially, it exposed strong resistance from African practitioners to UCLG's "city orientation" learning terminology, asking policy makers to be more sensitive about the definitions of major constructions. While advocating "city by city" learning, the work provides new insights that can contribute to a more subtle understanding of the complexity and policies of knowledge transfer between cities.

10. Finally, the study "Evaluating urban metabolism assessment methods and knowledge transfer between scientists and practitioners: A combined framework for supporting practice-relevant research" (Perroti, 2019) presents a retrospective assessment of a collaborative urban metabolism project carried out through evaluation BRIDGE in urban planning and the

effectiveness of the knowledge transfer approach in one of BRIDGE's case study cities (Helsinki, Finland) in a combined way. By generalizing the main conclusions about the strengths and areas for improvement, the author proposes a combined structure to assess both aspects in the design of collaborative research projects that can accommodate expectations, as well as priorities and sustainability objectives of both parties. The author explains that in recent years there has been a substantial growth in research on urban metabolism, resulting from the growing scientific consensus that metabolic flow assessments can inform resource-efficient urban policies. However, according to her, only a few studies report a retrospective assessment of the relevance and impact of studies of urban metabolism in urban planning. For the author, research on urban metabolism relevant to practice depends on the applicability of assessment methods, as well as on the effectiveness of knowledge transfer between scientists and professionals. When comparing the works above, it is possible to verify that technology transfer offices are essential for the development of ideas and projects that seek innovation in the urban environment. In this context, technology transfer guarantees two major economic elements that deserve to be highlighted in the contemporary world: knowledge and time. When we talk about time, we can go further. How long would it take to learn and develop a particular technology? Is it really necessary to internalize all the scientific capacity of the business? The answer is no! And open innovation is there to show that good ideas can come from inside and outside the organization. Hence the importance of technology transfer. When we talk about knowledge, in "The role of engaged scholarship and co-production to address urban challenges: a case study of the Cape Town Knowledge Transfer Program" and "Creating sustainable cities through knowledge Exchange: A case study of knowledge transfer partnerships" , for example, it is clear that technology transfer offices are multidisciplinary management structures, which function as the main vehicle for connecting universities, companies and government, with the objective of promoting technological innovation in the region in

question. It is also relevant to analyze a common point between the works "Knowledge and technology transfer to improve the municipal solid waste management system of Durango City, Mexico" and "Between progress and obstacles in urban climate interdisciplinary studies and knowledge transfer to society". Both have the environmental focus as the background of their themes. Franco et al. (2022) define that the environmental aspect in smart cities is the most referenced, mainly as an incentive for actions to minimize the negative environmental impacts generated by economic activities. Finally, from the selected works, it was possible to produce a cloud formed by the most used words in the abstracts of these works, as shown in Figure 4.

Figure 4

Most used words in the abstracts of the analyzed articles
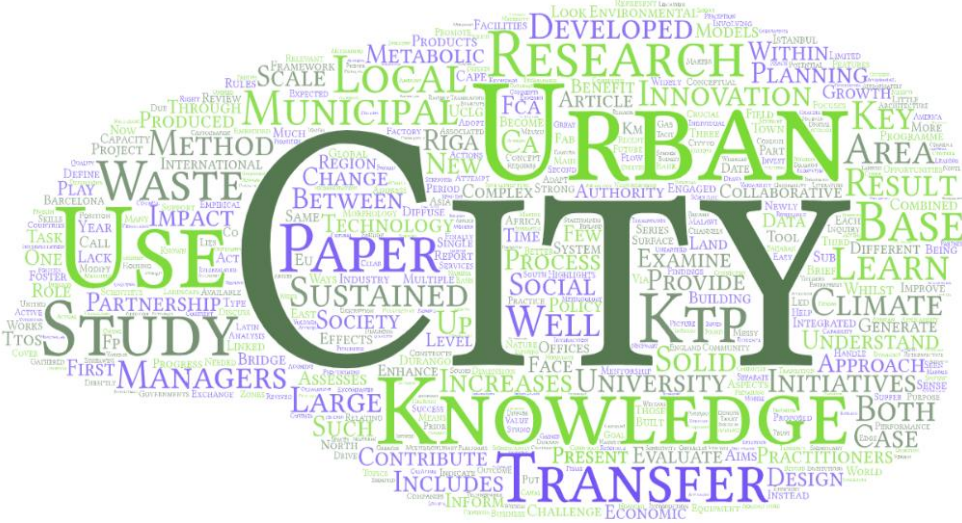
Source: Research data (2022).

Conclusion

The present study aimed to outline an overview of the studies that instigate a dialogue between technology / knowledge transfer and urban planning issues in the last decade.

To understand the current picture of studies on the subject, a literature review was carried out. The research was carried out on the Scopus, Science Direct and Web of Science databases and

delimited between the years 2010 and 2020. 151 articles relevant to the research were found and classified using the InOrdinatio equation.

It is possible to observe that the topic was little explored by the academy, remaining many opportunities for future researches, especially with regard to the context of smart cities, a fashionable city model.

Referring to the limitations of the study, the profile identified includes only review articles published in journals and provides a theoretical overview of the articles that present the terms of the keywords only in the titles of these works. However, it is worth noting that a broader survey, including work on congresses, or even a specific survey focusing on smart cities, can contribute to the debate, identifying gaps and research trends.

Regarding the profile of the articles selected to compose the panorama of this study, it is clear that the majority has a more theoretical than practical character. It was also found that 60% of these articles were produced in Europe, that 90% of the authors directed their research to theoretical analyzes while only the Chinese study proposed the creation of a method to be applied.

The main contribution of this article is to present an overview related to the transfer of technology and knowledge in urban planning. The study also contributes by bringing important information on the topics, serving as a guide for future publications.

The main limitation of this study is the fact that the review used a few databases. For future researches, it is suggested to expand the researched bases. In short, there are still great opportunities for literature reviews, development and validation of methods, tools and models to cover in greater detail the transfer of technology applied in the context of urban planning.

References

Boix, R., & Trullén, J. (2007). Knowledge, networks of cities and growth in regional urban systems. Papers in Regional Science, 86(4), 551-574, doi.org/10.1111/j.1435-5957.2007.00139.x.

Bozeman, B. (2000). Technology transfer and public policy: a review of research and theory. *Research*

Policy, Vol. 29, No. 4, pp.627–655, doi.org/10.1016/S0048-7333(99)00093-1.

Bulu, M. (2014). Upgrading a city via technology. *Technological Forecasting and Social Change*, *89*, 63-67. doi.org/10.1016/j.techfore.2013.12.009

Bulu, M. Y., & Olcay, G. A. (2014). Assessing the role of technology transfer offices for being an innovative city: the case of Instanbul. *The 7th Knowledge Cities World Summit*, 249.

Chen, H., & Xie, F. (2018). How technological proximity affect collaborative innovation? An empirical study of China's Beijing–Tianjin–Hebei region. *Journal of Management Analytics*, *5*(4), 287-308.

Dicken, P. (2004). Geographers and 'globalization':(yet) another missed boat?. *Transactions of the institute of British Geographers*, *29*(1), 5-26, doi.org/10.1111/j.0020-2754.2004.00111.x

Duan, D., Zhang, Y., Chen, Y., & Du, D. (2019). Regional integration in the inter-city technology transfer system of the Yangtze River Delta, China. *Sustainability*, *11*(10), 2941, doi.org/10.3390/su11102941

Edler, J., Fier, H., & Grimpe, C. (2011). International scientist mobility and the locus of knowledge and technology transfer. *Research policy*, *40*(6), 791-805, doi.org/10.1016/j.respol.2011.03.003

Franco, L.S., Franco, A.C., Doliveira, S.L.D., Maganhotto, R.F., & Magni, C. (2022). Desenvolvimento sustentável de smart cities baseada no contexto do Triple Bottom Line: uma revisão sistemática de literatura. Exacta.20(3), 627-646.

Hidalgo, J., Lemonsu, A., & Masson, V. (2019). Between progress and obstacles in urban climate interdisciplinary studies and knowledge transfer to society. *Annals of the New York Academy of Sciences*, *1436*(1), 5-18, doi.org/10.1111/nyas.13986.

Hope, A. (2016). Creating sustainable cities through knowledge exchange: A case study of knowledge transfer partnerships. *International Journal of Sustainability in Higher Education*. doi.org/10.1108/IJSHE-04-2015-0079.

Karlštrēma, I. (2017). Knowledge Transfer and Advanced Urban Planning in the Newly Established Ring of Boulevards in Riga: The Case of the First Municipal Gas Factory. *Journal of Urban*

History, *43*(4), 639-650, doi.org/10.1177/0096144217705642.

Lee, S. M. & Trimi, S. (2018). Innovation for creating a smart future. *Journal of Innovation & Knowledge*, v. 3, n. 1, p. 1-8, doi.org/10.1016/j.jik.2016.11.001

Li, L. (2017). China's manufacturing locus in 2025: With a comparison of "Made-in-China 2025" and "Industry 4.0". *Technological Forecasting and Social Change*, 2025, 66–74. https://doi.org/10.1016/j.techfore.2017.05.028.

Marques, J. L., Cavalcanti, A. M., & Silva, A. M, da. A. (2021, jan./mar.). A evolução dos núcleos de inovação tecnológica no Brasil no período de 2006 a 2016. Exacta, 19(1), 210- 224. https://doi.org/10.5585/exactaep.v19n1.11153.

Miszczak, S. M., & Patel, Z. (2018). The role of engaged scholarship and co-production to address urban challenges: a case study of the Cape Town Knowledge Transfer Programme. *South African Geographical Journal Suid-Afrikaanse Geografiese Tydskrif,* 100(2), 233-248, doi.org/10.1080/03736245.2017.1409649.

Moodley, S. (2019). Defining city-to-city learning in southern Africa: Exploring practitioner sensitivities in the knowledge transfer process. *Habitat International*, *85*, 34-40, doi.org/10.1016/j.habitatint.2019.02.004.

Pagani, R. N., Kovaleski, J. L., & Resende, L. M. (2015). Methodi Ordinatio: a proposed methodology to select and rank relevant scientific papers encompassing the impact factor, number of citation, and year of publication. *Scientometrics*, 105(3), 2109-2135, doi.org/ 10.1007/s11192-015-1744-x.

Pagani, R. N., Zammar, G., Kovaleski, J. L., & Resende, L. M. (2016) Technology transfer models: typology and a generic model. *International Journal of Technology Transfer and Commercialisation*, 14(1), 20-41.

Pagani, R., Kovaleski, J., & Resende, L. (2018). TICs na composição da Methodi Ordinatio: construção de portfólio bibliográfico sobre Modelos de Transferência de Tecnologia, *Ciência da Informação*, Vol.47, No.1. DOI: 10.18225/ci.inf..v47i1.1886.

Pancholi, S., Yigitcanlar, T., & Guaralda, M. (2014). Urban knowledge and innovation spaces: concepts, conditions and contexts. *Asia Pacific Journal of Innovation and Entrepreneurship*, *8*(1), 15-38.

Perrotti, D. (2019). Evaluating urban metabolism assessment methods and knowledge transfer between scientists and practitioners: A combined framework for supporting practice-relevant research. *Environment and Planning B: Urban Analytics and City Science*, *46*(8), 1458-1479, doi.org/10.1177/2399808319832611.

Santamaria Varas, M., & Martinez-Diez, P. (2016). How urban fabric fosters knowledge transfer and innovation: the example of Barcelona. In *ISOCARP 2015: 51st International Society of City and Regional Planners Congress: Cities Save the World: Rotterdam, Netherlands: October,* 19-23, 2105: proceedings book.

Stevens, A., Toneguzzo, F., & Bostrom, D. (2005). AUTM US licensing survey: FY 2004 [Survey summary]. *Association of University Technology Managers*.

Valencia-Vázquez, R., Pérez-López, M. E., Vicencio-De-La-Rosa, M. G., Martínez-Prado, M. A., & Rubio-Hernández, R. (2014). Knowledge and technology transfer to improve the municipal solid waste management system of Durango City, Mexico. *Waste management & research*, *32*(9), 848-856, doi.org/10.1177/0734242X14546035.

Yigitcanlar, T., & Lee, S. H. (2014). Korean ubiquitous-eco-city: A smart-sustainable urban form or a branding hoax?. *Technological Forecasting and Social Change*, *89*, 100-114. doi.org/10.1016/j.techfore.2013.08.034.